

# IL GAZZETTINO

## Inauguration in Legnaro

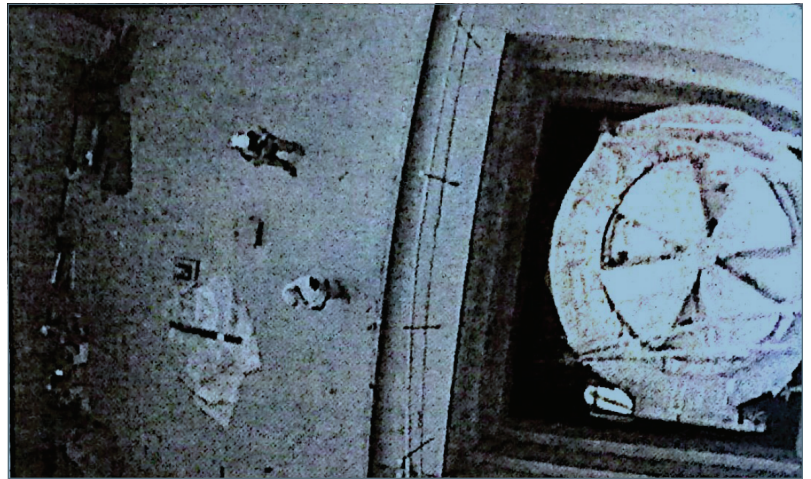
### Research and discoveries here at the National Institute of Nuclear Physics

The National Institute of Nuclear Physics is a public research body that operates under the control of the Ministry of Education. It conducts research, experimental and theoretical, in the fields of subnuclear, nuclear and astroparticle physics. INFN was established on August 8, 1951 by university groups of Rome, Padua, Turin and Milan to continue and develop the scientific tradition started in the '30s with the theoretical and experimental research of Enrico Fermi. In the second half of the decade it was born the first national laboratory at Frascati (Rome) and began working with the European Nuclear Research Center. In 1960, the

### Cyclotron: the future is in Padua

At the laboratory of the National Institute of Nuclear Physics of Legnaro was the big day of the Cyclotron SPES (short for Selective Production of Exotic Species). Yesterday in fact, after a meeting between all the organizations and researchers in the nearby Agripolis, was cut the ribbon in the building in Legnaro inside the complex that houses the innovative and modern apparatus. This Cyclotron puts Legnaro Laboratories at the cutting edge in the field of nuclear physics and advanced medical research. An event that brought together the biggest names of the research that made this project possible: Fernando Ferroni, president of the INFN, Giovanni Fiorentini, director of Legnaro laboratories, Barbara Degani, undersecretary of the Ministry of the Environment, Krishnan Suthanthiran, president Best Medical International, Luisa Cifarelli, President of the Italian Physical Society, Rosario Rizzuto, Rector of the University of Padua, Massimo Carpinelli, Rector of Sassari University, Paolo Collini, Rector of the University of Trento, Roberto Marcato, Deputy Mayor for economic development regional Veneto, Enrico Rinuncini, mayor of Ponte san Nicolò and Stefan Walter, mayor of Saonara.

The uniqueness lies in the dual use of SPES, which will allow researchers (120 in the laboratories of



#### The accelerator

A giant disk immersed in a "science-fiction garage"

#### The applications

Production of new drugs and materials ready for use

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Legnaro, but at least 700 around the world from South Africa to the United State to those who do research and those involved in medicine. INFN is ready to invest 30 million euro to develop the capacity of SPES, while they expect private sponsors to acquire funds of the same order of magnitude, which will be put toward the nuclear pharmacy able to produce isotopes for medical purposes. SPES is part of a larger European project, Euryalus, which today sees the European nuclear physicist engaged in the construction of three facilities of radioactive ion beams. Besides SPES, in France a machine with similar characteristics is under construction, Spiral 2, and CERN is in the process of upgrading the existing



**Weight: 170 tons**  
**Costed 20 millions of Euros**

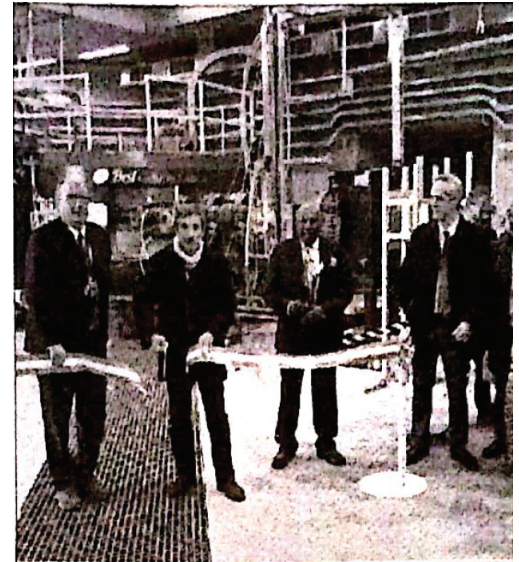
equipment Isolde: together will create widespread infrastructure at European level. At the end of the day dedicated the inauguration of the Cyclotron SPES, the classroom Bomsembiante at Agripolis also hosted the annual conference of the national Institute of nuclear Physics dedicated to the three-year research plan.



