East Japan HIC

East Japan Heavy Ion Center

Faculty of Medicine, Yamagata University

“Yamagata Model” Heavy Ion Therapy Facility Equipped with the World’s Latest Technology

The Yamagata University East Japan Heavy Ion Center is the first facility in the Tohoku and Hokkaido area, and is the world’s first facility which is directly connected to a general hospital.
The facility will make cutting-edge technology, including the world’s third rotating gantry and Japan’s fifth 3D pencil beam scanning system, available in Yamagata.
The Yamagata University East Japan Heavy Ion Center will provide the safest and most comfortable treatment.

Greeting

Special Advisor to the Dean, Faculty of Medicine, Yamagata University
Chairman of Steering Committee, East Japan Heavy Ion Center, Faculty of Medicine, Yamagata University
President Emeritus, National Cancer Center

Prof. Takamasa Kayama, M.D., Ph.D.

Yamagata University started a project to construct a heavy ion therapy facility in 2005. The “Preparatory office of the Yamagata University heavy ion cancer treatment facility” was established in 2012. After acquiring a supplemental budget in 2015, the office was reorganized as “The Research and Development office for a next generation heavy ion treatment system” and has carried out the development of a new heavy ion treatment system called “Yamagata Model,” looking toward the future of heavy ion therapy.
Heavy ion therapy is a type of radiotherapy for cancer that became practical through the combination of Japan’s leading cancer treatment with science and technology. The Center will offer an environment in which patients and their families can comfortably focus on treatment, provide a course of treatment optimized to each patient, endeavor to pioneer future treatments, and conduct research into cancer prevention.
Facility construction began on the Faculty of Medicine campus in 2017 and preparations are proceeding steadily according to plan, with the aim of begin treatments in 2021.
The local community has great expectations for this project. We are receiving enormous support and a constant stream of encouragement from Yamagata Prefecture, thirty-five local municipalities including Yamagata City and Higashine City, the Tohoku Economic Federation, and many local companies and individuals. We sincerely appreciate this support and we accept the responsibility to ensure that the project meets the collective expectations of the Tohoku region.
From here, in Yamagata, we will promote heavy ion therapy, which was born in Japan. We look forward to everyone’s continuing close relations.

Director, East Japan Heavy Ion Center, Faculty of Medicine, Yamagata University
Director, University Hospital, Faculty of Medicine, Yamagata University

Prof. Kenji Nemoto, M.D., Ph.D.

Heavy ion therapy is a kind of radiation therapy in which accelerated carbon ions hit cancer cells and kill them. Although it requires a large treatment machine, heavy ion therapy is an excellent treatment for its effectiveness to radio-resistant tumors, low rate of side effects, and short treatment periods. There are twelve heavy ion therapy facilities and six of them are in Japan, however, no facility was located in the Tohoku and Hokkaido areas. This center, the first facility in northeast Japan, will start the treatment of prostate cancer and other cancers, in a wide variety, in 2021. Heavy ion therapy was previously classed as Advanced Medical Care for which patients had to pay an out-of-pocket expense of around three million yen. With recognition of its effectiveness, however, its coverage under national health insurance has recently started to expand. Prostate cancer, head and neck cancer (mainly non-squamous cell carcinoma), and bone and soft tissue cancer are covered by national health insurance, with patients’ out-of-pocket expense equal to or less than radiotherapy. More types of cancer are likely to be covered in the future. Moreover, there are many private insurance companies which cover Advanced Medical Care for other cancers. Thanks to these companies, heavy ion therapy has become familiar to cancer patients.
We wish this heavy ion treatment machine to be widely accessible in the Tohoku area, and we will strongly contribute to regional cancer treatment.

