46th MEETING OF THE LNF SCIENTIFIC COMMITTEE

The program of the open session of the SC meeting of November 20 was set up to review the status of DAΦNE and of its experimental program and summaries of activities at LNF in astro-particle physics (CSN2) and in nuclear physics (CSN3). The last item on the agenda was a report of Massimo Ferrario on the IRIDE project. . In the closed session of November 21 the findings of the SPARC_LAB PAB were presented.

After it was announced that the evaluated projected cost of SuperB could not find place in the budget of the Italian Ministry of Research, INFN started parallel studies of alternative projects. They include two projects relevant for LNF, proposed to be installed in the Tor Vergata campus: a tau-charm factory whose cost and physics case are being evaluated and IRIDE, a new multi-purpose

accelerator complex based on two superconducting linacs whose design has recently started in LNF. In the closed session the president of INFN F. Ferroni informed the SC on the schedule for a decision about the alternative projects. By the end of the year INFN must present the new project to the Ministry and understand if it is welcomed. IRIDE can be considered as integral part of the INFN mission. It goes into the direction of having strong collaboration among different national institutes of research, which was very encouraged by the previous government. If INFN will be encouraged by the Ministry to continue with the new project, a new machine will be built by INFN in tor Vergata. The continuation of the Cabibbo lab consortium is instrumental for organizing the collaboration with the Tor Vergata University and possibly other interested Research Agencies. If the Ministry will not encourage INFN in proceeding with any project, then Cabibbo lab will be closed and INFN will reopen the discussion about the future of LNF.

1. DAΦNE, KLOE and SIDDHARTA

During the open session presentations it was clear that the investment made by INFN for DAΦNE and KLOE is paying back: the projects are on schedule and progressing well toward a good startup of the machine and of the detector for the new run.

1.1 DAΦNE

L. Rivkin, J. Rossbach and S. Stapnes met members of the Accelerator Division to discuss the presentations of DAΦNE consolidation and current status, by C. Milardi and L. Pellegrino.

During the 2012 run there was steady progress in achieved good luminosity, clearly showing the potential of DAΦNE. The measurements indicate that after a significant consolidation and maintenance, the collider should be capable to deliver the luminosity goals specified by the physics goals of the experimental programme.

Before the end of the run mid December, DAΦNE reached 1.44 10^32 with 102 bunches (currents 1063 and 850 respectively), and CW sextupoles at half strength. DAΦNE integrated 0.415 pb-1 in an hour and 4.4 pb-1 in 12 hours and 8.1 pb-1 in 24 hour periods. By the end of the run 100 pb-1 was delivered from the early November.

Switching off the sextupoles gradually demonstrated their efficiency and importance in obtaining high luminosity with low background and 10 bunch operation gave 2.2 10^{31} which could increase by a factor 10, provided multi-bunch operation, electron cloud effects and various other challenges can be mastered.

After this the team has methodically addresses the significant list of issues identified during the last run period. The long list includes: revised control system for auxiliaries (PLCs, electrical switchboard, logic/software); decoupling of the BTF (beam test facility) cooling supply; magnet re-measurements performed and 2nd injection septum repaired (electrical insulation); revision of the Power supplies, 36 to be delivered end 2013 (rapid installation prepared to avoid a significant break) and general maintenance carried out; new RF load (had vacuum leaks) and valves substituted, new pump after SLED in Linac; new more powerful (factor 2) power supplies for e-cloud electrodes ready for installation. One concern is that electron cloud effects are accumulative so every opening, even when kept to the minimum, has a tendency to worsen the conditions.
In addition the Vacuum system has been improved (windows, ion pump cabling/HV power supplies) – still some more items to be improved/replaced (PLC, feed through, scraper movement system, space klystron vacuum leak); the Control system has been revised and updated, including computer power and network, as well as server replacement; studies of radiation field in control room (also visitor area) have been performed; new horizontal kicker installed, improved thermal control of feedback system and general improvements of the system.

