COMPANY PROFILE

LinearBeam

PROTONS FOR LIFE

Linearbeam ERHA Proton Therapy System is not yet approved for clinical use.

ABOUT US

Linearbeam is a spin-off company of ITEL Group which has been developing through the **"ERHA" project** (Enhanced Radiotherapy with HAdrons), the first proton therapy system based on a linear proton accelerator (P-Linac) for cancer treatment.

ERHA project is supported by an investment of 14.9 million euros from the European Investment Bank through the Italian Ministry of University and Research and Equiter Research and Innovation Fund (Rif). ERHA system is a complete proton therapy solution made by a P-Linac, a linear proton accelerator for cancer treatment. It has an innovative robotic patient positioning system (which allows the fixed beam to enter the body from the best perspective for treating the tumor) as well as a complete treatment planning software.

Leonardo Diaferia
President and Founder of
LinearBeam and Itel Group

«ERHA» represents an ambitious scientific, industrial and clinical challenge for the advanced proton treatment based on the linear acceleration. This technology will lead to unexplored opportunities in the treatment of oncological pathologies.

PROTON THERAPY

Towards more effective treatments

Proton therapy is a form of radiotherapy used to treat cancer, which is capable of striking only the tumor while preserving healthy tissues and allowing more intense doses of radiation to be delivered, thus increasing the chances of successful treatment.

While conventional radiotherapy uses X-rays or electrons, proton therapy involves the use of protons, heavier atomic particles with greater energy than electrons and therefore being more precise and effective.

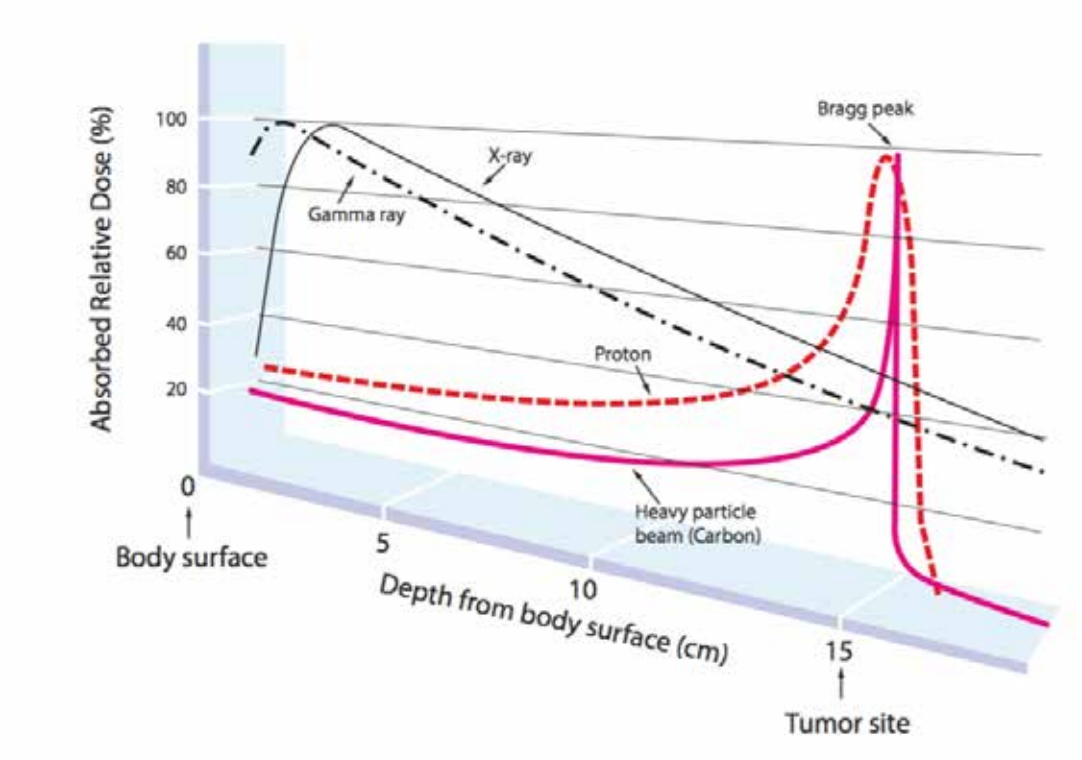
With proton therapy, energy is released at a particular depth of the tissue, the so called Bragg peak.