Feature of East Japan Heavy Ion Center

Vision

YAMAGATA model - toward the best advanced therapy

Feature 1

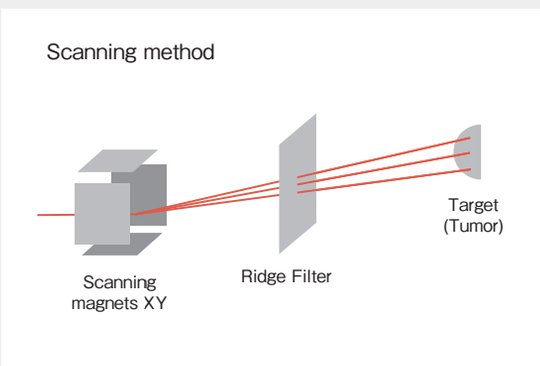
Compact facility that enabled connection to a general hospital

Dramatic size reduction to the world's smallest footprint enabled the creation of the world's first heavy ion center attached to a general hospital, allowing people to walk between the two areas. Our facility can provide comprehensive care to patients who also have diabetes or heart disease.

Feature 2

Irradiation from various angles while the patient remains in a comfortable position

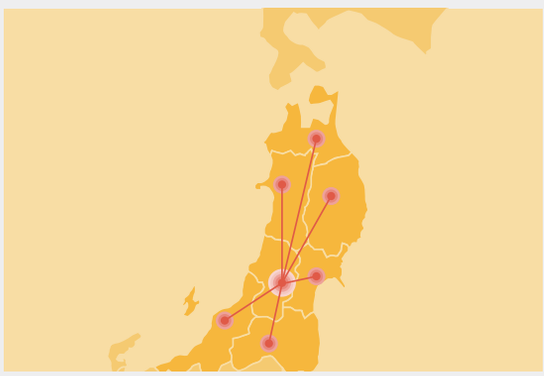
The facility is equipped with the world's third rotating gantry using superconductor technology. It promises to reduce side effects by avoiding important organs such as the spinal cord and nerves. The gantry is the smallest carbon ion rotating gantry in the world.



Feature 3

Accurate irradiation to cancer cells

The facility uses the world's highest performance 3D pencil beam scanning method, tailoring the narrow beam to the tumor, which makes it safer and more effective than conventional radiotherapy. Moreover, this facility is an environmental-friendly facility with an improved energy-saving performance (power consumption is about half of a conventional machine)



