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For further information about Hitachi`s particle therapy solution, please refer to the website below.

https://www.hitachi.com/businesses/healthcare/products-support/pbt/index.html

PBT-E001 Printed in Japan 2023.09

HITACHI
Inspire the Next

Particle Therapy Solution

Hitachi Particle Therapy Solution

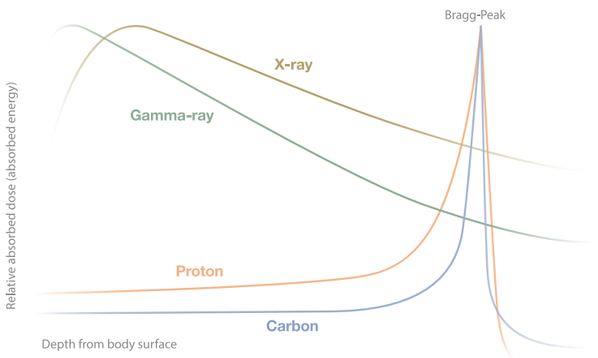
Particle therapy selected by global leaders

Particle therapy is one of the most advanced forms of cancer treatment. The delivery of high dose to a target with high precision and reduced side effects are the primary qualities that make this therapy so unique. Refining this technology and expanding its accessibility to more cancer patients did not happen overnight. Years of research and development, a broad range of technical and clinical experience, and collaborative work with world-class hospitals and cancer centers have given Hitachi a reputation for providing the medical community with the highest level of quality, exceptionally high clinical availability and cutting-edge innovations in particle therapy.

Discover why leaders in cancer therapy across the globe have selected Hitachi as a long-term partner to help patients fight cancer.

What is particle therapy?

For over 50 years, the physical advantages of charged particles in cancer therapy have motivated the medical community to advance the clinical application of particle therapy. It can maximize radiation dose to tumor sites while sparing adjacent healthy tissues, and is especially effective in treating many rare cancers, especially pediatric cancers. Particle beams enter the body releasing small amounts of energy until reaching the tumor site, where the particle stops and deposits the vast majority of its energy over a very short distance. As a result, short-term and long-term side effects in uninvolved tissues and organs are reduced or avoided, unlike external beam radiation treatment using X-rays. Given the potential for a more durable cure and better quality-of-life following cancer treatment, it is easy to understand why the number of particle therapy centers and patients seeking particle therapy is steadily increasing.

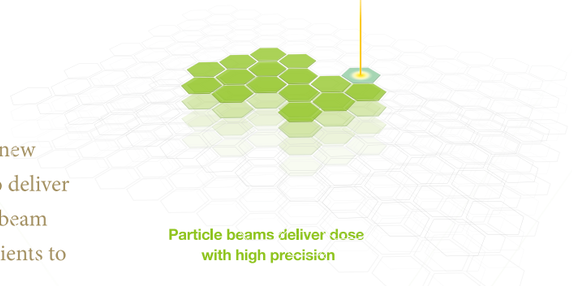


Ultra High Precision Beam Control Technology

Hitachi's technical advantages are based on its incomparably precise beam control technology – resulting from the continual refinement of electromagnet and synchrotron accelerator design since the 1970's. Leveraging its core strength, Hitachi has collaborated with customers to develop market-leading innovative technology, optimized to meet operational and clinical needs.

Intensity Modulated Particle Therapy

Hitachi was first to introduce FDA 510(k) cleared and clinically implemented scanning technology to the US market. Scanning beam technology is today's new standard in precision beam delivery. Hitachi's spot scanning system is used to deliver Intensity Modulated Particle Therapy (IMPT) – an advanced form of particle beam treatment. Hitachi particle therapy systems have treated more than 60,000 patients to date, many with Hitachi's industry leading, clinically proven IMPT.



Particle beams deliver dose with high precision

Real-Time Image Gating for Motion Management

Irradiation of targets that move due to respiration or other factors has posed a challenge, especially with high-precision scanning beams. Hitachi and Hokkaido University collaborated to develop Real-Time Image Gated Particle Therapy (RGPT) – an innovation that enables high dose beam delivery to moving tumors while sparing surrounding healthy tissues and organs.