And in addition, a complete RF system maintenance has been performed covering control, vacuum and tuner encoders , the beam diagnostics has been improved, beam size measurements along train, new beam-position monitors, also two around IP and close to injection septums ; the cryogenics system has been upgraded; there have been improvements on the Linac: klystron and modular maintenance, leak repair and vacuum system revision, diagnostics and controls, new linac gun system.

The old chamber had damaged RF contacts leading to heating and providing an obstacle to efficient running and luminosity performance. The replace work has covered all parts of the system: New IP Spherical vacuum chamber, New beryllium shields and new BPMs , Moving devices for quadrupoles , Cooling of the IP and Y vacuum chambers added, Lead toroidal shields added, New Cylindrical vacuum chamber support, Improvements on alignment tools, H supports reinforced with plates and modification of tail support of the girder, Temperature probes added, Carbon fibre composite additional supports. The work is well advanced with the alignment and TIG welding on side 2 completed. A non-conformity of the two halves of the shield caused by a lamination difference created concerns about residual stresses and “wrinkle” appeared in the em shielding during bake-out. After consultations internally and with the company the parts were accepted. This will nevertheless need to be carefully monitored during the initial operation.

The shut down started 16.12 aiming for completion by June 10th. Currently there is a 3-week delay. The plan outlines a restart 10.6 of the main systems and DAΦNE operation by 15.7 – followed by summer shut down in August, which could allow some extra time for system remedies if needed.

One has to expect 1-2 month to recover vacuum, followed by optics and beam dynamic optimization, and reliable physics towards the end of the year – with a more detailed schedule to come.

1.2 KLOE

During the SC meeting A. Golutvin (remote), G. Colangelo and L. Rolandi met members of the Collaboration to discuss the status of the upgrades and the physics program.

We are much more confident that the installation of the upgraded detector will be done in schedule. However there is still the most complicated part of the installation missing: the cabling. During the preparation, KLOE produced a very precise mapping for the cabling, gas and cooling pipe. Next step is the commissioning of the new detectors; this will be treated in more details in the next meeting.

Following the discussion at the last SC we reviewed the computing situation. A detailed presentation was given in the closed session in a very open and collaborative spirit. KLOE has a very large computing system: the commercial solution they found is very efficient but also unique. The current KLOE computing can reliably work at a rate of 20 MB/s, with ~5 kHz trigger rate and background levels as measured in 2012. The conversion to a different system is expensive in term of skilled manpower since some custom software modules have to be written to ensure the portability. The interest in porting the system depends on the future perspectives of KLOE data analysis and the schedule for this conversion is jeopardized by the chronically lack of resources and incertitude on the schedule and luminosity of DAΦNE. If the system has a perspective life longer than 5 years, porting becomes an effective investment. It has been notice that the IBM system used by KLOE cannot be virtualized and then it does not fit in the scheme of data preservation. For future purposes it is important to have an Intel system, also because KLOE data are unique.

During this meeting we reviewed the manpower situation, especially in view of commissioning, calibration data taking and analysis. There is a lack of experts, in particular on the slow control, drift chamber and offline computing. This is not more than normal and can be fixed finding 2-3 postdocs. The outside groups are very active on analysis but they must be better integrated for the commissioning/run/calibration. A clear synergy is missing. They will have a collaboration meeting in June where the participation of these groups to the startup will be discussed. The core group of KLOE is limited in number of people, but strong. F. Ferroni assured the SC that once DAPHNE will run, INFN will put efforts in having PhD students and investing money for dedicated young people.

Since the last meeting KLOE submitted four papers and produced six preliminary results. Three PhD theses were discussed and eight are in progress. Half of them are from non-INFN groups.

