

PROFILE

CNAO is the National Center of Oncological Hadrontherapy for the treatment of tumours with protons and carbon ions, a non-profit private Foundation created by the Ministry of Health in 2001 with seat in Pavia.

Operational since September 2011, it is the only Italian center and the fourth in the world that can carry out hadrontherapy both with protons and with carbon ions, an advanced treatment especially used for those types of not operable tumours, resistant to traditional radiotherapy.

In the world the other dual centers that use both protons and ions are only three and are located in Germany, Japan and China.

To date at CNAO the treatment of over 500 oncological patients is a reality, validating 23 therapeutic protocols for the same number of pathologies.

Also treatments of pancreas, liver, rectum tumours have begun recently. Soon vagina melanomas and advanced pulmonary neoplasia will be treated and protocols of both national and international collaboration for paediatric tumours.

To date, the center has an agreement with the National Health Service only for Lombardy and Emilia Romagna. Pending the inclusion of Hadrotherapy in the Essential Levels of Care (ELC), for other regions it is necessary to proceed with the authorization of the ASL of residence, with great difficulties for patients.



Hadrotherapy is an advanced form of radiation therapy. Unlike the latter that uses predominantly X-rays and electrons, hadrontherapy allows to hit the tumor with beams of protons and carbon ions. These are more powerful and effective particles in destroying tumour cells that resist to radiation therapy. With hadrontherapy also only cancer cells are hit, unlike what happens with radiotherapy that irradiates all tissues, even healthy ones.

To do this CNAO uses a synchrotron, which is a large and complex particle accelerator, issued from the Italian technology, which splits atoms and directs the beams of particles on tumour tissues.

The entire CNAO building in Pavia has been thought in view of the synchrotron, which consists of a device of circular shape with a diameter of 25 meters and a circumference of 80 meters. The particle beams produced here are transferred, after repeated accelerations, in the rooms where patients receive treatment. The creation of the center has required an **investment of 140 million euro, 50% less than the requirements of other centers abroad**. For its management and design capacity, many centers abroad have asked CNAO to work together to implement "twin" projects. These include Vienna, Dallas, Osijek (Croatia), Phoenix, San Francisco.

THE HISTORY

The National Center of Oncological Hadrontherapy (CNAO) is a non-profit foundation established by the Ministry of Health in 2001 with the objective to build and operate an advanced center for the treatment of tumors by hadrontherapy.

In 2001, CNAO started working on the design of the center together with the TERA Foundation of Novara, already engaged since 1992 in research in this area, thanks to the collaboration with CERN in Geneva. The TERA Foundation had in fact pursued concepts and studies of Ugo Amaldi, at CERN as a particle and accelerator physicist and of Giampiero Tosi who was Head of the Health Physics Department of Niguarda Hospital in Milan. Amaldi and Tosi, with their publication of 1991 "For a centre of teletherapy with hadrons", had already laid the foundations for the creation of a center for hadrontherapy in Italy. In 2004 Pavia was chosen as the site of the center, where the Municipality provides a free ground for the realization of the building. In 2005 the planning phase of the CNAO is terminated, also thanks to the collaboration with the National Institute of Nuclear Physics, and works began on the construction of the building. In parallel also advanced the design and implementation of the components of the synchrotron, the particle accelerator, heart of the project, around which the whole activity of the center is pivoted. In November 2009, the construction works ended and the phase of tuning of the complex device began. After numerous tests and controls in terms of technical and clinical efficiency and the obtainment of seventy authorizations, related to construction and safety and necessary to the accreditation within the Regional Health System, in September 2011 CNAO welcomes the first patient. In 2012 the Center obtains the certifications of the ISO 9001 and ISO 13485 quality system for its healthcare activities, for the design techniques and for those of clinical, radiobiological and technical research.

The construction of the center required an investment of about 140 million euro to which add up the 40 million needed for experimentation aimed at the "CE mark", required by the Ministry of Health. Of these total 180 million necessary for the construction and start-up, CNAO has received 118 with grants (94.5 by the Ministry of Health, 10 by Regione Lombardia, 8.5 by the Cariplo Foundation and 5 from others) and about 50 with a loan of the European Investment Bank. Allocations received to date (pending the 30 million scheduled by the Stability Law 2014 for the period 2015-2017) are therefore still below the realization cost of construction, not to mention the current expenses for the management and the maintenance of the center. Thanks to loans made CNAO still manages to carry on its activities. Treatments are to date only reimbursed by the Lombardy and Emilia Romagna Regional Health Service system.

The inclusion of Hadrontherapy in the Essential Assistance Levels (LEA), under study of the Ministry of Health, would instead help CNAO to provide treatments to patients of all Italian regions within the National Health Service, thus favouring citizens' access to care and the increase of the clinical activity of the centre.

THE FOUNDERS

Six founding members appointed by the Ministry of Health with the Incorporation act of 2001 compose the CNAO Foundation:

- Ospedale Maggiore Policlinics of Milan
- Neurological Institute C. Besta in Milan
- European Institute of Oncology in Milan
- National Cancer Institute of Milan
- S. Matteo Policlinics of Pavia
- TERA Foundation of Novara

The following as institutional participants:

- National Institute of Nuclear Physics
- University of Milan
- Polytechnics of Milan
- University of Pavia
- Local Council of Pavia

Other participants: Fondazione Cariplo

The Steering Council, composed of twelve advisors, one for each founding member and institutional participant, is the body to which is reserved the deliberation of guiding acts, the verification and achievement of the statutory purposes.