Gantry-Mounted CBCT

Precise patient alignment and assessment of anatomical changes require high-resolution imaging of the tumor region at the time of treatment. Gantry-Mounted Cone Beam CT, co-developed with Hokkaido University, provides 3D images of patients in the treatment position. Hitachi's system can also be equipped with a 2-axis CBCT imaging function that uses two pairs of orthogonal X-ray imaging systems at the same time. Compared to 1-axis CBCT imaging, this function has shortened the required imaging time by 35%. It is also useful when it is necessary to shorten the imaging time and when there is a gantry rotation angle limitation due to interference by the patient immobilizer. Alignment software and robotics enable automatic patient positioning - dramatically increasing the precision of irradiation when used with Hitachi's beam control technology. CBCT is a key element in the implementation of adaptive therapy.

Real-Time Image Gating

Adaptive Particle Therapy for Moving Targets

The 2-axis and 4-dimensional CBCT technology, which is expected to be applied to Adaptive Particle Therapy for Moving Targets, combines two technologies co-developed with Hokkaido University—RGPT technology and the technology for simultaneous use of two pairs of orthogonal X-ray imaging systems. Approved by the Japanese Pharmaceuticals and Medical Devices Agency in September 2020, this makes it possible to capture the three-dimensional shape and position of moving targets. With this technology, it is possible to acquire clear three-dimensional images of tumors and surrounding tissues in moving targets, which have been difficult to perceive with two-dimensional X-ray images and conventional CBCT, improving patient positioning accuracy. Hitachi will continue to pursue R&D of this 2-axis and 4-dimensional CBCT technology with the aim of commercialization.

Power-Efficient and Clean Synchrotron

Hitachi has developed synchrotron accelerators conscious of our customers' needs to operate the system safely and efficiently with peace-of-mind throughout its lifetime.

Lower power consumption

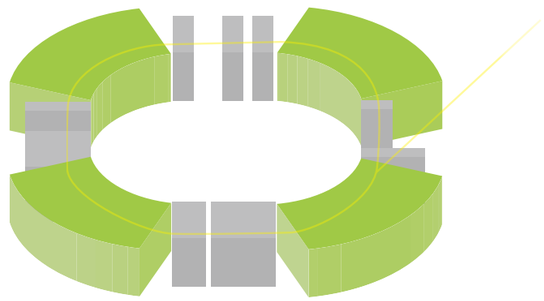
The synchrotron can supply the exact beam energy required for treatment on demand because it varies the energy electronically. This means it operates more efficiently and consumes less power, lowering operational utility costs.

Better maintenance access

The synchrotron requires no degrader for energy changes. This drastically reduces neutron generation and enables immediate access to the system for urgent maintenance with almost no waiting time for cool-down.

Easier decommissioning

Decommission of a particle therapy system may become an issue after many years of use. Since Hitachi's particle therapy system is low in radiation and can keep the radiation level of the building interior walls low, future disposal costs should be minimal.



Clean Synchrotron

Reliable Solution

From system installation to daily operation and system maintenance, Hitachi, with over 25 years of experience with particle therapy, has continually refined support services to ensure owners of highly reliable system operation. Continuous improvement has led to on-time installation, smooth/stable ramp-up, and excellent system uptime.

High System Availability*

With proven system availability, Hitachi is proud of its strong and successful system operation experience. Our high standards of engineering and manufacturing quality, coupled with seamless teamwork between the on-site maintenance team and our 24/7 remote maintenance service, yield industry-leading reliability so customers can focus on treating patients.

***Uptime guarantee of the system is optional.**

24/7 remote maintenance by Hitachi service team

Dedicated Customer Training

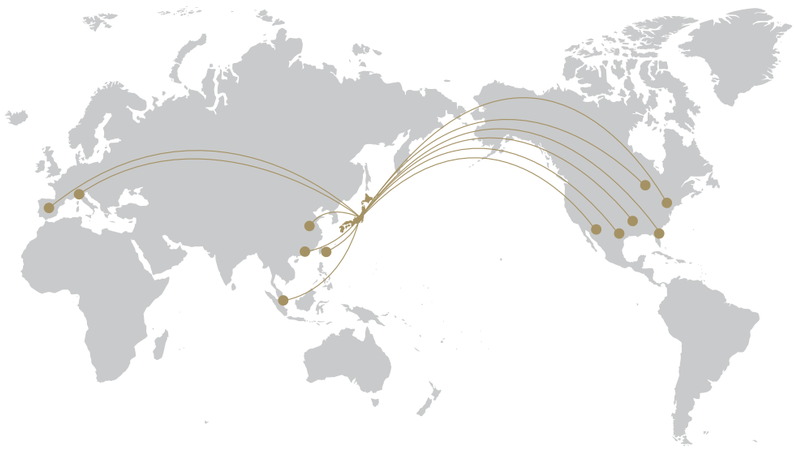
Utilizing a vast user network comprised of the world's top particle therapy leaders, new Hitachi customers receive expert staff training before treatments begin, in addition to on-site training. Hitachi provides the support needed to open each facility with confidence and to maximize operational success.

