FINAL INFN CVI Report 2012

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Introduction

This year the CVI had its annual meeting at the INFN laboratory in Pisa. The committee met for two full days and heard presentations covering each of the five sections of INFN. In advance of the meeting, the President had selected two sections, Nuclear Physics (CSN3) and Technological and Interdisciplinary Research (CSN5), for special focus. The CVI heard additional presentations on the strategic plans of the two labs most closely related to the science of CSN3, LNS and LNL, as well as an in-depth presentation on the new programs within INFN that are being developed to support Technology and Knowledge Transfer. In addition, the CVI visited the laboratory at LABEC in nearby Florence and heard a presentation on the rich program of environmental and cultural heritage studies being carried out there with the tandem Van de Graaff accelerator. The meeting agenda is included in the appendix. We would like to commend all the presenters for doing an excellent job of focusing their presentations on strategy for the future and generating lots of interesting discussion for the CVI.

INFN as an institution is performing at a very high level of scientific and technological excellence and compares very well with similar Institutions worldwide. Italian teams play a leading role in many international collaborations and the Italian School of Particle, Nuclear and Astroparticle Physics is one of the best in Europe. This excellence remains in spite of very difficult financial constraints.

We were impressed with an increasingly entrepreneurial spirit within INFN where we see researchers successfully pursuing external opportunities for funding. INFN was notably successful in winning 'premiali' funds for some of its programs in national competitions and some sections, most notably CSN4, were very successful in winning ERC grants. We believe this trend should be encouraged, especially in the technology transfer sector.

An area of great concern for INFN is the development of human capital. The workforce is aging. Formally only 1 in 5 positions opened by retirements can be replaced, but INFN has not even been able, because of bureaucratic hurdles, to fill the positions allowed under the 20% turnover limits. In effect, INFN cannot hire at this time and we feel this will rapidly have extremely detrimental effects. It will hinder the rejuvenation of the scientific staff and lead to a loss of essential expertise in the various areas of research of INFN. It is imperative that a research institution be able to hire quickly and flexibly within the constraints imposed. It will be impossible to maintain the scientific stature of the institution and to make progress in the strategically important efforts to mitigate gender imbalance and increase knowledge and technology transfer without some limited ability to hire new people. Furthermore, this stagnation in hiring exacerbates an already critical situation for young physicists who increasingly must go abroad to get jobs because no opportunities are available in Italy. While this 'brain drain' has been going on for some time, we see alarming signs of a worsening

situation as many young Italian physicists are now going abroad at earlier stages in their careers than ever before. While we were not presented with statistics, our anecdotal experience is that these talented young Italians will not return into the Italian system later in their careers and thus this represents a permanent loss of talent.

In this very challenging time for INFN we are impressed by the energy and dedication of the new leadership of INFN, and particularly the new President. We are confident that this new leadership team is capable of meeting the challenges in front of them and leading INFN to a successful future.

CSN1

The year 2012, with its announcement of the Higgs boson discovery by the ATLAS and CMS experiments at LHC, has been a historic milestone for the science pursued at INFN and has brought unprecedented attention to the field of experimental particle physics. INFN physicists have contributed significantly and with very high visibility to the tremendous and very successful effort at the LHC.

With all of the excitement surrounding the discovery, we support the phased approach that INFN is taking towards upgrades to the LHC experiments. While commitments to the first phase of upgrades are quite appropriate, INFN is wise in not rushing to commit to the much larger phase-two upgrades until more is known about the science opportunities at LHC in light of this discovery.

While LHC clearly represents the lion's share of CSN1 activities in terms of money and manpower, a diverse research program is pursued in addition to LHC, ranging from experiments in the early R&D stage (Mu2E, Super-B) to experiments under construction (NA62) and experiments being phased out (CDF, BaBar). We consider this a very healthy mixture as it guarantees sustained expertise in technological development and in physics analysis, both vital in the education of young scientists. However, given the current funding and manpower constraints, some strategic decisions will have to be made and some focusing will have to take place.

