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THE NATIONAL LABORATORIES OF FRASCATI, CRADLE OF ACCELERATORS PHYSICS IN ITALY

Interview with Pierluigi Campana, director of the National Laboratories of Frascati

Pierluigi Campana is the new director of the National Laboratories in Frascati, one of the four INFN national laboratories, symbol of the tradition of accelerator physics in our country. It was precisely in Frascati in the 60s that the electron synchrotron and the Accumulation Ring (Anello di Accumulazione - ADA - in Italian), the prototype of future accelerators in which particle beams collide to produce new particles, were built. Ada is named after the aunt of Austrian physicist Bruno Touschek, the scientist who conceived such a revolutionary idea and guided its construction. Transferred in France after its construction, and tested in the Linear Accelerator Laboratory in Orsay (LAL), the machine is the ancestor of current particle accelerators, such as the giant Large Hadron Collider at CERN in Geneva.

What type of research are the Frascati Laboratories currently engaged in and what are the main experiments?

The Frascati Laboratories, due to the long tradition in accelerator physics, are engaged in multiple lines of research. For over a decade we have been working on DAFNE (Double Annular Factory for Nice Experiments), a low energy electron and positron collider with which we study some of the symmetries that govern the particle world and the structure of the strong interactions between the lighter quarks. Moving abroad, the Laboratories are currently engaged in the construction phase of the Extreme Light Infrastructure – Nuclear Physics (ELI-NP), a gamma ray source to be installed in Romania and that will be built by the EuroGammaS consortium, led by the National Institute for Nuclear Physics.
Looking to the future, there are many expectations regarding the SPARC_LAB (*Laboratorio Sorgente Pulsanta Auto-amplificata di Radiazione Coerente*) project designed to investigate the feasibility of accelerators at the frontier of technology, able to accelerate particles in a just few hundred metres, with very small dimensions therefore compared to the large accelerators currently in operation, such

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as the Large Hadron Collider.
Experiments' scientific communities are widely international and our physicists, technologists and technicians are collaborating in the Atlas, CMS, Alice and Lhcb experiments, the main LHC detectors, and in many other subnuclear, nuclear and astroparticle physics experiments in the most important laboratories in the world. In this frame, not only do they design and build new detectors and electronic systems, but they also take part in initiatives that have a more direct impact on society: accelerators and detectors for medicine, the cultural heritage or for environmental analyses. In short, much on our plate, but initiative and curiosity are the fascinating part of this job.

What vision do you have for the future of the Laboratories and which are the most promising fields?

Certainly, as I said before, being able in the future to build an accelerator able to produce the Higgs boson and which is of limited dimensions, for example, within the perimeter of the Frascati Laboratories, is a dream. But there are research frontiers, such as the studies on plasma acceleration, which study how to obtain large accelerating fields in a small space and which have already led to promising results such as, for example, at SLAC (*Stanford Linear Accelerator Center*) in California, but also in other laboratories, including ours.
We must continue on this road with commitment and resources without, however, forgetting other and future options that allow us to remain a fully-fledged member of the worldwide club of laboratories that know how to design, build and operate accelerators. And the club is not very big. Then there is fundamental physics and our ability to build large devices. We are in a period of great expectations for the first results of the LHC with energy at 13 TeV. We could be on the verge of big developments. If so, we must get ready for a new phase of particle physics. But to do everything well we need clear ideas, resources, great determination and young people of international excellence. In short, a poker to rely on.

You have been spokesperson of an important international collaboration at CERN, the LHCb experiment in which Italy has a very important role.

As I have stressed many other times, the position that was assigned to me was the result of a great team effort, in which the role of the INFN, of my colleagues and of the Frascati Laboratories were decisive. Our research is successful abroad because we have a modus operandi that people like and appreciate. The adventure in LHCb was exciting and enriched me greatly. But managing a laboratory the size of Frascati, with over 1000 people including staff, students and users, and with the weight of its tradition on your shoulders is, however, a different and definitely "challenging" enterprise, as our

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Anglo-Saxon colleagues would say. Not only the scientific programmes but also management skills, relationships with staff and the support of the Organisation are important. Frascati can count on a staff that is in every way as good as that of the great laboratories worldwide. It is up to us to capitalise on this extraordinary human capital.

In the Laboratories in Frascati basic research is carried out, but it is from these studies that technologies and applications that are integrated in society arise.

Accelerators are an example that demonstrates how improving technology to allow us to improve our research ultimately has an effect on society as a whole. A fraction of the more than 10,000 machines spread around the world is dedicated to basic research; the majority is used for industrial or medical applications, or for the preservation of the cultural heritage. Not many people know that under the Louvre there is a particle accelerator: we have a similar laboratory in Florence. And then there are particle detectors in the operating theatre to guide the surgeon in eradicating the tumour in the precise point. And, more recently, someone had the idea of reviving an old mine in Sardinia to extract the rare gases necessary for the study of dark matter, but also used as in the diagnosis of tumours in medicine: here the impact is immediate. In addition, if the operation is successful, it will create jobs in an infrastructure which is unique in the world. ■