- **PROTON THERAPY CONSIDERABLY REDUCES THE RISK OF LONG-TERM SIDE EFFECTS.**
- **IT IS PARTICULARLY SUITABLE FOR THOSE PATIENTS WHO HAVE A LONG LIFE EXPECTATION AFTER THERAPY.**

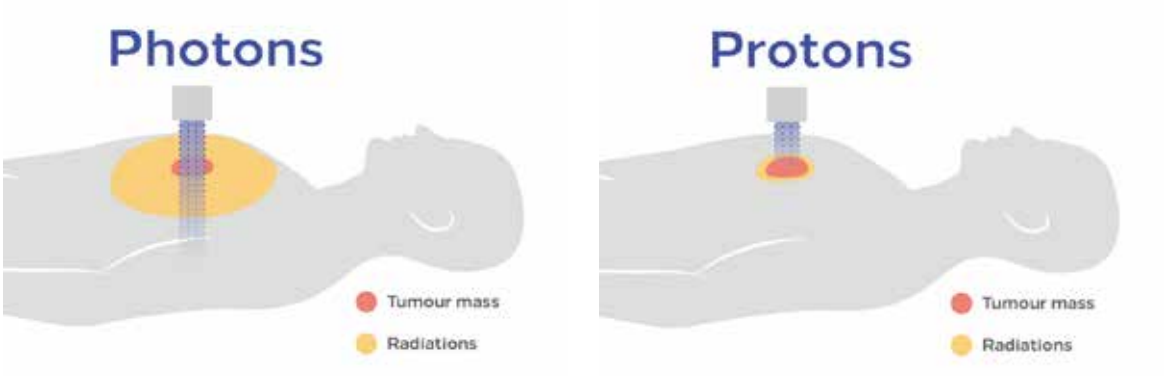
BRAGG PEAK

The Bragg peak is the curve that is obtained by plotting the energy lost by a particle that penetrates into matter, depending on the depth it reaches as it progresses.

The “peak” shape of the protons shows that these particles release most of their energy at the end of their path and this important feature is utilized in radiotherapy to treat tumors using particles as “depth bombs”.



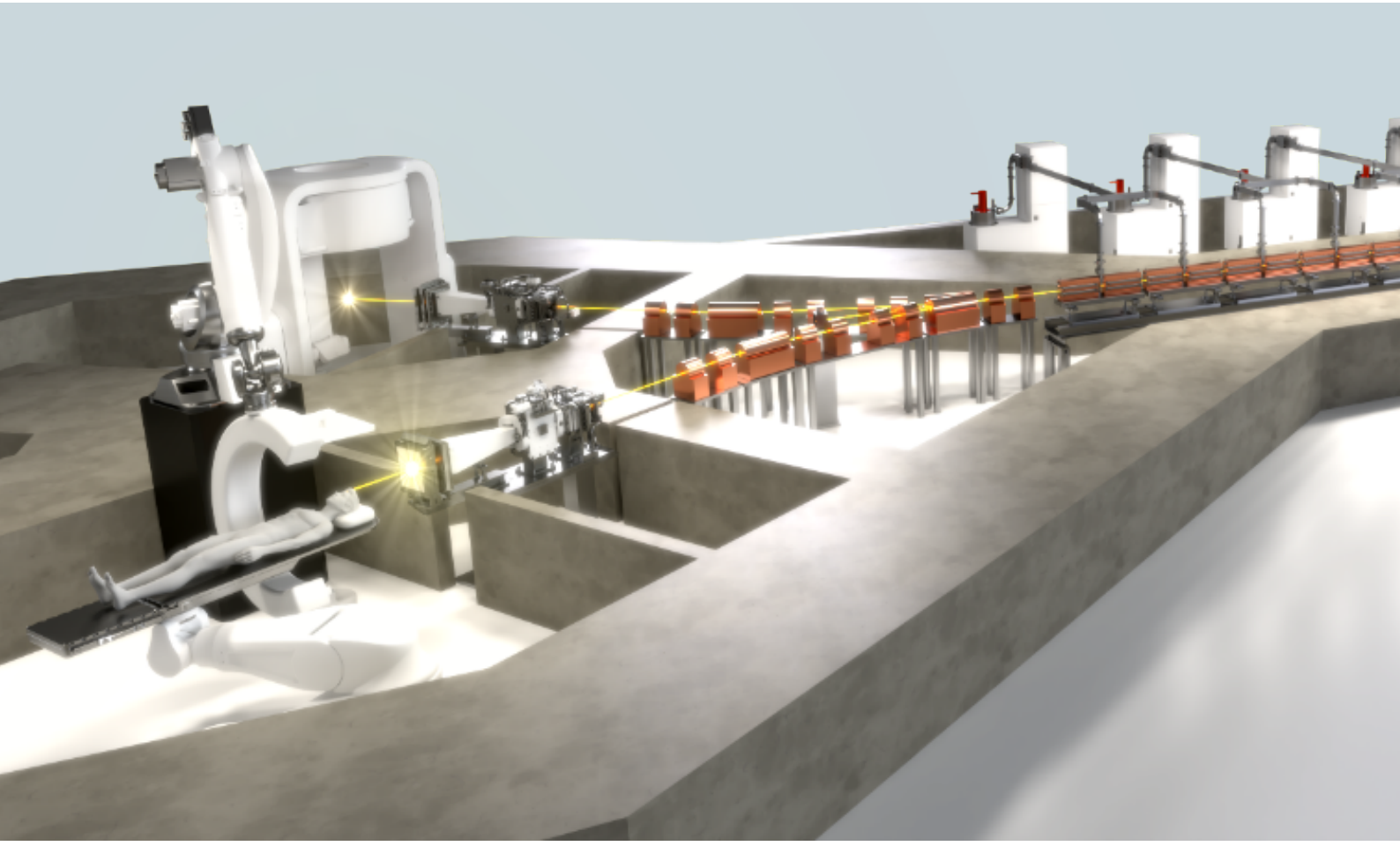
By changing the energy of the protons, health workers obtain contraol of the proton beam bragg peak, which releases the tumoricidal dose only within the last millimeters of its travel, therefore striking exactly at the target.