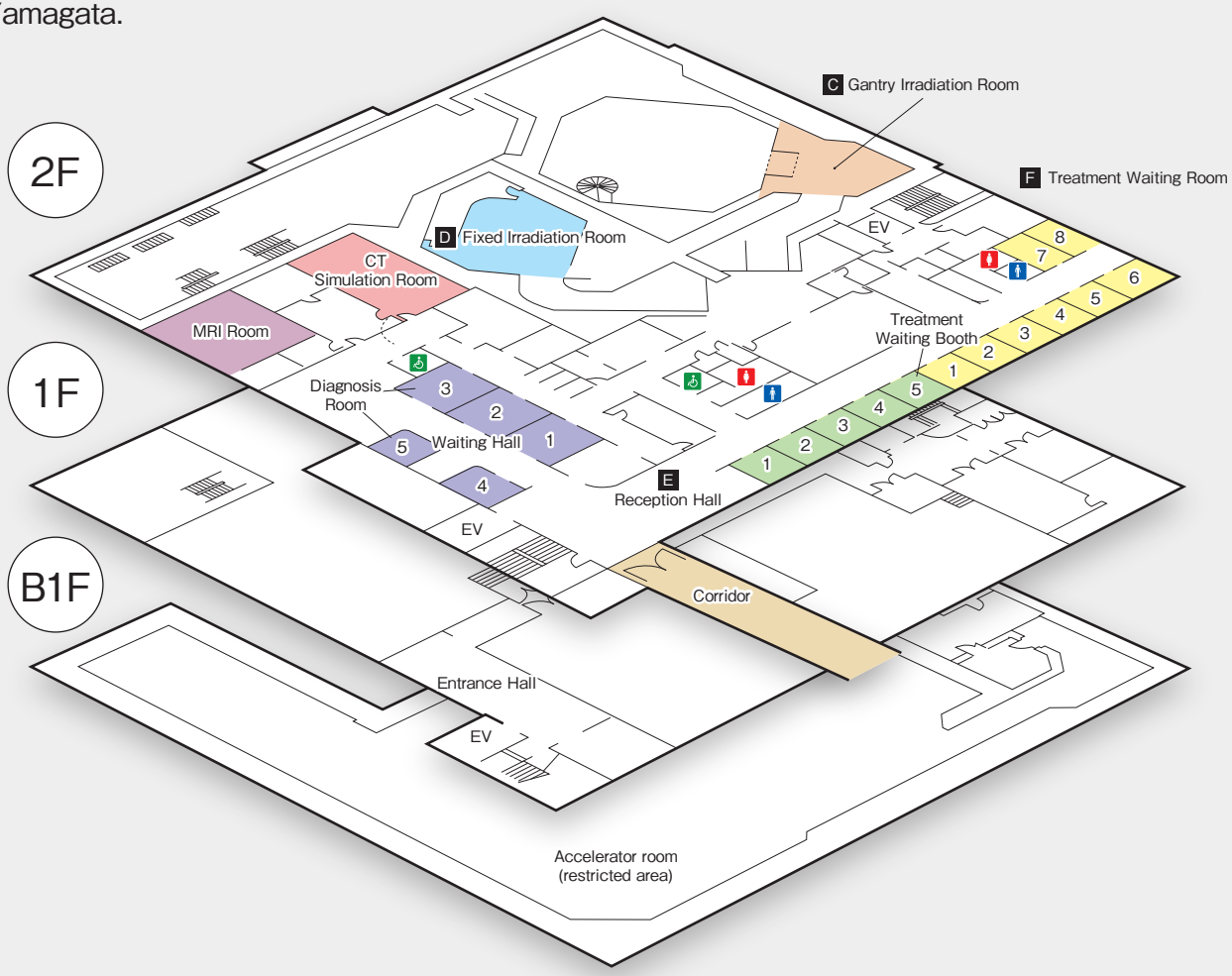
Feature 4

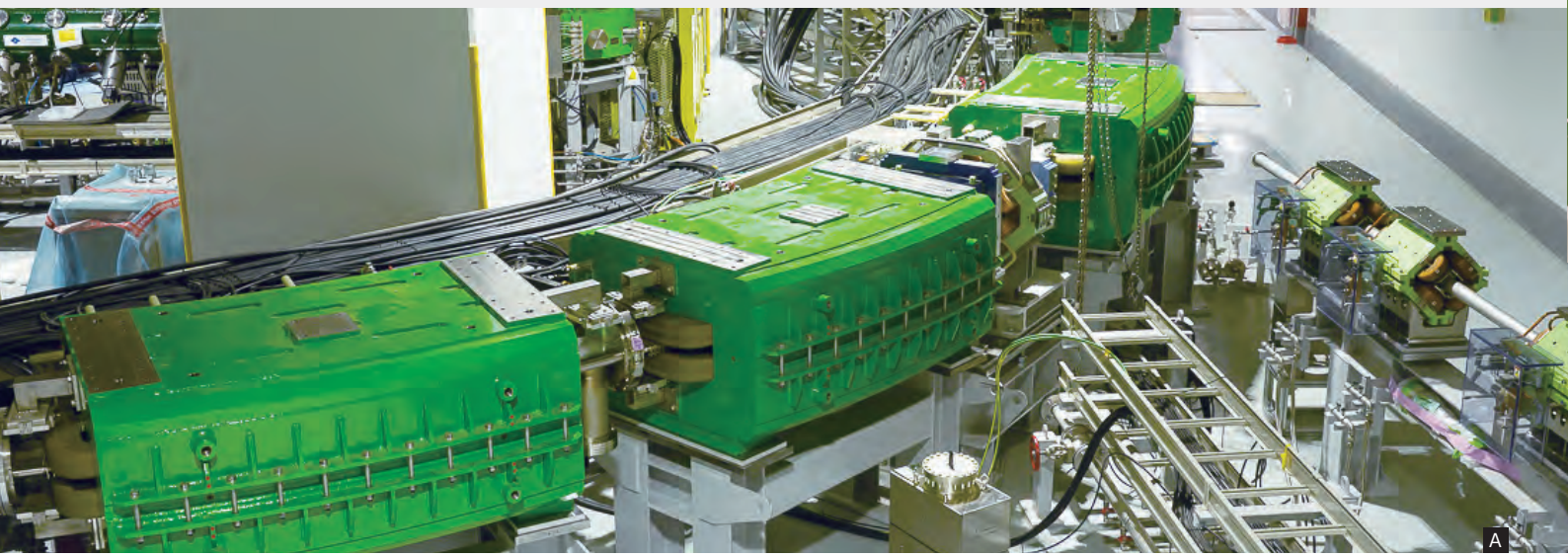
Regional cooperation using a medical information technology network (first instance in Japan)

