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Improvement of Microwave Injection for Heavy Ion Production at Compact ECR Ion Source

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There is a desire that a carbon-ion radiotherapy facility will produce various ion species for fundamental research. Although the present Kei2-type ion sources are dedicated for the carbon-ion production, a future ion source is expected to enable : 1) carbon-ion production for medical use, 2) various ions with a charge-to-mass ratio of 1/3 for the existing linac injector, and 3) low cost for modification. A prototype compact electron cyclotron resonance ion source, named Kei3, based on Kei series has been developed to correspond to produce these various ions at National Institute of Radiological Sciences. The Kei3 has an outer diameter of 280 mm and a length of 1120 mm. The magnetic field is formed by the same permanent magnet as Kei2. We investigated basic performance of the Kei3 source in a previous experiment. Maximum beam intensity of C^{4+} , N^{5+} , O^{6+} and Ne^{7+} were $565 \mu A$, $185 \mu A$, $99 \mu A$ and $50.5 \mu A$, respectively.

In order to increase a beam intensity of heavy ion such as argon, we modify the microwave injection. The rf shield in the plasma chamber was used as a tuner of a microwave. The rf shield was installed at the position of a mirror peak of injection side, and it can move 30 mm upstream from there. As a result, we found an optimal position of rf shield for production of highly charged Ar ion. In this paper, modification of microwave injection and ion production (e.g. carbon and aluminium ion) are described.

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