ERHA

THE FUTURE OF PROTON THERAPY IS NOW

ERHA (ENHANCED RADIOTHERAPY WITH HADRONS) IS THE INNOVATIVE PROTON THERAPY SYSTEM DEVELOPED BY LINEARBEAM.



If compared to proton accelerators currently on the market:

- It is the first in the world to have a P-Linac designed for clinical use
- It requires a surface area of less than 300 sqm. shielding included
- Each component is installed by a single company and managed by a whole integrated software
- It can be equipped with up to 2 treatment rooms at maximum energy (230 MeV)
- Upgradability of the PT facility with several treatment rooms at different energies up to full energy (230 Mev)
- Erha PT facility can be equipped in just 18 months

A LINEAR APPROACH

A NEW FRONTIER OF PROTON THERAPY: THE LINEAR ACCELERATION

P - LINAC

ERHA PROTON THERAPY SYSTEM

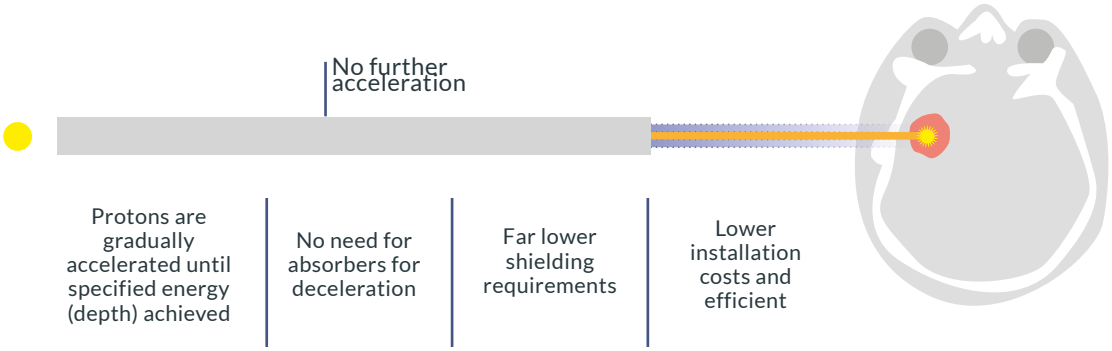
In order to treat tumors with protons, an accelerator is required, that is a device able to increase the speed and therefore the energy of the protons.

Current existing systems use two different types of accelerators - cyclotrons or synchrotrons - which nowadays are considered as a mature technology.

Cyclotrons represent the oldest technology still widely used worldwide.

Synchrotrons are a more recent type of technology, yet they have a significant bulkiness andare also expensive.

ERHA system technology uses a P-Linac has a more advanced technology than a cyclotron and combines many of the advantages of a synchrotron with greater cost-efficiency. Furthermore, **a linear acceleration system that could be easily placed in a small surface area**, only 26 m in length and only 4 m in width.