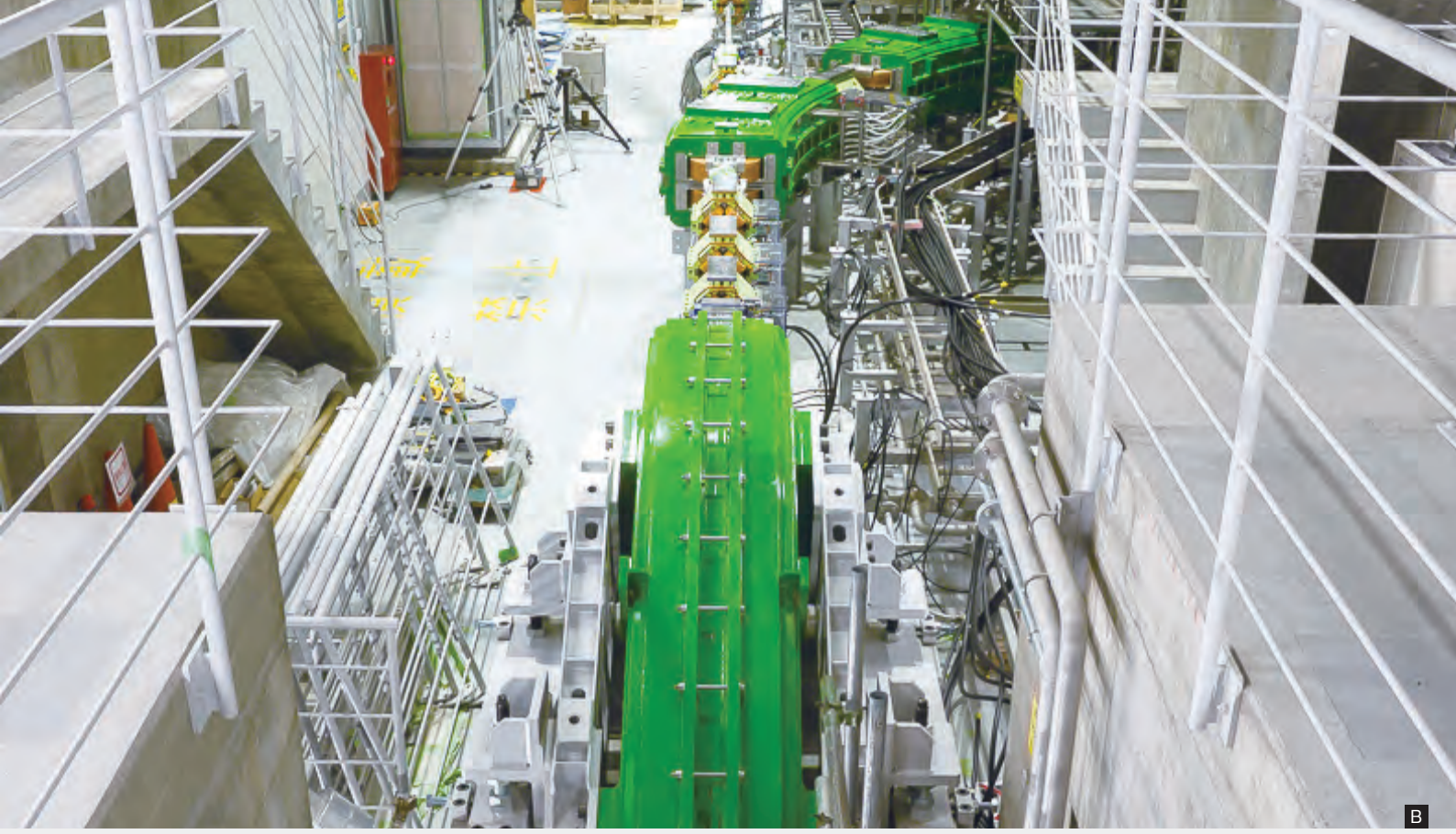
We are connected to more than sixty foundation hospitals in six prefectures throughout the Tohoku area. Patients living in distant areas can consult doctors at their nearest hospital.