1.3 SIDDHARTA

A. Gal and M. Taiuti met Catalina Curceanu and other members of the AMADEUS and SIDDHARTA Collaborations.

A somewhat more detailed exposition of the open-session Highlights talk by Oton Vazquez Doce on Low-Energy Kaon-Nuclei Interaction Studies at DAΦNE was given by him and other members, followed by a brief discussion of the potentiality of the results obtained last December on a carbon target with the KLOE detector. These results suggest a possible separation between K- capture at rest and capture in flight processes, and indicate how the Lambda(1405) subthreshold resonance behaves in dense matter.
Focusing on the proposed K-d SIDDHARTA-2 experiment, we were briefed on the state of preparedness for mounting the experiment. Having tested successfully their vacuum chamber, cryogenic target and SDD cooling unit prototype, and with their SDD charge particle veto detector under construction, SIDDHARTA-2 should be ready for testing with 1/3 of SDDs during Summer 2013. Given integrated luminosity of 600 pb-1, SIDDHARTA-2 running time is estimated to be about four months. The Collaboration repeated their top request to be granted concrete scheduling for the installation and data-taking periods of the SIDDHARTA-2 experiment.
Furthermore, it was our impression that the issue of a second interaction point, that would allow them to run simultaneously with KLOE, is still perceived by the SIDDHARTA-2 Collaboration as a major issue for which the Accelerator Department could have done more to find a satisfactory solution.
We reiterate that the K-d SIDDHARTA-2 experiment is a forefront experiment that should be done with high priority at DAΦNE.

1.4 Recommendations

The SC recommends that LNF continue to put as first priority of the Laboratory the physics program of DAΦNE.

The committee is pleased to see a very significant progress on DAΦNE consolidation and on the KLOE-2 completion of the upgrade work and installation. Most of the ambitious plans and goals aimed at during this shutdown have been achieved, and the resources mobilized in an excellent way.

The DAΦNE team is optimistic that new levels of luminosity, both peak and integrated, will be achieved in the next running period. Almost all of the machine components have been affected (improved) by this consolidation and it is important to find out as soon as possible potential problems introduced in order to minimize any delays to the start of DAΦNE and KLOE-2 data taking period, in particular in view of the limited time available before the August vacation period.

On the resource side the shutdown period has been well managed with additional support as outlined in the previous SC report. A similar effort to secure operation resources will be needed in the forthcoming period, where more PhD grants in accelerator physics, internal re-assignments, help from the Cabibbo lab and other national labs, and from international labs all need to be investigated and pursued in order to strengthen the operational team.

The SC looks forward to follow closely the startup of DAΦNE and encourages AD to provide the SC with links to WEB pages where the information is updated daily.

The SC recommends that the soon after the DAΦNE start-up attention is put to produce an assessment of the achievable level of luminosity and an official schedule including the running of the two experiments. The goal is to have the schedule six months after the start-up.

The SC notices that there is no MOU with the non-INFN groups participating in KLOE. The SC encourages the LNF director to propose and sign an MOU that regulates the participation of these groups also in view of the sharing of the responsibilities for the new run of DAPHNE.

The SC recommends that KLOE continues with current computing system at least until one can make a reliable assessment of the luminosity of DAΦNE. The SC asks the LNF management to support the maintenance of the system in order to keep its efficient operation.

The SC recommends that KLOE produces a document on data preservation by the next SC meeting.

The SC recommends producing by the next SC meeting a study of the luminosity and background in IP2 when separating the beams in IP1 and an estimation of the time needed for replacing the beam-pipe and installing SIDDHARTA in IP2 and an estimation of the running time of SIDDHARTA in IP2 to collect 600 pb-1.

2. SPARC_Lab

P. Mugli, L. Rivkin, J. Rossbach (SPARC_LAB PAC), and L. Rolandi and U. Dosselli met with members of the SPARC_LAB and discussed the SPARC-Lab status and plans.