The pivotal input to these considerations is the impact of the Super-B factory. After establishment of the Cabibbo Lab consortium an international finance committee was appointed with the initial task of reviewing the first cost estimate for the facility. A report from this review is expected in mid-November, 2012. The outcome of this review will influence the future direction of CSN1 significantly. We consider two scenarios.

Scenario 1: The cost review results in a 'go ahead' from the Ministry and significant funding for the project is approved. First and foremost, this would be a tremendous success for the Italian

physics community in securing such a prestigious and ambitious project. While right now about 100 INFN physicists are committed to research in preparation for Super-B and in particular for the detector, approximately another 100 will be needed to bring the project to completion. As new positions are unlikely to be opened in sufficient numbers, these additional people will have to come from within the existing CSN1 programs. This means that they will have to divert their research from other current and planned experiments. In this case a very thorough examination of all activities is inevitable and hard cuts will be unavoidable, including participation in the LHC phase 2 upgrade planning.

Scenario 2: If the Super-B does not go forward or is significantly delayed, the 100 people currently active in this area will have to redirect their efforts. Again, a critical assessment of planned participation in all projects within CSN1 should be taken. We are strongly in favor of choosing few experiments where INFN is one of the leading participants with a significant manpower commitment, rather than participating in many experiments with reduced scope and sub-critical group size. Even in this scenario, the LHC phase 2 upgrades cannot be easily funded in the assumed constant CSN1 budget.

We note that the Super-B decision will significantly influence the future of the Frascati Laboratory. LNF has put a significant effort in manpower and money into improving the luminosity and reliability of the DAFNE machine, and the physics program with KLOE for the next few years is straightforward. The longer term strategy for the lab involves using the accelerator complex for some nuclear physics investigations and as test facility for future accelerator development. We consider it very important that the excellent expertise in accelerator science at Frascati be kept and expanded through the next years in any scenario. While this is straightforward if Super-B goes forward, it is less clear how to do this without Super-B. We look forward to hearing about the strategic future for the Frascati laboratory at our next meeting.

While the fate of Super-B is still unknown, we support INFN's current strategy of keeping options open. At the next meeting, we look forward to hearing the strategic plans of the CSN1 program in view of the developments of this year.

CSN2

Astroparticle physics is a corner stone of the INFN program and of basic research in Italy. With the unique infrastructure of the Gran Sasso Laboratory (LNGS) and its beautiful experiments, with the Virgo gravitational wave detector, and with an excellent astroparticle program in space, INFN plays a role in the field that is highly respected internationally. Worldwide only the US, Japan, France and Germany have comparable stature. The INFN astroparticle program covers six research lines:

1) Neutrino physics, presently with the experiments Borexino, Opera, ICARUS at LNGS (the latter two running with a CERN neutrino beam) and T2K in Japan. ICARUS@LNGS and Opera will end and likely ICARUS@CERN be added in the next years.
2) Rare processes, presently with the Dark Matter (DM) detectors DAMA-LIBRA and XENON-100 and the GERDA searching for neutrino-less double-beta decay ($0\nu\beta\beta$). They will be joined by Dark-Side (DM) and CUORE ($0\nu\beta\beta$) and, respectively, replaced by XENON-1T in the next years.
3) Cosmic particle detection from the ground and underwater, at present with ARGO-YBJ, AUGER (charged cosmic rays), MAGIC (gamma rays) and ANTARES/KM3NeT-R&D (neutrinos); in future AUGER, MAGIC, CTA and KM3NeT
4) Cosmic rays from space, with PAMELA/AMS-02 (charged cosmic rays) and AGILE/FERMI (gamma rays)
5) Gravitational waves, with three bar-detectors and Vigo/Virgo+ as well as preparation for LISA-pathfinder now; and two bar-detectors, advanced VIRGO and LISA-PF in the future
6) Fundamental physics, with a series of smaller experiments looking for axions and other exotic particles or effects

Many of these experiments have provided landmark results during the last 2 years. As examples: Borexino has measured solar p-e-p neutrinos and geo-neutrinos; T2K has added evidence for a finite mixing angle θ_{13}; DAMA-LIBRA has further confirmed their observation of the tantalizing annual modulation signal; XENON-100 has improved previous Dark Matter (DM) limits by an order of magnitude and is constraining the parameter space of cMSSM models for DM; the space experiments with puzzling hints for a non-standard contributions to cosmic rays and with a huge number of new gamma ray sources – to mention just a few. Soon, similar important results are expected from AMS-02. The number of publications in the past year increased for the 5^{th} year in a row. INFN should be proud by this rich and successful program.