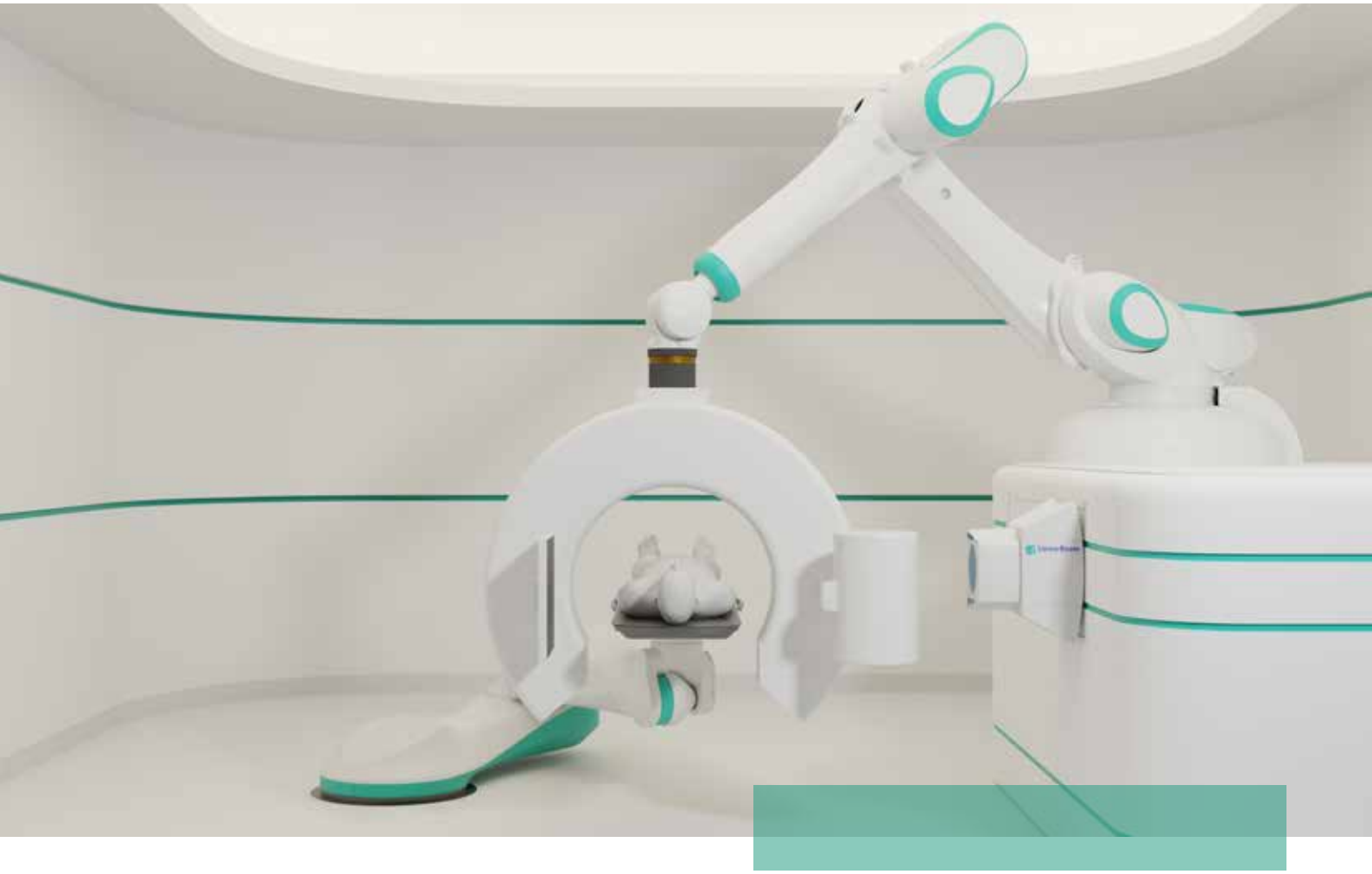
KEY FACTORS

THE ADVANTAGES OF A LINEAR ACCELERATOR

- Modular installation
- Best beam optics
- Intensity modulation (IMPT)
- Active Energy modulation
- Low radiation and low activation
- Fast warm-up

ROBOTIC PATIENT POSITIONING SYSTEM

EASY PATIENT ORIENTATION AND GREATER TREATMENT PRECISION WITH IMAGINE GUIDED RADIOTHERAPY



The robotic platform allows the patient to be positioned according to the treatment plan.

Linearbeam patented “Robotic patient positioning system” ensures positioning with an accuracy level of less than 0.2 mm on the target, by using a stereoscopic 3D vision system and a dedicated cone beam CT.

KEY FACTORS

THE ADVANTAGES OF A FIXED BEAM SOLUTION

- Significant cost reduction compared to the traditional Gantry
- Space reduction
- TPS fully integrated with the positioning system
- Repeatability and positioning accuracy
- Semplified workflow for patient positioning

4see Plan

TREATMENT PLANNING SYSTEM -TPS

The Monte Carlo calculation algorithm for the simulation of the proton therapy plan.

Certified as a medical device. UE 2017/745 MDR

TREATMENT PLANNING

The Monte Carlo module of the TPS is able to track every single particle and reproduce every interaction with healthy tissues and cells on the way to the lesion.

This is the most realistic method and it allows calculating the effective dose in difficult cases also, when the calculation of the dose delivered to the patient could be carried out only through the traditional way of water equivalent (pencil beam).

Both the treatment planning system for proton beams with radiobiological calculation and the full Monte Carlo code run on a standard work station- thus reducing the time evaluation for each plan, thanks to parallel computing and code optimization.

KEY FACTORS

FEATURES OF THE TPS

- Import and visualize treatment planning CTs (DICOM) with associated segmentation of oncology structures (DICOM RT STRUCTURE)
- Display in a treatment planning environment the images, 3D views, prescription dose, beam definition and treatment plan settings
- Perform inverse treatment planning: calculation of the optimized plan and the dose distribution (analytical dose-to-water calculation)
- Perform forward treatment planning with full Monte Carlo simulation of the previously optimized plan (dose-to-tissue calculation)
- Calculate dose statistics (cumulative DVHs, plan evaluation indexes)
- Create and export the dose calculation in DICOM format
- Create and export the RT Ion Plan in DICOM format

ERHA IS THE FIRST LINEAR PROTON THERAPY SYSTEM

A MADE IN ITALY TECHNOLOGY, READY TO ENTER THE CLINICAL WORLD

“Erha” - Enhanced Radiotherapy with Hadrons developed by Linearbeam is a revolutionary and unprecedented technology which undertakes a very complex scientific and industrial challenge in the field of particle therapy.