Floor map

The waiting area and irradiation area where patients stay are decorated with light, vivid colors. The center is connected to the general hospital via a corridor and has eight individual waiting rooms to protect patients' privacy. The accelerator (the machine that creates the heavy ion beam that irradiates the malignant lesion; in the equipment area centered on a synchrotron), which is usually out of patients' sight, has been painted green with a nature-rich image of Yamagata.







B

C

D

E

F

Accelerator room

A Synchrotron

B Beam Transport Line

Irradiation Area

C Gantry Irradiation Room

D Fixed Irradiation Room

Waiting Area (2F)

E Reception Hall

F Treatment Waiting Room

What is heavy ion therapy?

Heavy ion therapy is an external radiation therapy using a carbon ion beam to break the DNA of cancer cells. Patients feel no pain and no physical load during the irradiation process.

Feature of Heavy Ion Therapy

Heavy ion has the following merits when compared with other radiation (proton or X-ray) procedures:

1. Strong effect

Carbon ions have a stronger biological effect than protons or X-rays. For example, it is more effective against sarcoma, which is resistant to X-rays.

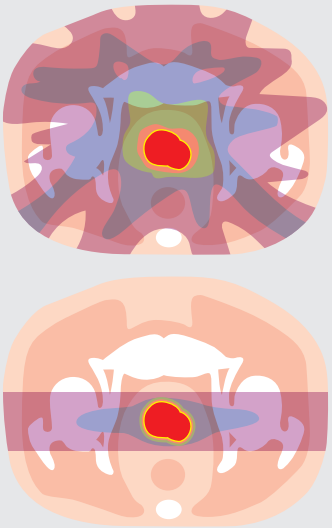
2. Localized irradiation

Damage is concentrated on the tumor, which means less damage to the surrounding cancer-free tissues.

3. Short treatment duration

The number of treatment sessions and the duration of treatment is about half of proton or X-ray treatments.

Difference of irradiated region
Heavy ion and X-ray



The heavy ion beam is concentrated on the target (contoured with yellow line) and avoids cancer-free tissues.