In times of a tight budget, INFN is making choices and is turning off older projects (or terminating INFN participation), e.g. CNGS, ARGO-YBJ, Antares, Agile, Explorer in order to have the freedom to start new ones, e.g. CTA, KM3NeT, Dark-Side, and possibly ICARUS/NESSIE.

INFN is committed to making full use of LNGS and the committee supports this strategy. Still, INFN will not be able to exploit all scientific opportunities of this unique infrastructure due to the budget limitations. The insufficient international and national coordination in the field of astroparticle physics, combined with the budget constraints within INFN, makes it difficult to look beyond the horizon of the next few years.

At the next CVI meeting, the following questions should be discussed:

- What is the strategy for full use of LNGS?

- How do the scientific midterm programs fit into a flat budget scenario?
- What is the strategy for neutrino-oscillation projects at accelerators, reactors and with atmospheric neutrinos?
- What is the technical progress of the Catania KM3NeT activities and how do they fit into KM3NeT as a whole?
- What is the strategy for future space missions?

CSN3/LNL/LNS

The CVI was very pleased to hear about the developments within and the results obtained by the various lines of research of CSN3. The science productivity in 2011, reflected in the number of publications and the high-impact journals in which they have been published, has been very high. It is also reflected in the number of invited talks as well as in the fulfilment of scientific and technical milestones. Among the various INFN indicators the gender distribution of CSN3 seems to be better than the average for INFN as a whole and compares very well with those in other European countries. CSN3 has, however, the problem faced by INFN in general of attracting and appointing young researchers in permanent positions. This is exacerbated by the limitations on filling positions opened by retirements.

During the CVI meeting, the progress in research and the highlights were presented and the short-term strategy for each of the four sections within CSN3 was outlined. The pursuit of research with electromagnetic probes to study quark dynamics in the regime of non-perturbative QCD at JLAB (USA) and Bonn and Mainz (Germany) forms the backbone of research activities of the Section “Quarks and Hadron dynamics”. Complete measurements of light meson photo-production with polarised beams and targets have been performed and data analysis is in progress. One of the highlights in this research line was the determination of the radius of the neutron density of ^{208}Pb through performing parity-violating electron-scattering measurements with polarised electrons (PREX Collaboration) allowing the establishment of the neutron-skin thickness of ^{208}Pb. The measurement of the spin-dependent proton-proton cross section in the spin-filtering experiment at COSY, Jülich has implications for polarised antiproton scattering in the future PANDA experiment.

There is a strong commitment to participate in the upgrade of JLAB which will allow the investigation of the 3-dimensional structure of the nucleon at very small *x* (Bjorken variable) and large 4-momentum transfer. In addition to the strong involvement of the INFN groups in the JLAB upgrade, there is a strong involvement in the construction of the PANDA tracking detector especially after the PANDA Collaboration decided to build it based on straw tubes, as favoured by the INFN groups. The financial commitment of INFN to the JLAB upgrade is relatively small and has already been budgeted, whereas to PANDA it is still under discussion.

The ALICE experiment is the main activity of the Section “Phase transitions in Hadronic Matter”. The experiment ran for the whole year in 2011 taking high-statistics data with p-p at 7 TeV and Pb-Pb at 2.76 TeV per nucleon. The analysis of the data on particle production and correlations is still in progress. In the p-p channel, heavy flavour production down to very low p_T could be measured. The zero polarization of J/ψ was measured for the first time at LHC. Particle multiplicities were measured in the Pb-Pb channel and indicated a stronger increase with energy than with the p-p channel. The elliptic flow and momentum spectra measured are characteristic of low viscosity suggesting an almost ideal fluid. Another highlight is that the Pb-Pb data indicated through correlation studies that the system produced at these energies is hotter, lives longer, and expands to a larger size that at the energies measured at RHIC.