Our highly specialized team of engineers, scientists, researchers, has been working with the aim to deliver to the clinical world the first complete proton therapy system based on a linear accelerator for proton therapy, finalized in our R&D Linearbeam Department in Italy.

Being strongly committed with this ambitious mission, we are working hard to bringing the global experience and knowledge with protons to new frontiers in hadrontherapy. We believe that this will have a strong social impact in cancer care, introducing unexplored possibilities for the treatment of the most complex forms of oncological pathologies in adults and children.

The native features of this technology, such as the active energy modulation, will make it possible for «ERHA» system to treat the most widespread tumors with a much more effective, safe and precise approach and with innovative perspectives at the pediatric stage, too.

ERHA SYSTEM

At a glance

Linear proton therapy benefits

INNOVATIVE CLINICAL PROTOCOLS

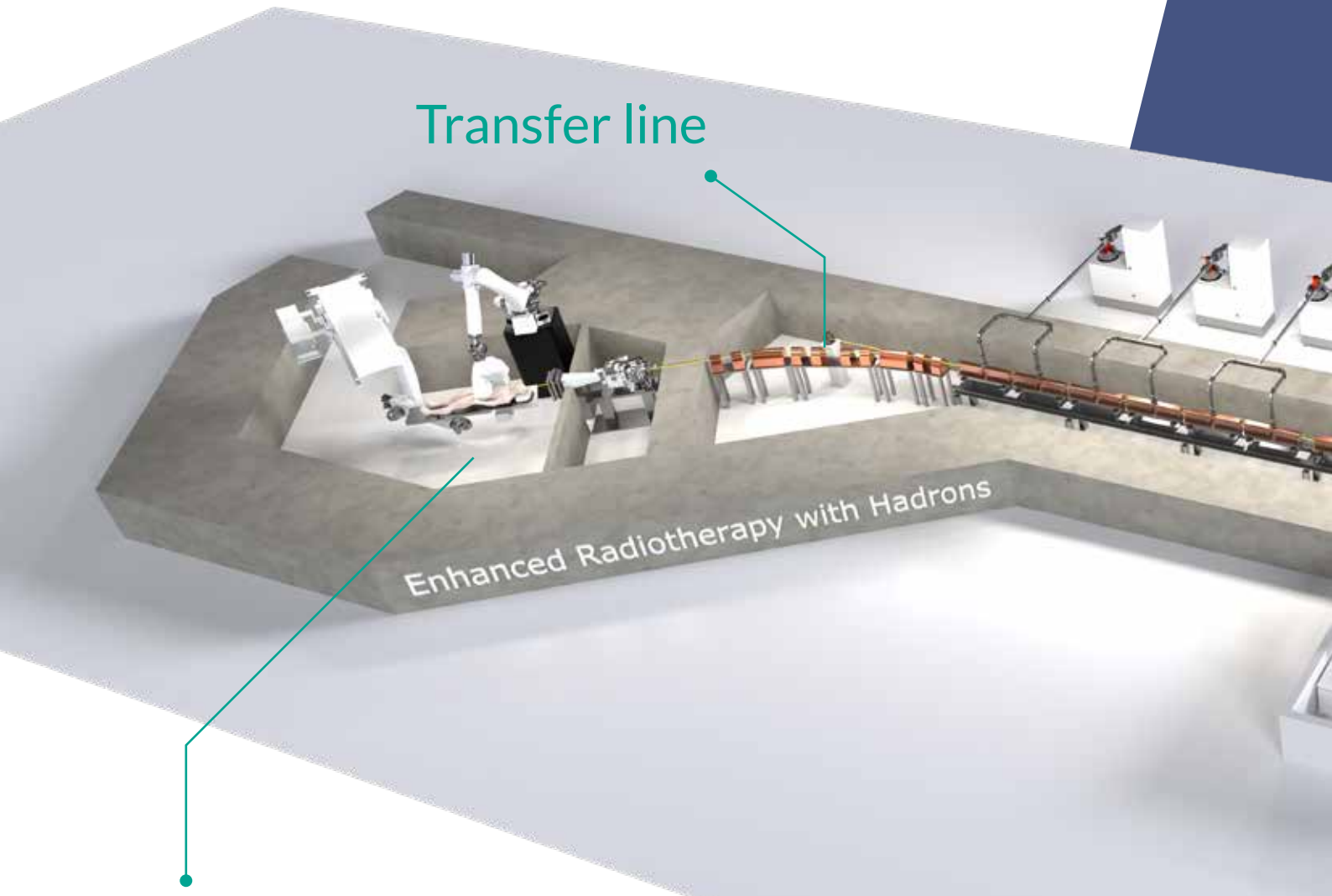
SMALL FOOTPRINT SOLUTION

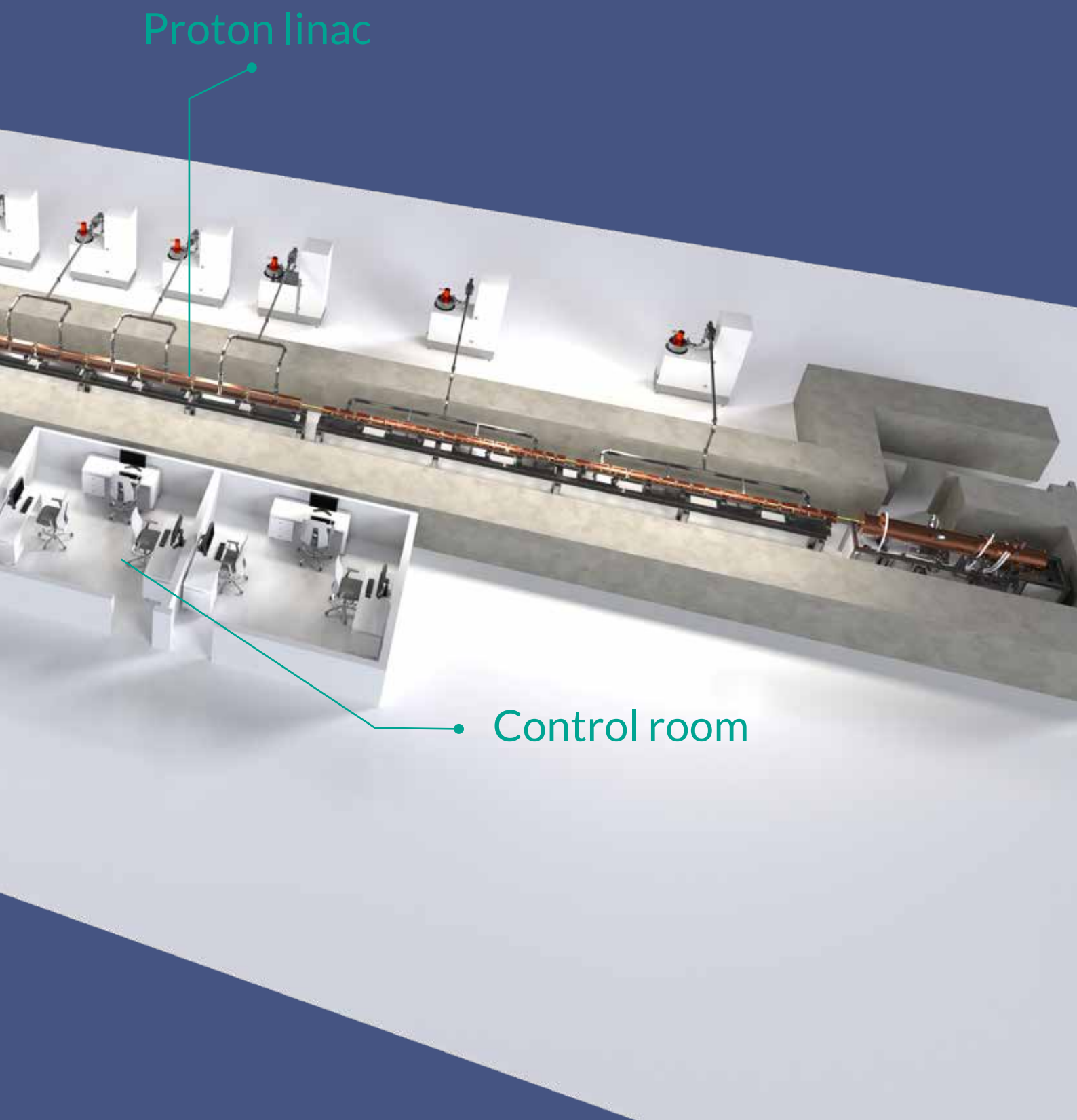
