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## Concept Design of New Compact Electron Cyclotron Resonance Ion Source with Permanent Magnets for Multi-Ion Radiotherapy

The multi-ion radiotherapy with dose distribution and Liner Energy Transfer optimization is being studied at QST. Helium, carbon, oxygen and neon ions are considered as ion species for multi-ion therapy. Requirement values of beam current were 940  $\mu\text{A}$  correspond to  $\text{He}^{2+}$ , 290  $\mu\text{A}$  to  $\text{C}^{4+}$ , 330  $\mu\text{A}$  to  $\text{O}^{6+}$ , and 245  $\mu\text{A}$  to  $\text{Ne}^{7+}$ , respectively. We performed some beam tests for design of a new compact ion source with the existing 18 GHz NIRS-HEC. From the results of the beam tests, we estimate the mirror magnetic field of NIRS-HEC. Then, the structure of the permanent magnets for new ECR ion source is determined so that they reproduce the values of the upstream mirror peak (Binj), B minimum (Bmin) and the downstream mirror peak (Bext) at the NIRS-HEC. The magnetic field of Binj, Bmin and Bext at NIRS-HEC were 1.14 T, 0.475 T and 0.9 T, respectively. We will describe about the beam tests with the NIRS-HEC and design of the new compact ECR ion source.

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