During the past 6 months, SPARC_Lab made impressive progress. Among others, simultaneous FEL operation at two different colors was established for the first time, based on the capability of SPARC to generate and manipulate two bunches with different energies simultaneously. For the Compton Backscattering source, both the electron and the photon beamlines were completed and the interaction

chamber installed. In parallel, the team was heavily involved in working out two project proposals. We acknowledge that the SPARC_Lab program is now more focused in view of uniqueness of SPARC and the mission of the lab. In terms of the future program, it is mandatory to understand the role of SPARC_Lab in two proposed projects, which rely heavily on the expertise of the team: a Compton-based Gamma-Source for ELI and IRIDE. Once any of these projects are approved, the SPARC_Lab mission must be adapted accordingly. Generally speaking, we are delighted to see that SPARC_Lab became a seed for two major project options for the lab.
We congratulate on the collaboration agreement with DESY and University of Hamburg on joint plasma acceleration research. This is an important step in establishing international collaboration on using SPARC.

As it was stressed previously, SPARC_LAB represents a very exciting and attractive environment for the next generation as it covers cutting edge technologies from various fields such as lasers technology, accelerator physics, plasma science, RF technology, and digital controls. It is thus once more suggested to define a strong education program as an integrated part of the SPARC_LAB, in collaboration with one or more university faculties. In this context we were disappointed to hear that only two out of the six PhD openings for accelerator physics at the University La Sapienza could be filled. This indicates that more efforts are needed, probably in earlier phases of university education.

2.2 Recommendations

In view of running collaborations and attracting more of them, we remind once more of the need to publish a Technical Design Report and establish and maintain an adequate webpage.

It is necessary to define the program of BEATS2/Mammography more clearly, and it would be helpful to identify a stand alone profile. Proton acceleration should concentrate on external injection and post acceleration of an ultrashort proton bunch, which could be done only at a few places in the world. The scientific case of LIDAR should be strength. Flame: in order to make full and adequate profit of the laser hardware, the focusing technology (adaptive optics) deserved high priority because it determines the power density that can be directed onto a target.

3. Summary of activities at LNF in astro-particle physics (CSN2)

The quick picture of the CSN2 in LNF is the following: there are experiments that will be closed in the next few of years and experiments that are under discussion for approval. Among those in the first category there are Opera, Icarus, Wizard, Pamela and Nautilus. On the new experiment side we have Nessie, supported by people from Opera, which is a short base line experiment from CERN, in discussion in these days; Cuore, that is in a very advanced construction phase for the

detection of the double beta decays; KM3 which is in a very strong phase of construction thanks to the resources from Sicily Region, Jem Euso to detect extremely high energetic cosmic rays, and Moonlight using retro-reflector for precision measurements in space. There was and there is a strong support of the laboratory infrastructure : the automatic robotic facility of OPERA, cryogenic facilities for CUORE, the participation to the design of the magnet of Nessie.

3.1 Recommendations

The SC takes note that in spite of the small size of the groups involved in these experiments, the impact of the LNF group has been large and the LNF groups made the difference in several experiments. The laboratory, with its local infrastructures can play even a more important role in INFN centered way.
LNF may benefit in increasing the participation is space experiments where INFN has quite a unique tradition, with the ambition of becoming a national INFN center providing specialized engineering support and infrastructure.

4. Summary of activities at LNF on nuclear physics (CSN3)

There are six experimental activities presently running at LNF. In addition to SIDDHARTA that is analyzing data taken at DAPHNE, the other experiments are in progress in different Italian and foreign laboratories: ALICE at CERN, JLAB12 at Jefferson Lab (USA), MAMBO at DESY (D), PANDA at GSI (D) and VIP at LNGS. Except PANDA that still necessitates of an official agreement between INFN and the hosting laboratory, the other experiments are in progress and the Frascati groups are actively involved both in the data analysis and in the upgrade of the detectors. The overall number of physicists is 42 and the size of the groups is sufficiently large to cover all the planned activities.
There is also strong support from the laboratory infrastructure, in particular Frascati will host the construction of the Internal Tracking System of ALICE and participate to the construction of the RICH detector for CLAS12 at JLAB.