The ALICE Collaboration has decided to upgrade the detector in the coming years to meet the requirements of a higher luminosity after the upgrade of LHC. The total upgrade will cost on the order of 30 M€. The inner tracking system (ITS) upgrade costs around 10 M€, and INFN groups involved in this upgrade have to decide soon about the magnitude of the involvement. It was suggested that a commitment to 1/3 of that amount over a period of 5 years should be undertaken, which seems a reasonable investment strategy keeping INFN as a key partner in this collaboration.

Within the “Nuclear Structure and Reaction Dynamics” line of research experiments were performed at the INFN laboratories, LNL and LNS, and at the major European laboratories, GSI and GANIL. The AGATA campaign at LNL was successfully completed in 2011 with the AGATA Demonstrator comprising 15 crystals before AGATA was moved to GSI. Twenty measurements were performed consuming about five months of effective running time. Better precision measurements of transition probabilities have been performed allowing the study of shell and shape evolution as well as evolution of other nuclear properties as function of N/Z providing stringent tests for nuclear models. At LNS, the upgrading of the fragmentation beam led to about an order-of-magnitude increase in the intensity of secondary beams, which benefited strongly certain experiments. Further studies of the isospin-dependent term of the nuclear equation of state that were started at LNS continued at GSI after moving the CHIMERA detector there. During 2011, there were several technical developments of detectors for different experimental set-ups at LNS. The short-term strategy of this CSN3 Section is strongly related to those of LNL and LNS, which will be discussed below.

The “Nuclear Astrophysics and Interdisciplinary Research” community in Italy has been very successful with collaborations built around internationally well-recognised infrastructures that include LUNA at Grand Sasso laboratory, ASFIN at LNS and ERNA at CIRCE laboratory in Caserta.

They have developed different techniques to study reactions of importance for nucleosynthesis at different stellar sites. As part of its short-term strategy the community applied for a 6 M€ project to install a 3.5 MV accelerator with the necessary ancillary equipment to perform the demanding measurements with high efficiency and resolution. Only 2.8 M€ have been granted sufficient for the LUNA Collaboration to purchase and install the 3.5 MV accelerator at LNGS. This is an interesting development for the community who have now to devise the plans to finance the needed ancillary equipment. This will hopefully be possible in the coming few years.

The CVI visited the laboratory at LABEC in nearby Florence and heard a presentation on the rich program of environmental and cultural heritage studies being carried out there with the tandem Van de Graaff accelerator and with the portable equipment that was developed to examine delicate and treasured artefacts on situ. We had a tour of the laboratory and saw the diverse set-ups and equipment used for research and service measurements. Many of the techniques applied in these measurements have been pioneered by LABEC's scientists. We were very impressed with our visit to LABEC. We note that LABEC provides an excellent example of taking the science and technology of CSN3 and using it to benefit society more broadly. The Van de Graaff program for environmental studies and cultural heritage is one of the best in Europe. The focus on technology development is essential to keep them at the forefront. We feel this resource is somewhat underutilised. We encourage the LABEC program to become more visible and to develop a plan that allows individuals to continue to be active scientifically while providing more service to the broader community.

The CVI heard additional presentations on the strategic plans of the two labs most closely related to the science of CSN3, LNS and LNL. Both LNS and LNL are working to define their strategic futures in the face of challenging budgets. Both laboratories are recognised as large-scale European infrastructures and receive funds under the "Integrating Activity" program of EC FP7 to support transnational access to their facilities. LNS has been working to upgrade its present infrastructure, in particular the FRIBS facility. This resulted in a gain factor of around eight in the beam intensities of secondary radioactive beams which benefitted users tremendously. In addition to the nuclear physics experiments performed with advanced instruments such as CHIMERA, dedicated presently to the study of isospin degree of freedom in heavy-ion collisions, and MAGNEX, there is a vibrant nuclear astrophysics program. This program (ASFIN project) focuses on measurements of nuclear reactions using the Trojan-Horse Method developed at LNS to gain information on nuclear astrophysics at stellar temperatures.