### **Results: aerospace and common life**

Not only the exploration of the mysteries of the universe, but also an immediate response to the needs of people, especially the sick ones. The impressive cyclotron inaugurated in Legnaro will also become "drug manufacturer". If today the isotopes (atoms with different mass from the atom from which they derive) most used in medicine are produced often in hospital pharmacies, research is pushing more and more towards the use of new elements that the "normal" medical nuclear equipment are not able to produce, but SPES will:

"We create the isotopes that do not exist in nature and can be introduced into the human body by using them in drugs," said Giovanni Fiorentini, director of the Laboratory of Legnaro, "via their decay may diagnose diseases or treat them. Some of the produced isotopes have capacity we now call "teranostiche" that is linked both to the knowledge, to the diagnostics, to the therapy. You can instantaneously monitor and see if the target has been reached "The applications are therefore multiple, physics, medicine and more." This is a factory of radioactive nuclei that generates particle that we do not have on Earth," continues Fiorentini, "we can produce neutron beams that can serve to space travel, because they can simulate the radiation that astronauts will be exposed to in space on the way to Mars. The main idea is to have a tool that can do at the same time basic research, fundamental research and applied research. Nowadays a laboratory must also have consequences on society, otherwise it is perceived as sterile "



**A spiral that approaches the beams of particles at the speed of the light.**

The cyclotron is a complex tool that is mostly used for research in nuclear physics, although as will happen to SPES, the innovative machine hosted in Legnaro, may also be useful in medicine for diagnostics and therapy. Nuclear physics is the specific field of research of laboratories of Legnaro, it deals with the study of neutrons and protons, the particles which in fact constitute the nuclei. The cyclotron is used to accelerate beams of electrically charged particles (usually light ions), using an alternating current at high frequency and high voltage, in combination with a perpendicular magnetic field. The particles start their movement from the center of the machine and increase speed moving away towards the outside of the machine, then they go out at a speed which may be close to the speed of light. So the accelerated particles can go out from the cyclotron and colliding with other particles, other particles that become the particular object of the researchers study. The cyclotron was invented in 1930 and completed in 1932 by the American physicist Ernest Orlando Lawrence. Giovanni Fiorentini, director of the Legnaro Laboratories, explained in simple words this complex machine "it is a kind of merry-go-round where the protons turn around and run while receiving a boost that makes them speed up, just like on a carousel where someone pushes you to go faster and faster. At some point the hydrogen nuclei that are in carousel, jump down and go crashing all around." In the field of particle acceleration cyclotron is an evolution of linear accelerators, of which exceeds certain limits (for example being circular allows the particles to travel in less space). The Legnaro laboratories also house a superconducting linear accelerator called the Alps, built in the nineties, which also works in support to older electrostatic accelerators made in previous decade.

## **SPES will improve our health**

Researchers and institutions have gathered for the inauguration of the cyclotron SPES, which will have repercussions on different disciplines. SPES in fact comes as cutting edge machine in pure research, but also as a tool that will be useful to many sick people."The Veneto is confirmed as a region capable to create an high level of research and technology transfer,"confirms the Councillor for Economic Development Robert Marcato, "we are proud of this achievement which will have a significant return for the health of our citizens. The importance of SPES was remarked by the rector of the university Rosario Rizzuto, who recalled once again the primacy of the university research Padovano,who was also among the leaders in the INFN creation."

The president of the national Institute of Nuclear Physics says: "As such a complex instrument may have practical consequences; the cyclotron is a machine that accelerates protons and produces a beam of particles, the distinguishing features of SPES are two: it works in very high energy and produces a significant amount of protons. By exploiting these two properties, the machine can be used in two different ways, equally important. One involves basic research to produce radioactive nuclei that can enable us to understand what is still not well known in modern nuclear physics.

The other aspect concerns the production of radio isotopes for nuclear medicine. These isotopes can be distributed around the world from a nuclear pharmacy that will be created here. Those isotopes cannot be produced in the normal hospital centers and that may be useful for the identification of certain specific diseases." The path to arrive at a festive day like yesterday was particularly long: "This cyclotron was ordered several years ago,"continues Ferroni, "our projects do not last a day, but include several phases. It starts with the design, we go in search of funds and then to the project. Here today we enter the phase preceding the actual installation exploitation. We are showing that the machine does all it has to do, and in a short period of time the cyclotron will be fully operational and will start to work in physics research and in nuclear medicine. This is our way of doing research: we think not to the next year, but to the next twenty." Right now Legnaro becomes a reference point in Italy for these researches: "This machine right now is unique in Europe," said the President of INFN, "there are others under construction that will come after us. At the moment it is the most important machine for nuclear physics and it will be for some years. As regards the medicine instead this machine will be leading for a long time in Europe. With this machine the Legnaro laboratories are located at the forefront in a European context, and perhaps the world, and it will be for many more years.