4.1 Recommendations

The SC is impressed by the strength of the LNF participation to CNS3 activities: the contribution of the LNF groups to the scientific production of the Nuclear Scientific Community is of primary importance. Each group went much over the threshold of the participation for a good visibility. The only concern is that there is a group waiting for PANDA.

5. IRIDE

The SC is impressed with the IRIDE proposal that has been put together in such a short time. The scientific case includes outstanding experimental opportunities for nuclear photonics with the Compton backscattering gamma source, FEL based femtosecond photon science and particle physics based on variable energy electron positron collider.

It can be complemented by many exciting fields such as neutron spallation source, electron gamma collider, THz source and plasma acceleration for highest energies. A group with a lot of enthusiasm is working in order to define the details. By summer, there will be the preparation of a white book.

IRIDE involves state of the art accelerator technologies in many respects, matching very well the special expertise available at INFN and in Italian industry. On this basis its realization could in principle start right away. The only issue may present the electron positron linear collider with its positron source in particular. In our opinion there would be a simple and reliable way to provide variable energy high luminosity collisions by adding two storage rings to the facility. This addition could be realized at a comparatively moderate cost and would be based on unique expertise existing at the lab. In addition we believe that that a 4 GeV linear accelerator based FEL with present days advances in the undulator technology could be pushed towards a 1 Angstrom on the first harmonic.
IRIDE is also timely in the sense that there is a significant potential for linking the realization of IRIDE to the backend of the XFEL module production, fully exploiting existing European industry capabilities and lab infrastructures.

6. Theory Group

Following SC_44 recommendation the LNF director appointed an advisory committee (AC) composed by M.Mangano, A.Masiero and A.Lerda to help defining a strategy for the Theory Group of LNF. The AC met during the SC. In the closed session Ferroni reminded the SC of the new possibility for INFN staff to teach at University that will trigger new equilibrium among the theory INFN groups in the Rome area (the three University and LNF) up to now only marginally collaborating each other. CNS4 and Universities should encourage a gathering of the groups.

6.1 Report of the AC to LNF director

General remarks:
The scientific standings of the group, and of its individual members, are excellent. This is recognized by publication and citation records, by the award of european and other international grants, and by the leadership role played by all members in various committees, workshops, etc. We see the diversity of profiles of the various group members as an asset, which enables the group to contribute to the broad spectrum of experimental activities the laboratory is engaged in. This contribution was acknowledged and praised by the representatives of the experimental groups, which we met during our review.
Recommendation #1:
A sign of recognition, by the management, of the value and achievements of the theory group, is in order. This should come with a closer interaction between the group and the management, and with periodic meetings to review the plans and needs of the group, as

well as to identify possible opportunities of synergy with the other initiatives of the laboratory.

Stategic directions:
While LNF's activities cover a broad area, some of them have particular strategic value, and in those the laboratory expresses its leadership. It is reasonable that, while preserving the diversity of the topics covered in the TH group, special efforts be made to strengthen those areas that are strategic to the excellence of the laboratory.
Recommendation #2:
The management of the laboratory should identify strategic directions for the TH group, to be strengthened. While new developments such as the IRIDE project might modify the picture, we believe that, today, this strategic direction should coincide with high energy phenomenology.

Means to enrich the group:
We understand that a significant increase in staff, while desirable, is not a realistic mean to strengthen the group. On the other hand the group has the leadership and the infrastructure to increase its impact, by organizing activities such as workshops, schools, Summer Institutes, that could attract to LNF a large number of researchers. This should be done in cooperation with the experimental groups and possibly with the theory groups of the Rome area, and could aim at establishing in Frascati a national pole of attraction for phenomenology activities.
Recommendation #3: the management of the laboratory should support such activities. A coherent overall programme that would benefit the whole national high-energy community might deserve dedicated resources from INFN. Further efforts to secure European support, e.g. via ERC grants or COST programmes, should also be made by the members of the TH group.