Example of treatment sessions and fractions

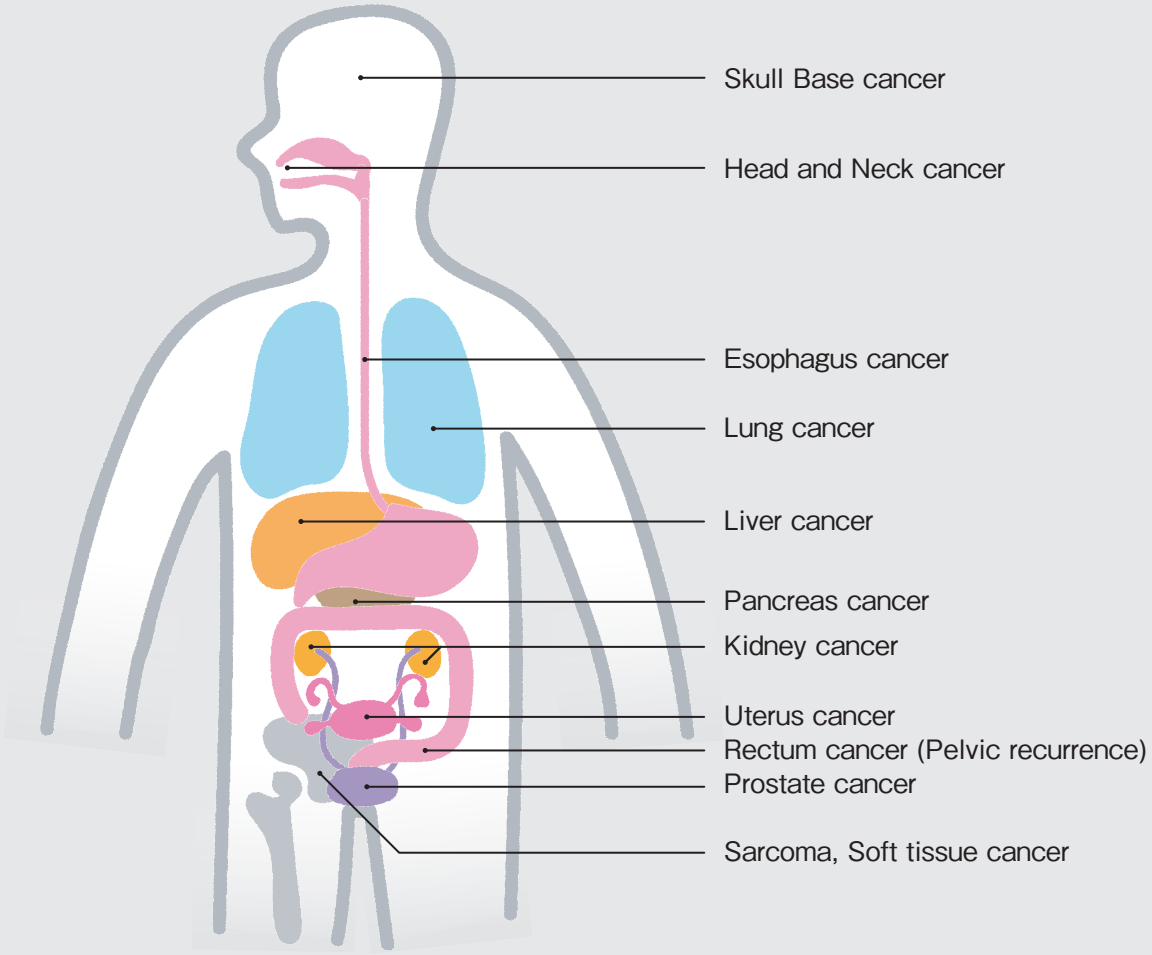
Region		Conventional radiation therapy (X-ray/Gamma rays)	Heavy ion therapy
Liver cancer		6~25	2~4
Lung cancer	Stage I	4~30	1~4
	Locally Advanced	30	16
Prostate cancer		35~39	12
Pancreas cancer		25~30	8~12
Head and Neck cancer/ Bone and soft tissue cancer		30~40	16

Indications suggesting the use of heavy ion therapy

The general indication suggesting the use of heavy ion therapy is a localized solid cancer without systemic metastasis.

*A small number of metastatic tumors are treatable. For detailed information, please consult a radiation oncology specialist.

Cancers that can be treated by heavy ion therapy:



Common perimeters for all cases of heavy ion therapy:

- The patient is definitely diagnosed with cancer
- Disease is observed in a diagnostic image
- In principle, the maximum tumor diameter is less than 15 cm
- No previous irradiation to the same region
- No systematic metastasis
- Patient's general condition is tolerable for treatment and patient consents to treatment

Treatment might be infeasible in locations close to the skin or organs such as the stomach or intestines.
For detailed information, please consult a radiation oncology specialist.