PRESIDENCE AND BOARDS

Erminio Borloni, President. An experienced Manager, his professional activity vaunts 30 years of professional work in the multinational Unilever group with Chief Executive Officer duties in the company and as member of the Italian board.

In his career he was later engaged in ATM as a member of the Board of Directors, Director of the Non-Profit Organisations Agency, Adviser of the Foundations IRCCS Ospedale Maggiore Policlinico, Mangiagalli and Regina Elena. He introduced a Management approach in the realisation of the Center and, in addition to founders included by ministerial Decree in the Foundation, he has created around the project a network of national and international partnerships currently representing the backbone of CNAO system.

Sandro Rossi, Secretary General and Technical Director. His experience begins at CERN in the development of the DELPHI experiment and subsequently deals with the PIMMS project (Proton Ion Medical Machine Study) and studies of the TERA Foundation coordinated by Professor Ugo Amaldi, which will issue the design of CNAO synchrotron.

From 2003 he coordinated the design, realisation and start-up of the accelerators and of the tools for the treatment of patients at CNAO. He manages over 100 people and many national and international collaborations for nursing activities, research and development of the Foundation.

For his twenty years' experience in the field of hadrontherapy, his participation is often required for conferences and international committees.

Roberto Orecchia, Scientific Director. Graduated in medicine with three specializations: radiation therapy, medical oncology and diagnostics imaging.

Professor of radiation oncology at the University of Milan and Director of the Division of radiation of the European Institute of Oncology, Milan (IEO). Former President of the Italian Association of Oncological radiotherapy AIRO and Director of the school of specialization in radiotherapy, currently he covers the roles of Director of *Medical imaging and radiation sciences* of the IEO, scientific Director of CNAO and scientific co-director of IEO. He is author of about 300 publications in prestigious scientific national and international magazines.

Francesca Valvo, medical director. Graduated in medicine and surgery, she vaunts thirty years of experience at the National Tumour Institute where she is committed to medical oncology and

radiotherapy. She is annually appointed to teach within the specialization course in oncological radiation therapy and Oncology at the University of Milan. She was national coordinator of the AIRO (Association of Radiation Oncology) cancer study group of the digestive system. For AIOM (Associazione Italiana Oncologia Medica -Italian Association of Medical Oncology) and AIRO she writes the national guidelines for the rectum and anus tumours. At CNAO she is in charge of the coordination of the entire clinical Department.

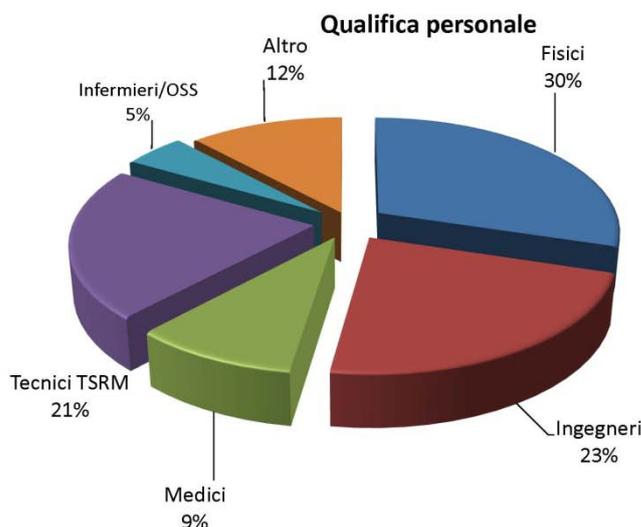
Marcello Imbriani, health director of the CNAO Foundation. Graduated in medicine and surgery, specializing in Occupational Medicine and Respiratory Diseases, he is Professor of Industrial Medicine at the University of Pavia. He is currently director of the Department of Public Health, Experimental and Forensic Medicine of the University of Pavia and Director of Occupational Therapy Course. Author of over 300 scientific publications reviewed in PubMed, he is editor of the "Italian Journal of Industrial Medicine and Ergonomics"

CNAO TEAM

At the centre 110 people, mostly physicists (30%), engineers (23%) and healthcare technicians of Medical Radiology (21%) complete the doctors' team (9%), nurses (5%) and the Administrative staff (12%), in addition to some collaborators.

The average age is 38 years, women are 45%. Most people employed in the centre, more than two out of three, are dedicated to scientific activities (clinical, research and synchrotron running).

Other resources are employed in managerial and administrative activities.



CNAO NUMBERS

- 1000 man years required for planning;
- 600 companies involved in the construction (500 Italian);
- 300 km of cables;
- 16,000 kW of installed electrical power (approximately 5000 spaces);
- from 2 to 6 meters: thickness of the shields of reinforced concrete;
- 16 mt.: depth of the excavation for digging the foundations;
- 80,000 tons of concrete;
- 1800 tons of iron;

- 5000 tons of prefabricated elements for the synchrotron Hall roof;
- 150 tons: single heaviest object installed using 2 cranes of 400 tons;
- 50 national and International collaborations;
- 70 between authorization and permissions practices;
- 14 European races completed.

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CNAO's website – www.cnao.it

CNAO's history and the images of the construction– www.cnao.it/index.php/it/la-storia-del-centro.html