Definition and realization of a development plan for TH:
The current mechanism of financing of the group actiities, based on competitive calls within the national INFN commission for theoretical physics, does not seem best suited to support activities that are fully intertwined with the overall strategy of the laboratory. To fulfill the above goals, it is essential that a plan be drawn by the management in concordance with the group, and that the management takes direct responsibility for the assignment and use of the needed resources.
Recommendation #4: the management must directly appoint a group leader, responsible for the implementation of the commonly agreed plan and the use of the resources allocated. This process could be formalized by establishing the theory group as a division within the laboratory.

7. From Previous Meetings

7.1 NAUTILUS Recommendations_SC_44

The SC recommends guaranteeing the run of NAUTILUS until VIRGO will restart after its upgrade, in spite of the limited sensitivity of the NAUTILUS detector compared to the interferometers.

SC_45: Nautilus will be kept running.

7.2 Theory Group Recommendations_SC_44

The SC recommends defining a clear strategy for the Theory Group of LNF. A working group with representatives from the Theory Group, the Lab management and theorists from nearby universities should be formed with the mandate to define and state this strategy for the medium/long term.

An effort should be made to increase the number of young people in the group: establishing collaborations/official agreements with nearby universities and possibly finding ways to finance more postdoc positions.

SC_45:Dosselli states that the preparation of the panel to review and to define the strategy is ongoing. It was decided to go up to 5 postdoc positions (a fraction of which will go to the theory group) reducing the money for foreign visitors.

7.3 Space Research at the SCF_LAB Recommendations_SC_44

The SC takes note that the group is making good use of existing infrastructures (eg. clean rooms) giving added value to the Laboratory also with external contracts.

7.4 PANDA Recommendation_SC_44

The SC acknowledges the good work done on the SST and is impressed by the very light design. The SC recommends that the participation of INFN to PANDA and to its funding is clarified before the start of the construction at LNF and takes note that CSN3 has a new scientific committee to better understand the scientific position of PANDA.

SC_45: The report of this new scientific committee was positive endorsing the participation of the Italian community to the project. However the funding (5MEu) situation is not clarified. Dosselli states that LNF will start the construction work on PANDA when the situation will be clear. R&D will continue.

SC_46: Taiuti has been invited in the SB of PANDA, otherwise no progress in the clarification of the funding.

7.5 BES Recommendations_SC_45

The SC takes note that the group is making good contribution to BES also in synergy with other hardware activities of the Laboratory. The SC notices that the size of this contribution is quite limited and configures more as the participation of a "Sezione" than as the participation of a Laboratory. See also the recommendation section 3.2.

7.6 NA62 Recommendation_SC_45

The SC takes note that the group is making good use of the structures of the Laboratory in order to contribute to an important experiment capable add new constraints the CKM matrix.

7.7 CNS5@LNF Recommendations_SC_45

The SC recommends that the LNF management, together with all involved people, define the common goals and the appropriate follow up process for each project.
The SC invites a new presentation of the summary of LNF CSN5 activities at the next meeting addressing some of the questions asked by the committee and showing the correlation between the LNF CNS5 activities and the needs of the Laboratory.

SC46: The LNF direction is trying to streamline the CSN5 activities in the lab even if this is not easy because of diversification already at national level. The SC iterates the importance of a new presentation at SC_47.

7.8 CNS1@LNF Recommendation_SC_45

The SC invites a presentation from KLOE of consequences of possible shortage of human resources for the commissioning, run and analyses of the KLOE-2 due to researchers migrating to different experiments.
The SC recommends the LNF management to tune the assignment of resources to CSN1 LNF groups privileging a) the internal core activities and b) the large and visible extramural activities, which have an impact on the local LNF infrastructures.
The goal of this request is to reduce to a minimum the Laboratory participation in small and less visible extramural activities with little return on the Laboratory.