PTCOG-AO 2025
HONG KONG
NOV 7-9

PTCOG-AO

**Theme: Physics**

**Abstract No:. PTCOG-AO2025-ABS-0073**

# Abstract Title: Heavy ion radiotherapy system with advanced scanning magnet and rotating gantry in Yonsei University Health System

Yusuke Suzuki, Masaki Asano, Tomoya Shimada, Kosuke Nakanishi,
Toshiba Energy Systems & Solutions Corporation, Japan

## Abstract

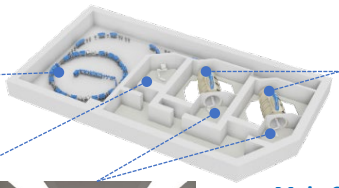
The heavy ion radiotherapy system has installed in Yonsei University Health System in Korea. It consists of one fixed beam treatment room and two compact superconducting gantry treatment rooms. Toshiba has developed the compact gantry system utilizing our superconducting technologies and the downsized scanning system. This is the world's first heavy ion radiotherapy facility equipped with two gantries featuring an advanced 3D scanning system.

## 1. Yonsei University Health System with Two Compact Rotating Gantry

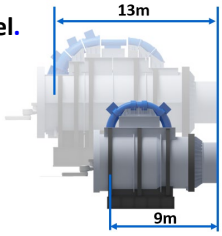
**The superconducting magnet and short-length scanning magnet technology reduced the length of the rotating gantry from the first model.**

➢Installed two gantries that are similar size to the proton therapy system

Accelerator



Rotating gantry




Fixed beam treatment room
(delivered in April 2023)

Rotating gantry treatment rooms
(Gantry 1 was in May 2024,
Gantry 2 will be in Dec 2025)

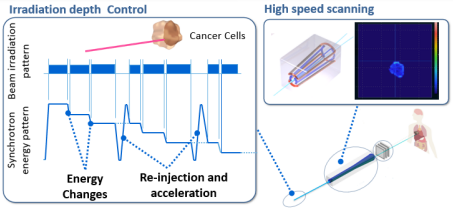
### Main Specifications for Heavy-ion Therapy System

| | |
|---|---|
| Treatment rooms | 1H2G<br>1H : 1 room for fixed beam<br>2G : 2 rooms for rotating gantry |
| Particle | $^{12}C^{6+}$ |
| Beam delivery | Pencil beam scanning |
| Beam Energy / Range steps | 55.6 – 430 MeV/u |

## 2. Fast, Precise & Accurate Irradiation System

**Irradiation system can precisely and accurately irradiate the tumor with high-speed scanning.**

| | |
|---|---|
| Irradiation speed | 40 mm/ms in X, 80 mm/ms in Y |
| Irradiation depth | 0.25 – 30 cm water-equivalent |
| Irradiation depth Control | Energy resolution has 600 steps at 0.5mm pitch (w/o range shifter) |
| Irradiation Field | 20cm x 20cm |




## 3. Project Management

➢**Periodic meetings**:
To ensure comprehensive information sharing such as project schedule, important issues and other information.

➢**Issue List** :
To mutually understand important issues, prioritize them, and ensure necessary actions were taken without omission.

➢**Spare Parts List** :
To prevent treatment interruptions, we maintain a list of parts prone to failure and consumables, and keep spare parts to replace immediately in case of trouble or malfunction.

## Summary

➢Yonsei University's system with two rotating gantries is for the first time in the world.

➢A high-speed scanning irradiation system can precisely and accurately irradiate the tumor and X-ray imaging enables respiratory-gating irradiation while tracking tumor movement.

➢Toshiba obtained various skills and know-how from advancing projects for future projects.