The present proton therapy facility for treatment of ocular cancer has now been functioning for 10 years with a high rate of success. The move to support a proton-therapy facility at

Cannizzaro Hospital in Catania (a project of 120 M€) taking advantage of the existing accelerator expertise is a natural and good move.

We were very impressed to see the new laboratory director at LNS diversifying the program at his laboratory to ensure a healthy future. He is developing a strategic plan that will ensure a vital science program in the next decade and at the same time participating in technical developments for major new pan-European facilities (e.g. ESS, ELI, etc.). He seems also to have "unified" the communities working in the laboratory by proposing a program that involves everyone in a complementary way. We look forward to hearing the details at a future meeting. The diversification into particle astrophysics with the KM3 effort with a starting budget of 20.8 M€ from regional funding, and the leadership of the LNS director in forming a collaborative effort on the KM3/underwater neutrino detection effort to build a large-scale demonstrator is very appropriate. This will pay off for the laboratory and the community and will strengthen the role of LNS as an astrophysics lab harmonising the nuclear astrophysics groups working in the keV energy regime with the particle astrophysics community working in the TeV energy regime. This said, the committee stresses that the future of the KM3NeT project is still uncertain and that a broader astroparticle physics program building on the complementarity with nuclear physics should be envisaged for the long term.

The core project for LNL in the short and long terms is the project SPES (Selective Production of Exotic Species). The first α phase of the project has been approved by INFN in 2003 and a budget of 16.3 M€ was allocated and later supplemented by an additional 3 M€ for the purpose of acquiring and installing a high-current cyclotron and for construction of the building for it and the experimental stations. It is expected that the building will be finished and the cyclotron delivered in Spring of 2014.

In the second β phase of the project, it is foreseen that radioactive ions will be produced by bombarding a UCx target with the high-current cyclotron beam. The radioactive ions will be extracted using the ISOL technique and reaccelerated with the ALPI-PIAVE following which they are available for experiments. This phase requires an estimated budget of about 27 M€ to be fully completed over a planned period of three years. An application within the framework of the Premium projects 2011was approved for the amount of 5.6 M€ corresponding to the needed budget of the first year 2013. More than 20 M€ are still needed for the years 2014 and 2015 to complete this phase. LNL will apply again for this money in the next years and hopefully will get it.

In the γ phase of the project, it is foreseen that the cyclotron beams will be used for production of isotopes for medical use. We applaud the efforts at LNL to work with the private company

BEST, which is constructing the cyclotron, to use the facility for research and production of radioisotopes for medical purposes. This has the potential to be a wonderful partnership that helps support the accelerator as well as an excellent way for INFN to contribute very visibly to society more broadly. However, it is important also to realise the potential of this facility for performing fundamental nuclear physics research which has been the primary motivation to build SPES. The CVI is concerned about how and where INFN will find the investments in times of financial difficulties to make SPES a machine for science. Significant resources are still needed to achieve that and a clear plan is needed to ensure those resources are in place on an appropriate time scale. Nevertheless, we encourage the LNL director to set with his staff appropriate priorities for realising the infrastructure to allow for scientific programs to start in a phased approach. Being resourceful in such difficult times may help in solving part of the problem as, e.g., through trying to find surplus equipment at other laboratories or forging collaborations that would be willing to contribute to building of the equipment. It should be emphasized here that a delay of a year or even two in the realisation of the full project would not impact badly on the scientific program, since other radioactive beam facilities are not able to provide even a small fraction of the requested beam time for research in this field.

We look forward to updates on the SPES and the strategic plans for the future of LNS at future meetings.

CSN4

The Italian theoretical physics community supported by INFN is quite broad in its scientific coverage and includes almost 1000 FTE. It is held in very high regard internationally and it is a remarkable asset for INFN as well as for Italy. This community is among the best in the world, and the committee is not surprised that they have been very successful in securing ERC grants. The scientific productivity is high with a bit above 1000 papers published per year. Most papers are written in collaborations of a few authors, giving a publication rate of a few papers per FTE per year, a standard number in the theory community. The high rate of international collaborations is a clear sign of the important role of the Italian theory community.

