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THE LATINO PROJECT – AN ITALIAN PERSPECTIVE ON CONNECTING SMEs WITH RESEARCH INFRATRUCTURES

L. Sabbatini†, D. Alesini, A. Gallo, A. Falone, INFN/LNF, Frascati (Roma), Italy
V. Pettinacci, INFN-Roma1, Roma, Italy

Abstract

The National Laboratories of Frascati (LNF) are the first Italian research facility for the study of nuclear and subnuclear physics with accelerators and are the largest laboratories of the Italian National Institute for Nuclear Physics (INFN), the public body whose mission is theoretical, experimental and technological research in subnuclear, nuclear and astroparticle physics. LNF have an extensive experience in designing, installation, testing and operation of particle accelerators and the related technologies. The competences range over almost all the technologies related to particle accelerators, including radio frequency, vacuum, magnets and mechanics.

LNF have always had a close relationship with the regional and national industries, stimulating the development and growth of the industrial background by means of close collaboration with partners.

The LATINO (a Laboratory in Advanced Technologies for INnOvation) project is an initiative that fits into this path and aims to strengthen this relationship, allowing access to the technologies, instruments and competences not otherwise available to the enterprises. A modern vision of advanced economies recommends the Technology Transfer from the research world to the productive activities through the creation of research infrastructures as the most efficient system for generating innovation and economic development [1-3]. The Regione Lazio, despite hosting centres of excellence, has a delay in the establishment of this kind of infrastructures.

THE LATINO INFRASTRUCTURE

LATINO is an open access Research Infrastructure that will be opened to external users, for both research and economic activities. LATINO will also be a focal point for Research Institutions operating in the development of advanced technologies for particle accelerators. It is based on four main laboratories: Radio Frequency, Magnetic Measurements, Vacuum and Thermal Treatments, Mechanical Integration. The laboratories, already in operation at LNF, are now under a deep upgrading process in order to fully exploit their potential. INFN Roma1 – one of the other divisions located in the Lazio region and one of the most ancient of the whole institute – will collaborate with LNF sharing its relevant knowledge about mechanical 3D design and integration of large facilities. In the future, other laboratories could eventually be included in the project, depending on the interest of the industries and on the sustainability by INFN.

† lucia.sabbatini@lnf.infn.it

The main goal is to promote the access to those technologies in order to support the development also in areas other than the nuclear and particle physics research.

This project is co-funded by the LAZIO regional government, as one of the winners of the call "Open Research Infrastructures" within POR-FESR 2014-2020 European activities (http://www.lazioinnova.it/bandi-post/sostegno-alle-infrastrutture-aperte-la-ricerca/). The main goal of the call is the re-industrialization of the Region, enabling the access of Small and Medium Enterprises to the technologies developed in Research Institutes that could help in qualifying their products and activities.

The project is organized in two main phases. The first phase (2018-2020) is aimed to set up the infrastructure, procure the required instrumentation and upgrade the existing facilities. During the second phase (2020-2025) the activities will start and will be monitored by the main stakeholder (regional government) in order to assess the financial sustainability as presented in the business plan. The overall budget of the project is about 2.5 M€, 65% of which will be funded by Regione Lazio, with a contribution of less than 1 M€ by INFN. According to the rules of the call, this budget has to be used for instrumentation and civil engineering.

During the first phase, now in progress, the laboratories will be equipped with state of the art instrumentation, which will integrate the already existing tools. The instrumentation includes, among others, a X-band high power plant to test cavities up to 50 Hz repetition rate and 200 MW input power, a network analyser to characterize microwave devices up to 110 GHz, an ultra high vacuum furnace for thermal treatments and brazing, an outgassing measurement system to characterize vacuum materials, a stretched wire bench and a rotating coil for magnetic field measurements of multipoles, environmental and stereoscopic laser scanners.

Radio Frequency Laboratory

The Radio Frequency laboratory will be organized in two sections: high power and low power RF and it is devoted for the characterization of RF systems for particle accelerators, medical accelerators, telecommunication systems and aerospace applications.

The high power section includes a 12 GHz (X-Band) RF Klystron and a solid state pulsed RF modulator able to provide 50 MW, 1 μs RF pulse at 12 GHz with a repetition rate of 50 Hz, if used with a pulse compressor the peak power and the pulse length would be 200 MW and 100 ns respectively. The X-Band RF station will be installed in a dedicated bunker in order to guarantee all the radioprotection issues. The bunker will be equipped with

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cooling water (both for the station and for the equipment under test) in a temperature-controlled environment.

In the low power section, there will be a complete set of instruments that allow the study of frequency response of RF components and devices up to 100 GHz, and signal measurements in time and frequency domain up to 20 GHz. The instrumentation will include a 100 GHz network analyser.

Magnetic Measurements Laboratory

The Magnetic Measurement Laboratory will be able to fully characterize magnets, from field maps to harmonic analysis.