On-site customer training

Courtesy of St. Jude Children's Research Hospital

Upgrade

Upgrades to expand the functionality of the system are developed and proposed throughout the lifetime of the system. As innovations are introduced, Hitachi customers are ensured that their technology investment will always be state-of-the-art.



Versatility in Proton Therapy

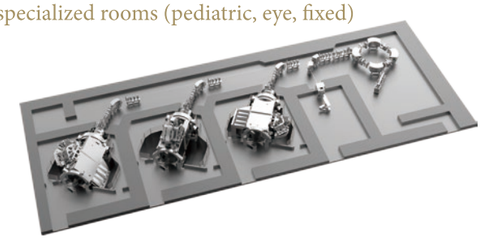
Hitachi is focusing on the development of technology to enhance versatility in proton therapy - aiming to expand treatment applications according to the needs of customers. Current Hitachi customers provide patients with a wide range of treatments utilizing today's most advanced applications – Intensity Modulated Proton Pherapy (IMPT), Real-Time Gated Proton Therapy (RGPT) and Cone Beam CT imaging for precise patient positioning and adaptive therapy.

Facility Solutions for Proton Therapy

■**Single Room** for lower initial investment cost and compact size
■**Expandable** separating the investment cost into phases while having the capability of more economically adding additional treatment rooms in the future with increased patient demand
■**Multi-room** for larger volumes of patient treatments, and specialized rooms (pediatric, eye, fixed)

Single Room Solution

Expandable Solution



Multi-room Solution

Treatment Room Type Lineup

■**Standard 360-degree Gantry**
Non-coplanar irradiation available with its wider opening for vertex irradiation.
CBCT-equipped as a standard feature.
■**Compact 360-degree Gantry**
CBCT mounted on gantry is a standard feature for 2D and 3D CT imaging at isocenter.
■**Fixed Room**
Beam irradiation angle is fixed in the horizontal and/or vertical direction.

Standard 360-degree Gantry

Compact 360-degree Gantry

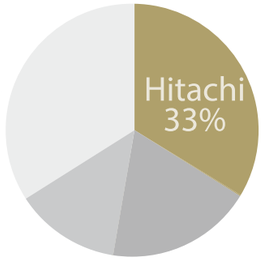
※Specifications are subject to change without notice.

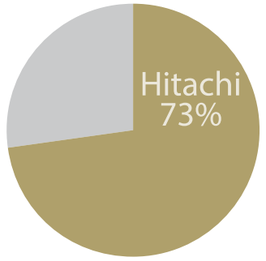
World-Leading Carbon-Ion Therapy

Most SELECTED Carbon-Ion Therapy Technology

Developed with the National Institute of Radiological Sciences in Japan, Hitachi's Carbon-Ion Therapy system has the largest market share (33%) in numbers of facilities (in operation and under construction), and a proven track record, having treated 73% of all patients that have received Carbon-Ion Therapy in the world.

Market share of Carbon-Ion Therapy system supplier
Source:
MEDraysintell Report Edition 2019





Patients treated with Carbon-Ion Therapy worldwide
Source:
PTCOG Patient Statistics

Carbon-Ion Therapy System

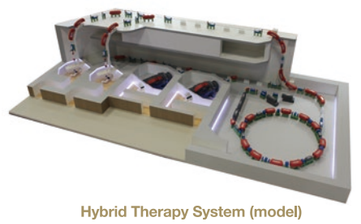
Due to its larger mass, Carbon-Ions have 3x higher relative biological effectiveness (RBE) than photons or protons. Higher RBE means that patients need fewer fractions to administer the same amount of radiation dose with Carbon-Ion Therapy, and Carbon has demonstrated greater effectiveness on radio-resistant tumors.
Hitachi has been supporting five Carbon-Ion therapy facilities worldwide. In October 2018, Osaka Heavy Ion Therapy Center*1, Japan, started operation on schedule.

