

**LIP International Advisory Committee**  
Meeting of 15<sup>th</sup> and 16<sup>th</sup> April 2020 via teleconference

**Executive summary**

The LIP International Advisory Committee and representatives of LIP held their annual meeting on 15<sup>th</sup> and 16<sup>th</sup> April 2020 via a teleconference, a consequence of the Covid-19 pandemic restrictions. Prior to the meeting, the Committee had received extensive and well-prepared documentation about the LIP activities. Oral presentations and discussions during the meeting provided further clarifying information.

This meeting followed an in-depth review by the International FCT Evaluation Panel, June 2019, attesting LIP the rating “Excellence”.

LIP’s primary mission is the study of the fundamental laws of particle physics. Most of the accelerator-based programme of this research is carried out at CERN, principally with the two flagship experiments ATLAS and CMS at the LHC and with COMPASS at the SPS. Neutrino properties are investigated with SNO+ in Canada. Cosmic rays and their astrophysics implications are studied with the world’s largest array of earth-based detectors (Auger in Argentina) and on the International Space Station (AMS). Search for Dark Matter in our Universe is pursued with the LUX-ZEPLIN (LZ) experiment (in USA). These research programmes are conducted in large international scientific collaborations in which LIP has many leading positions, shares major responsibilities and makes first-class scientific contributions. Noteworthy and very productive is the close involvement of LIP theorists in the interpretation of the results obtained by the experimental groups.

In parallel, LIP maintains a strong programme directed at future activities. LIP teams are progressing with R&D, design and prototyping for the High-Luminosity LHC upgrade of ATLAS and CMS. R&D, design and prototyping are also pursued for the DUNE neutrino experiment in preparation in the USA. LIP is among the proponents of the new SHiP facility at CERN, searching for weakly interacting long-lived particles and studying neutrino physics. LIP is a key promoter of SWGO, a novel ground-based array in the Southern hemisphere for high-energy gamma ray astronomy.

A second major pillar of LIP are activities with a direct and beneficial impact on society. This line leverages the competence of individuals and teams, notably in particle detector R&D and construction techniques, electronics and computing. LIP’s development of novel medical imaging instrumentation is one promising direction. LIP also makes significant contributions to important programs in terrestrial and space radiation simulation and environmental monitoring.

LIP is maintaining its outstanding leadership in scientific computing, both within Portugal and internationally. Software developments, advanced algorithms and techniques and an excellent record of system management, performance and availability have made LIP the leader in the deployment and operation of the Portuguese scientific computing infrastructure and a most welcome partner in many international projects. The LIP computing teams are engaged in many important international collaborations and have again steadily progressed during 2019.

LIP is growing, in line with its mission to federate institutions and groups with activities related to LIP. During the past few years, the joining of new groups strengthened areas such as theoretical and nuclear physics and computing. Very recently, the group “Societal Physics and Complexity” joined, bringing to LIP stimulating new competences. The Committee strongly supports this strategy, which will be fruitful beyond LIP for the scientific life in Portugal.

LIP is aware of the importance of communicating science to society. Its staff is fully engaged in an innovative outreach programme, with emphasis on attracting students to STEM and to particle physics, through seminars, masterclasses, internships and summer courses. The Committee considers this activity exceptionally good at a European level.

As noted previously, the remarkably diverse and multi-faceted research and R&D activities carry a certain risk of fragmentation. The LIP Leadership is fully aware of this risk and continues their efforts in sharpening the focus. One example concerns the many R&D efforts in medical instrumentation, where streamlining and clarifying LIP's strategy should be undertaken. These activities should also be aligned with the programme at the planned center for tumor therapy with proton beams.

The Committee applauds and encourages the LIP Management to pursue vigorously these several lines of convergence.

The Committee was pleased to learn that the employment perspectives at LIP continue to improve. In line with LIP's healthy agenda, aiming at growth, LIP plans to increase its staff by more than 20% over the next five years. The Committee strongly supports this strategy. Implementing it will require a clearly defined roadmap for LIP's development over the coming five to ten years, critical internal reviews prioritizing activities, as well as documenting the need for each new position. Part of the strategy, in the view of the Committee, must also be a reasonable balance between baseline and project-related funds to cover staff expenses.

The recently established Portugal-CERN Ph.D. programme will provide 15 new positions per year. This is a most valuable addition to the research staff, requiring proper supervision of the students. Some level of supervision and mentoring of the supervisors may also be necessary. Steps in this direction should be intensified.

The recently established new management structure has proven to be effective. Notable achievements are the improved coordination among groups active in neighboring fields of research. The very successful Competence Centers are another fine example of leveraging the staff's competences.

LIP employs its limited financial and personnel resources with great care, which is one important factor for its remarkably successful and multi-faceted programme. The Committee is impressed by the scientific output of many research groups, despite sometimes extremely limited resources. Unsurprisingly, these restrictions are clearly limiting a number important of LIP activities.

The Committee respectfully reiterates its view that the available funds could be used even more effectively if the Portuguese medium-term funding strategy would be more closely aligned with the long-term scientific research plans and engagements of the Laboratory.

The Committee congratulates the LIP directorate and the LIP staff for another exceptionally productive year with an impressive range of world-class activities. It thanks the Laboratory for the efficient organization of the review.

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