LOW ENVIRONMENT IMPACT

PROTON BEAM QUALITY

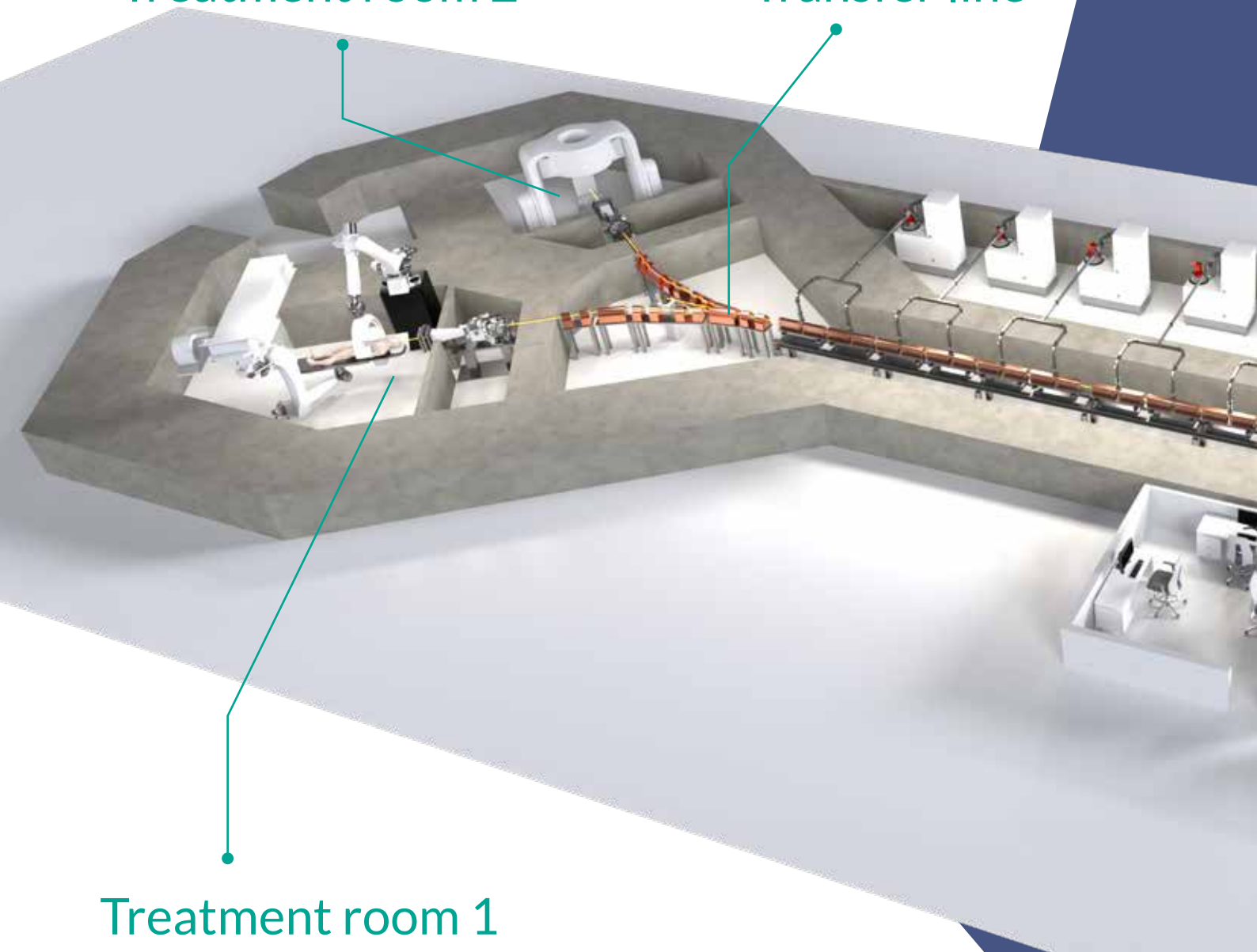
• Beam optics	**Smaller entrance dose**
• Compact and customizable design	**Lower exit dose**
• Small footprint	**Better tumor dose distribution**
• Flexibility	**Reduced OAR toxicity**
• Integrated control system	**Greater radiobiological efficacy**
• Minimum maintenance costs	**FLASH and Lattice/ GRID delivery**
• Minimum operational costs	
• Low secondary radiation emission	
• Low decommissioning costs	
• Higher delivery accuracy	
• Positioning system accuracy	