***1: PMDA Approval No. 23000BZX00286000**

Osaka Heavy Ion Therapy Center

Hybrid Therapy System

Utilizing decades of experience, Hitachi has integrated technologies to offer a hybrid therapy system, capable of irradiating with proton and carbon. In May 2019, Hitachi was awarded a contract to deliver the first hybrid system outside Japan by Xuzhou Proton and Heavy Ion Hospital, China. Furthermore, Hitachi can also offer systems to generate beams other ions for future clinical applications or for research purposes, according to customer needs.



Hybrid Therapy System (model)

Join Hitachi's Global Particle Therapy Network

Hitachi holds regular users meetings with global particle therapy leaders who have selected our proton, carbon, and hybrid solutions. Here, we discuss the most advanced clinical and operational experiences and objectives and fine-tune the Hitachi R&D roadmap to enhance existing systems and integrate new capabilities into the future product and technology pipeline. It is a highly valued exchange of ideas, providing a unique forum and opportunity to Hitachi's innovations in particle therapy.

Discover the right particle therapy solution for your patients and join Hitachi's global particle therapy network of leading radiation oncology centers.

Facility name (treatment start year)　Facility information is current as of September 2023.

MD Anderson Cancer Center
Proton Therapy Center
Houston, TX, USA (2006)

Mayo Clinic Rochester Campus
Rochester, MN, USA (2015)

St. Jude Children's Research Hospital
Memphis, TN, USA (2015)

Mayo Clinic Phoenix Campus
Phoenix, AZ, USA (2016)

Sibley Memorial Hospital, a member of Johns Hopkins Medicine
Washington DC, USA
(2019)

MD Anderson Cancer Center
Proton Therapy Center
*Additional construction
Houston, TX, USA
(Under Construction)

Mayo Clinic Jacksonville Campus
Jacksonville, FL, USA
(Under Construction)

University of Wisconsin Health
Madison, WIS, USA
(Under Construction)

Clínica Universidad de Navarra
Madrid, Spain (2020)

Centro Nazionale di Adroterapia Oncologica (CNAO)
Pavia, Italy
(Under Construction)

National Institutes for Quantum and Radiological Science and Technology
National Institute of Radiological Sciences
Chiba, Japan (1994)

University of Tsukuba Hospital
Proton Beam Therapy Center
Ibaraki, Japan (2001)

Hyogo Ion Beam Medical Center
Hyogo, Japan (2001)

Shizuoka Cancer Center
Shizuoka, Japan (2003)

Southern TOHOKU Proton Therapy Center
Fukushima, Japan (2008)

Gunma University Heavy Ion Medical Center
Gunma, Japan (2010)

Fukui Prefectural Hospital
Proton Therapy Center
Fukui, Japan (2011)

Medipolis Medical Research Institute
Medipolis Proton Therapy and Research Center
Kagoshima, Japan (2011)

Nagoya Proton Therapy Center
Aichi, Japan (2013)

SAGA Heavy Ion Medical Accelerator in Tosu
Kyushu International Heavy Ion Beam Therapy Center
Saga, Japan (2013)

Hokkaido University Hospital
Proton Beam Therapy Center
Hokkaido, Japan (2014)

Tsuyama Chuo Hospital
Okayama University Proton Beam
Okayama, Japan (2016)

Hakuhokai Osaka Proton Therapy Clinic
Osaka, Japan (2017)

Hyogo Ion Beam Medical Center Kobe Proton Center
Hyogo, Japan (2017)

Osaka Heavy Ion Therapy Center
Osaka, Japan (2018)

Kyoto Prefectural University of Medicine
Nagamori Memorial Center of Innovative Cancer Therapy and Research
Kyoto, Japan (2019)

Shonan Kamakura General Hospital
Kanagawa, Japan (2022)

University of Tsukuba Hospital
Proton Beam Therapy Center
*Additional construction
Ibaraki, Japan
(Under Construction)

HKSH Eastern Hospital
HKSH Proton Therapy Centre
Hong Kong (2023)

Taipei Veterans General Hospital
Heavy Ion Therapy Center
Taiwan (2023)

National Cancer Centre Singapore
Singapore (2023)

Xuzhou Proton and Heavy Ion Hospital, Xuzhou City, China
(Under Construction)

Heyou International Hospital
Project Proton & Heavy Ion Center
Foshan, China
(Under Construction)