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## Reliability of a Compact Carbon Ion Medical Accelerator

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Gunma University Heavy Ion Medical Center has provided a carbon ion radiotherapy by a compact carbon ion accelerator since 2010. Carbon ions are generated in a permanent-magnet ECR ion source and accelerated in RFQ linac and APF-IH linac. The carbon ions are accelerated up to 400 MeV/u in a synchrotron and extracted to treatment rooms with a beam intensity of  $1.3 \times 10^9$  particles per second.

High availability and enough safety are required in the treatment operation. In order to satisfy such requirement, daily / weekly quality assurance (QA) and inspection and yearly maintenance was carried out. The medical physicists and the operators recorded and analyzed machine troubles and operation failures in order to prevent recurrence of the trouble and realize more stable operation. The availability concerning treatment operation was 92.5% in the first year and 98.4% after the second year. In order to improve the availability further, preventive maintenances, such as prompt replace of the parts, are necessary but it is still difficult to decide the timing of replacing. We started to use failure mode and effect analysis (FMEA) technique to recognize the severity of a certain trouble.

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