All theoretical aspects of the field are appropriately represented in CSN4, with a special emphasis on the more theoretical aspects, i.e. string and field theory. But at a time of high experimental activity with significant release of important experimental data, the communities working in particle phenomenology and astroparticle physics are very active. One may also note a healthy multidisciplinary line of research with the statistical and applied theory activities, again a domain of excellence of the Italian community.

As with all other research communities in INFN, the theorists are hit by the severe cuts in permanent positions. This has benefitted other countries internationally who hire most of the young Italian theorists, but it is a suicidal strategy for the Italian community in the long run. It is also very costly to train brilliant young researchers and then have them all take positions abroad. It would be interesting at a future meeting to see the age distribution of permanent researchers and how it has evolved over the last years (we were only given the overall age distributions including non-permanent personnel).

The significant drop in the early 2012 budget of CSN4, particularly in resources for travel, seems to have been resolved to the satisfaction of the community. We applaud this prioritization of resources within INFN.

The Galileo Galilei Institute is only a few years old but has already established itself as the equal of similar Institutes in the US and Europe; a great achievement in a very short time.

Computing facilities are important for some branches of theoretical physics. We support an evaluation of the future computing needs and a corresponding upgrade of the cluster in Pisa.

The INFN management has identified that they have too many small groups in CSN4 and the budget is fragmented in many small portions as a result. They are encouraging and facilitating convergence of some groups in advance of their next triennial evaluation a year from now. We support this approach.

The activities of CSN4 are critical to the overall health of the INFN programs and we look forward to updates at future meetings.

CSN5 & Knowledge and Technology Transfer

This was the second area of strategic focus at this year's CVI meeting.

CSN5 is responsible for funding interdisciplinary and technology transfer efforts within INFN. We were pleased to see the management taking a more strategic approach to this process by reducing the number of projects and concentrating the efforts somewhat. We applaud the 'mixed' strategy to allocate funding with some programmatically strategic directions for investments identified along with room for clever, blue-sky efforts.

In technology development areas, INFN needs to participate more and more successfully in the European program solicitations. However, there are some specific challenges for fundamental science disciplines that have large collaborative efforts to succeed in these competitions. This is a Europe-wide problem for these fields. We believe that it is possible that support from the Ministry in redefining eligibility criteria and refocusing the ERC program calls could help. Partnerships between INFN and other institutes in Italy may also help.

INFN has been very receptive to encouragement from the Ministry to share knowledge and technology more broadly for benefits of society. The Report presented to the CVI demonstrates a growing awareness of the value of the technological assets developed inside INFN and of the importance of encouraging better technology transfer between INFN and industry. This is currently done mostly through the involvement of suppliers in the development of technologies. Three new start ups based on CSN5 investments have already been started and a fourth is in development, and new regulations have been approved for spin off activities and patenting. Despite this tremendous progress, we feel that technology transfer needs to be further fostered and we provide some specific suggestions.

Effective actions in advancing technology transfer within INFN need to be based on clear goals and a long term vision. This cannot be seen only as a complementary activity whose goal is generating research funding or providing job placement for PhD's. We believe that a special effort is needed to state the goals and to develop quantitative measures that will allow objective measurement of progress as the new technology transfer programs mature within INFN.

At the same time we understand that current INFN personnel are motivated mostly by research, and the technology transfer activity may be felt as a diversion from the attainment of the main goal. We suggest several potential actions that could both help broaden the perspective of INFN researchers to enter into relationships with industrial R&D departments, and encourage them to consider other motivations for their work than pure research.

Incentive and promotion plans for INFN researchers could be modified to give weight to the activities of technology transfer, like patenting, collaborations with firms and spin offs, in addition to more traditional metrics such as publications. Support also is needed for researchers who wish to develop relationships with industrial R&D departments. One suggestion is to build up an office within INFN with good ties to the Italian industrial community that can help connect the researchers with technological solutions to the societal and industrial problems that need solving.