Q&A

Q1 Can anyone consult a specialist and be treated by heavy ion therapy?

A Anyone can make a reservation after getting a medical referral letter (letter providing medical information) from their doctor. Check the "Indications of heavy ion therapy" to see which cancers can be treated with heavy ion therapy.

Q2 How can I consult a specialist at this center?

A Please tell your doctor that you want to receive heavy ion therapy, or that you want to have more detailed information about heavy ion therapy, and ask them for a medical referral letter (letter providing medical information). After being referred to this hospital, the doctor in charge will decide whether you fit the perimeters for heavy ion therapy or not.

Q3 How long is the waiting time from the first visit to the start of treatment?

A It takes about one-four weeks depending on the treatment region. The doctor will carefully examine information that heavy ion therapy would be beneficial for the patient. If the patient is cleared for heavy ion therapy, then preparations for accurate treatment, such as making immobilization devices and CT simulation, will start.

Q4 During the treatment, must I be admitted to a hospital, or can I visit as an outpatient?

A In general, a patient's load is not severe in heavy ion therapy. Therefore, patients can be treated as outpatients. Neighboring hotels are available for patients who live in distant areas. Depending on the disease or chemotherapy, some patients may require hospital admittance.

Q5 How long is one treatment session?

A The time between entrance to and exit from the treatment room is around thirty minutes. The actual time of heavy ion irradiation is several minutes. These times depend on the disease and treatment techniques. The total number of treatment sessions also depends on the disease (anywhere from one-twenty times).

Q6 What is the difference between surgery, chemotherapy, and immunotherapy?

A Since heavy ion therapy is a localized treatment focused on the target lesion, its purpose is similar to that of surgery. On the other hand, chemotherapy and immunotherapy is a systematic treatment for the whole body. Actually, the best treatment is chosen by taking the advantages of each treatment, and in some cases, heavy ion therapy is combined with other treatments.

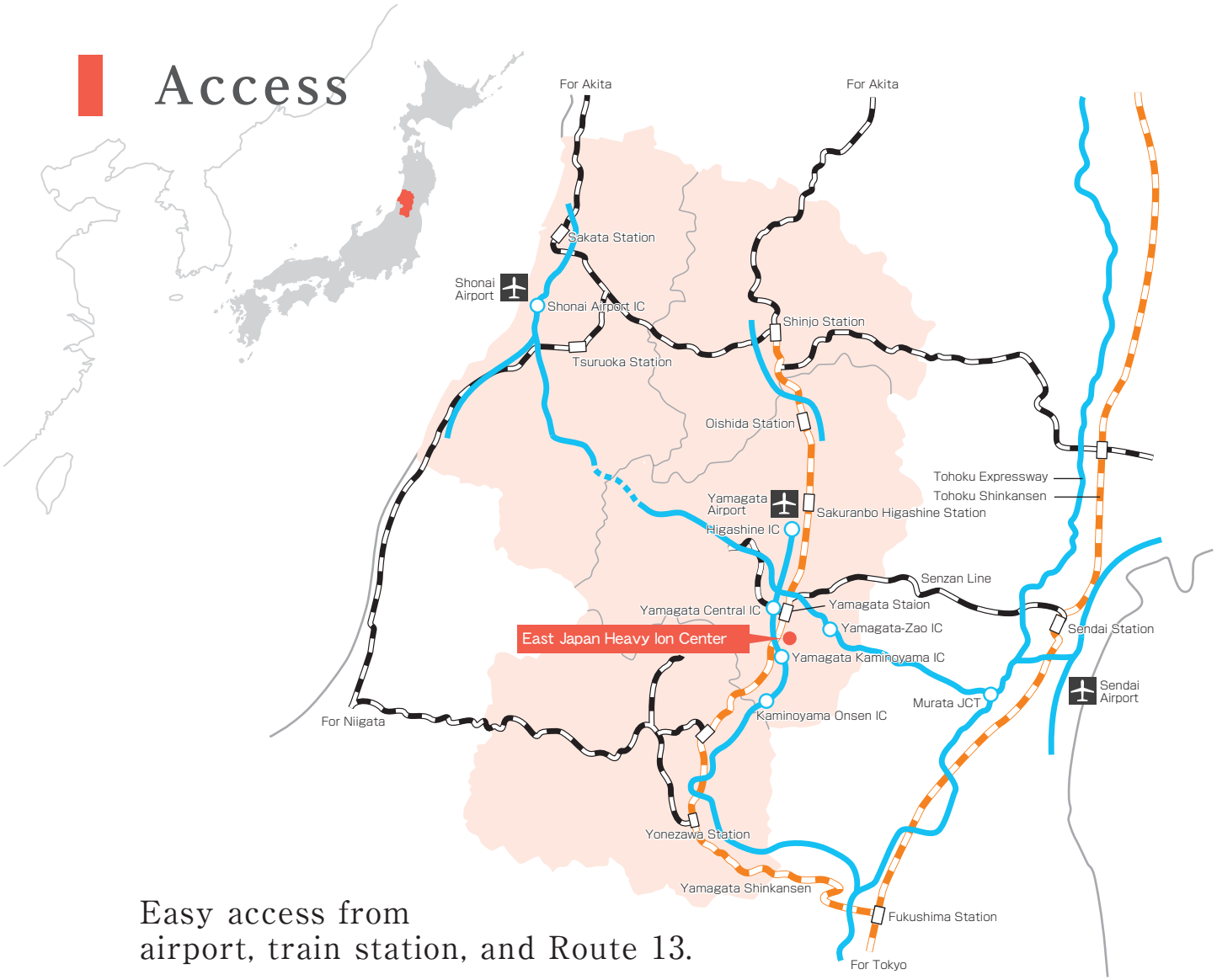
Q7 What is the difference between X-rays and protons?

