Contribution ID: 52

Production of carbon ion at electron cyclotron resonance ion source for high energy carbon ion radiotherapy

Tuesday, 12 November 2019 10:30 (1h 30m)

Carbon-ion radiotherapy (C-ion RT) using Heavy Ion Medical Accelerator in Chiba (HIMAC) has been carried out in National Institute of Radiological Sciences (NIRS-QST) since 1994. Over 12000 cancer patients have been treated with carbon beams having energies of between 56-430 MeV/u. A 10 GHz electron cyclotron resonance ion source, named NIRS-ECR, is used for production of carbon ion at HIMAC. There is a carbon stacking in the plasma chamber and insulator for beam extraction. Therefore, we needed cleaning of NIRS-ECR two times per year until September 2018. In order to increase an operation time for C-ion RT, we change operation parameters for production carbon ion. Usually, CH4 gas is used for production of carbon ion. We decreased the gas flow with enough beam current for medical use. As a result, we could operate during one year with small stacking of carbon to the insulator compared previous parameters. However, we found new problem about starting of the NIRS-ECR. Plasma is not turn on during about 10 minutes in starting. We increase the gas flow a little since September 2019. Improvement of carbon ion production with long life time at NIRS-ECR for C-ion RT will be described.

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Session Classification: Poster Session