The transformation of technological assets into business opportunities has its roots in technological advances but it will also require people within INFN who are motivated and capable of looking at technology from a business point of view. This will also be needed to foster productive communication between INFN and industrial researchers. We encourage the management of INFN to look at opportunities for joint participation in European projects with industrial R&D departments. Cooperation with industrialist associations can help match INFN researchers with interested partners. A first step would be for INFN to share detailed information on its activities with Confindustria's Innovation Network and then work together with them to develop joint projects and technology transfer opportunities.

A parallel action might be to ensure that PhD students are exposed to a broader set of motivations for research. In the Italian tradition, PhDs candidates are encouraged to think of research as a goal in itself. Students would benefit by being encouraged to look at research experience as a way to attain a broader set of goals, including business development and technological deployment. Such a strategy might actually broaden the number of PhD candidates associated with the Institutes as well as giving room in the INFN to young people motivated by different perspectives, keen to search for industrial collaboration and looking for it as a way to attain their goals. This action can be supported by the new program "Dottorati industriali " that will be activated soon by the Minister (Miur) in collaboration with the Italian industrial enterprises. A final suggestion is create an Alumni association, aimed at keeping alive long term relationships with researchers trained in INFN and making their careers in business or industry.

We have seen tremendous progress in the past year in developing new programs and policies to encourage better technology transfer between INFN and industry, and the plans for the future are excellent so that we expect even more progress next year. The CVI is very impressed at how quickly this effort is moving since the framework was put in place to facilitate transfer of technology. Technology transfer is one of the major challenges INFN faces: the Institute has to look at this activity as an urgent issue coming from the society that, while recognizing the very high level of research carried on in the fields of nuclear, particle and astroparticle physics, expects that some of the technological assets of INFN should be exploited also for the creation of wealth. For this reason we would like to see the following questions addressed at our next CVI meeting:

- What is the long term vision for TT and what are the metrics for progress towards the long range vision?
- What incentives exist for researchers to collaborate with firms and business R&D departments?
- What kind of support is being built within INFN to sustain TT activities?

Summary

INFN faces challenges but the leadership is aware of the challenges and addressing them to ensure that Italy retains its scientific leadership position in the important fields that INFN is responsible for managing. The CVI found this meeting particularly helpful in its focus on the strategic challenges facing INFN, and we look forward to a similar focus at subsequent meetings.

We would like to thank INFN Pisa, the members of the executive board and the chair-persons of the scientific sections for organizing a very successful meeting and extending such warm hospitality to us.

Appendix---CVI Meeting Agenda

Meeting of the INFN International Evaluation Committee (CVI)
Pisa October 2-4, 2012

Tuesday, October 2
20:30 CVI meets for dinner at Osteria dei Cavalieri

Wednesday, October 3

8:15	Departure to visit LABEC in Florence
9.30 -11.00	Visit LABEC. Presentation by LABEC Director, then visit and interview with researchers involved
11.30 -12.30	travel back to Pisa

13:30 – 14:30 Lunch at INFN Pisa. CVI meets INFN Giunta

Open Session

14.30 -15.30	R. Battiston: CSN2 (astroparticle) presentation (15'+45' for discussion)
15.30 -16.30	M. Taiuti: CSN3 (nuclear), presentation and discussion as above
16.30-16.45	coffee break
16.45 -17.45	G. Fiorentini: Laboratori Nazionali di Legnaro (15'+45' discussion)
17.45 -18.45	G. Cuttone: Laboratori Nazionali del Sud (15'+45' discussion)
20:30	Dinner at Osteria dei Cavalieri with INFN Management

Thursday, October 4

9.00 -10.00	M. Carpinelli: CSN5 (technological and applications) (15+45' discussion)
10.00 -11.00	S. Falciano (INFN Giunta): Technology Transfer at INFN (15'+45')
11.00-11.20	coffee break
11.20-12.30	F. Bedeschi: CSN1 (particle physics)
12.30-14.00	Lunch at INFN Pisa
14.00-15.00	A. Lerda: CSN4 (Theoretical Physics)
15:00-15.30	G. Chiarelli: VQR in Italy: A short presentation on INFN and the exercise to evaluate quality of research in Italy (15'+discussion)
15:30	Closed session