

AbstractID: 7157 Title: Development of an ultra-small C-band linear accelerator guide and automatic frequency controller

Purpose:

The aim of this study was to evaluate the performance of our newly developed C-band linear accelerator guide and digital AFC.

Method and Materials:

We are developing an image-guided radiotherapy system with a gimbaled X-ray head. The system has the capability of pursuing irradiation in addition to the capability of precise irradiation with the help of the agile moving X-ray head on the gimbals. The moving X-ray head requires a very small C-band accelerator guide and control system to stabilize the operation of the accelerator guide. Especially an automatic frequency controller (AFC) is needed to compensate properly for the thermal characteristics of the accelerator guide and assure a stable and optimized performance of the treatment X-ray. We invented a small size C-band accelerator and new concept digital AFC. Basic beam performance, leakage radiation and AFC control performance were evaluated with an existing radiotherapy system.

Results:

The accelerator guide is 38 cm long including the electron gun and weighs is about 10kg. The output beam current was 75mA with a transmission efficiency of 58%.

The average energy was 5.3MeV. The beam profile was 0.7mm x 0.9mm FWHM width at the 88mm point on the axis of the accelerator guide. The maximum radiation leakage of the accelerator guide at 100cm from the axis of the accelerator guide was 0.33cGy/min at the rated X-ray output of 500 cGy/min. This leakage requires no radiation shielding.

The AFC acquired the resonance frequency of the accelerator guide within 0.15 s after the beam on and gave a stable tracking and adjustment of the frequency of the microwave source to the resonance frequency of the accelerator guide.

Conclusion:

An ultra-small C-band linear accelerator guide and new concept digital AFC were developed and the performance of this system was confirmed.

Conflict of Interest (only if applicable):