A Compared to x-ray treatment, the cancer can be irradiated with a higher dose concentration, while minimizing the effects on cancer-free tissue, since the heavy ion beam can pinpoint the size and depth of the tumor. Biologically, carbon ions are two-three times larger than protons and X-rays. They are more effective combating radioresistant tumors and this enables treatments with a smaller number of sessions.

Manami Hashimoto Assigned as Health Ambassador of Yamagata University Faculty of Medicine!

Yamagata University Faculty of Medicine assigned Manami Hashimoto, an actress who was born in Yamagata, as a Health Ambassador. From now on she will support the Faculty of Medicine's efforts as a symbol of medicine, healthcare, and welfare.

Access



Easy access from airport, train station, and Route 13.

Access

Airplane

New Chitose Airport (Hokkaido) ····· 1hour ····· Yamagata Airport
Nagoya (Komaki) Airport(Aichi) ····· 1hour 15min ····· Yamagata Airport
Haneda Airport(Tokyo) ····· 1hour ····· Yamagata Airport
Osaka (Itami) Airport(Osaka) ····· 1hour 20min ····· Yamagata Airport

Train

Tokyo Station ····· Yamagata Shinkansen (2hour 50min) ····· Yamagata Station

Car

Urawa Interchange ····· Tohoku Expressway (3hour 10min) ····· Murata Junction
··· Yamagata Expressway (30min) ····· Yamagata-Zao Interchange ····· (15min) ····· University Hospital

Bus

Yamagata Station ····· Bus to "University Hospital / Tokai Univ.Yamagata High School" (15min) ····· get off at the University hospital bus stop
Sendai station ····· Highway bus (1hour) ····· Yamagata Station
Sendai Airport ····· Highway bus (1hour 20min) ····· Yamagata Station
Yamagata Airport ····· Shuttle bus (35min) ····· Yamagata Station

※ A shuttle bus service from Sendai Station is planned for the future.

Taxi

Yamagata Station ····· Taxi (10min) ····· University Hospital

※The schedule of public transport will change. Please see the latest information.

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Faculty of Medicine, Yamagata University

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