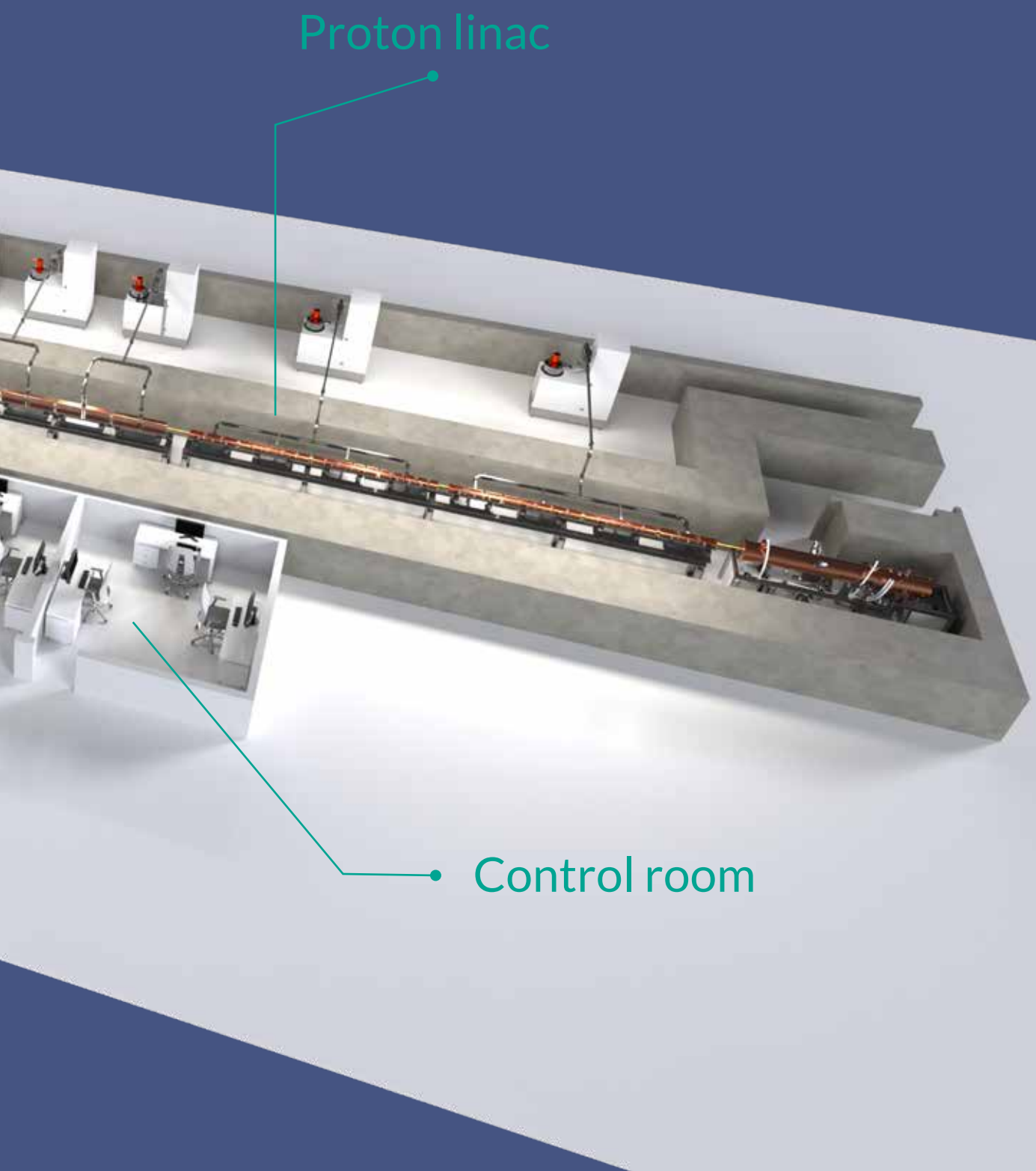
LB230S PROTON THERAPY SYSTEM SINGLE ROOM




Proton linac
Control room

LB230D PROTON THERAPY SYSTEM DOUBLE ROOM




Proton linac
Control room

ITEL GROUP

DRIVING HEALTHCARE CHANGES

Founded in 1982, TEL operates and grows in the telecommunications sector, acquiring competence and know-how in electromagnetic waves, fields and radiations, such as to become national and international market leader.

With over three thousand installations all over the world, the company consolidates and specializes in the wide range of products and services forthemedical, clinical and industrial system, such as electromagnetic and magnetic solutions for diagnostic and intraoperative imaging sector, industrial site auditing, project integrated planning, design of complex healthcare facilities. Over the years, ITEL Tele-communications Group evolved, integrating medical and mechatronics technology, tests and electromagnetic compatibility measures with the division EMC TEST LAB. The company looks out during time to new industrial sectors that increase ITEL division, expanding the range of products investing in high innovation and specialization in the biomedical sector providing research and microbiological analysis, production of radiopharmaceuti-cals and services aimed at nuclear medicine.

That's how ITELPHARMA was born in 2009, today the only national radiopharmaceutical company in Italy, which produces and distributes Radiopharmaceuticals in many Regions of Italy, employed in healthcare and hospital nuclear medicines for diagnostic investigation activities. Last among the business units in 2018 LINEARBEAM is born as spin-off company of the Itel Group, committed in Research and Development in Proton Therapy to carry on the "ERHA" Project (Enhanced Radiotherapy with HAdrons): patent for an innovative proton therapy (P-Linac) system based on linear acceleration of protons, one of a kind technology in the world. The project was supported as a best practice of innovation in Italy from the European Investment Bank (EIB) with a huge investment of 14.9 Millions of Euros from the RIF fund (Research and Innovation) of Equiter through the MIUR.

Our vision:
DRIVING HEALTHCARE CHANGES

Identity • Multidisciplinary skills • Vocation to innovation Multi-year expertise • Research and Development Technological and scientific know-how • Corporate culture Sustainability Progress • Future • Talent

These are the key values and highlights of ITEL Group which has been concentrating its industrial commitment for forty years in supporting scientific research and development programs, promoting technological and medical innovation in Health and Life Sciences, by adopting effective and modern solutions and investing in specialized skills, with a future-oriented mission and an inclusive and ethical vision, based on excellence and sustainability, together with a business culture inextricably linked to the value of cooperation and synergies with clients and partners.

THE GROUP'S BUSINESS UNITS

ITEL DIAGNOSTIC

Healthcare and medical Division for design and Supply of Imaging diagnostic systems and solutions.

EMC LAB

Accredited laboratory certified by the Ministry of Economic Development for the CE products marking.

ITELPHARMA

Manufacturing and Distribution Division of Radiopharmaceuticals with an internal microbiology lab.

LINEARBEAM

Research and Development Division in Proton Therapy. The team is developing the innovative «ERHA» system for linear proton therapy.

LinearBeam

PROTONS FOR LIFE

linearbeam.com