The field maps will be performed with a Hall probe mounted on a five-axis movement system located on a granite bench, with a probe positioning precision of 10 µm and a measurements sensitivity of about 0.01%. The harmonic analysis of the multipoles will be carried out with a rotating coil bench, having a relative accuracy of integrated main harmonic of $3\,10^{-4}$ and a positioning accuracy of about 30 µm. The integral magnetic field measurements and fiducialization of magnets will be done with a stretched wire bench, with a centering accuracy of 2 µm and integrated field precision of 0.2 G m.

The magnetic design of electromagnets could also be provided.

The main applications are in the field of medical and research accelerators.

Vacuum and Thermal Treatments Laboratory

The Vacuum Laboratory will implement two facilities: a dedicated system for outgassing rate measurements and an ultra-clean vacuum furnace. The first system will be able to provide specific outgassing measurements of materials used in UHV and HV applications and material used in aerospace technology. It will integrate two chambers, one for UHV materials with low outgassing rates, the other for HV materials and larger outgassing rates. It will be equipped with a residual gas analyser at 200 amu and partial pressure sensitivities up to $2\,10^{-14}$ mbar. Outgassing rates measurements at different temperatures will be also possible.

The ultra clean vacuum furnace for thermal treatments and brazing will have a diameter of 50 cm and a length of 1.5 m. It will be able to reach up to 900°C with an internal pressure of about 10^{-7} mbar in a very clean environment since it will avoid internal resistors in vacuum. It will be used for brazing and thermal treatments, also in controlled atmosphere (N_2, H_2, etc.), of materials for particle accelerators, normal and superconducting cavities, detectors, ultra-clean systems in general and materials used in aerospace technology.

Mechanical Integration Laboratory

The mechanical Integration Laboratory will be provided with two laser scanners, one for architectonic measurements and one for stereoscopic scans.

The architectonic laser scanner will be used to measure environments, buildings, plants. The range of measurements is broader than 140 mm with a positioning precision at 10 m of less than 2 mm. These measurements are useful for space management applications, such as to plan installation or handling of instruments and components.

The stereoscopic laser scanner will allow the design, quality control checks, dimensional survey of mechanical components and interfaces and reverse engineering. The distance between points in the scan is of 0.04 mm with accuracy of 0.018 mm in its best configuration, 6 Mpixel for each camera and a field of view of 460 mm.

The applications field of this technology is mainly for industrial plant construction and high precision mechanics. The lasers will be able to operate both inside the INFN structures and outside for industrial applications.

ORGANIZATION

LATINO is led by a general manager responsible for the management, coordination and interaction with users. The manager is an Engineer with competences in particle accelerators, quality assurance and experience in dealing with industries. The general manager will be supported for the daily activities by administrative staff and secretaries, which will also organize the access for external users and support the commercial aspects of the initiative.

LATINO manpower will be based mainly on the organization structure of the Accelerator Division of LNF. Every laboratory is thus led by an INFN subject matter expert on each field. The technical personnel of the corresponding Service of the Accelerator Division will be involved to carry out the daily activities.

The rules governing the access to the Infrastructure have been defined. Different kinds of users are allowed to the access: internal users, institutional (research) users and industrial ones.

The access point to the infrastructure is mainly the website (http://latino.lnf.infn.it/), that contains a users area where applicants could fill a form that will be automatically spread to the management. The LATINO project is being introduced at various conferences and exhibitions; dissemination to the industries is proceeding also through the usual LNF programs, including Industrial Seminars and Events.

ECONOMIC ACTIVITIES

Besides the scientific and technological issues, the main challenge of this project is the inclusion in a large research institute of an open-access technological infrastructure that provides services to the research and industrial community.

In order to be prepared for economic activities, a business plan has been prepared, with the support of an external consultant. The goal of the business plan is the analysis of the capabilities of the Infrastructure in terms of target users, approach to the market, economic feasibility, operational costs.

Other similar infrastructures have been contacted in order to learn and prevent the problems and difficulties

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inherent the simultaneous management of research and economic activities.

While preparing the proposal, the initiative already rose the interest of some national companies, that sent letters of interest for future collaborations.

The External Funds Service of LNF has organized a Working Group at LNF dealing with separate accountancy, to help in evaluating the economic aspects involved in the interaction with industrial users.

CONCLUSION

The regional and national industrial background shows high quality small and medium enterprises that could take advantage of the technologies provided in the LATINO Infrastructure to develop novel products and to get access to new market segments [4-7]. This project will enhance the current relationship between INFN and industries.

Moreover, INFN will benefit from the efforts made to build and manage such an infrastructure. This project shows a synergistic approach of financing research and encouraging the development of industrial background.

Finally, the LATINO Infrastructure can be seen as a test bench of our capabilities of doing Technology Transfer at this level, being a part of a broader work on Technology Transfer at LNF.

The infrastructure will be fully operational in Spring 2020. Please visit our website: http://latino.lnf.infn.it/.

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