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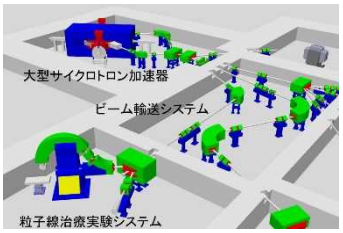
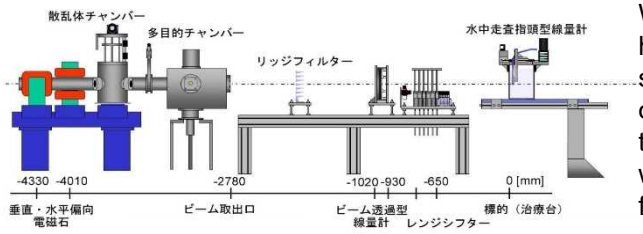
Charged particles have advantages in cancer treatment over an X-ray such as large energy deposition at the end of their path, the so-called Bragg peak and superior radiobiological properties. We have developed beam-irradiation facilities at Cyclotron and Radioisotope Center, Tohoku University, and studied charge-particle therapy and its related technologies.

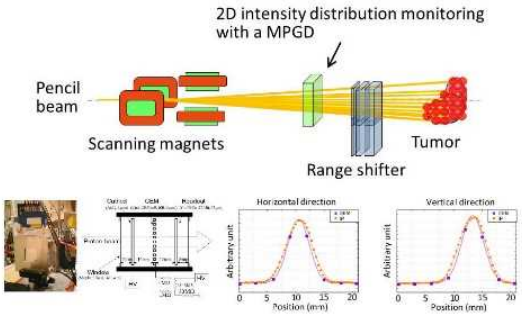
Studies of Charged-Particle Therapy and Its Related Technologies





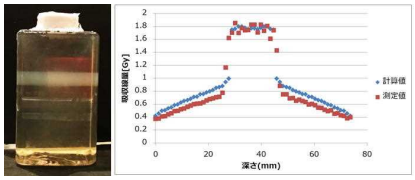
We have developed the horizontal beam irradiation system dedicated to studies on proton therapy using tumor-bearing mice and rats with an 80-MeV proton beam from the AVF cyclotron.

Real-time 2D beam monitoring



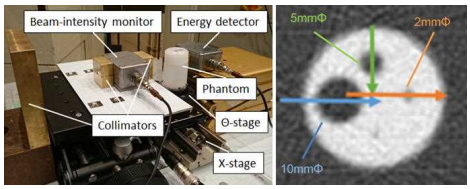
A micro-pattern gaseous detectors (MPGD) based on gas electron multiplier technologies (GEM detector) have been developed as a new transmission beam monitor to obtain real-time information about the parameters of a therapeutic beam.

3D proton dose monitoring



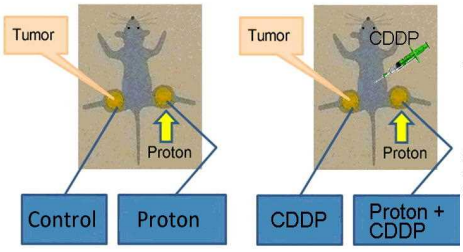
Polymer gel dosimetry for evaluating 3D dose distribution in beam scanning irradiation in proton therapy

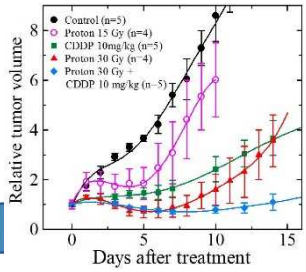
Proton CT (pCT) technology

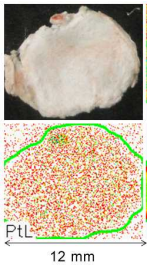


We aim to reduce range-simulation errors in proton therapy planning based on pCT.

Research for advanced proton therapy combined with chemotherapy







We have studied proton therapy combined with chemotherapy to enhance therapeutic effect. In addition, particle-induced X-ray emission (PIXE) analysis has been employed to evaluate the concentration of anti-cancer drug in tumor tissue.

Research Topics

- **Technologies for charged-particle therapy and boron-neutron capture therapy (BNCT)**
- **Real-time 2D beam monitoring, 3D proton dose monitoring and proton CT**
- **Advanced proton therapy combined with chemotherapy**
- **PIXE analysis for biological and environmental samples**