AbstractID: 2985 Title: Sub-millimter Image Based Radiotherapy Treatment System for Small Animals

PURPOSE:

The sub-millimeter animal imaging modality is a new field for study molecular or animal images. Such high resolution images can help us study radiation-induced biological response in small animals. The spatial resolution of current used human treatment system is at least 2 mm, which is too large for the organ dimension of a mouse (5 mm). We have developed an animal RT system based on a Varian Clinac 2100, and a dose calculation kernel using BEAMnrc.

MATERIAL AND METHODS:

As the result of lateral electron disequilibrium, it is difficult to measure dose characteristic for small beam field. Therefore, our Monte Carlo simulation was verified with a small volume ion chamber and a PTW diamond detector for a larger beam (6MV, Varian Clinac 2100 equipped with a BrainLab 14mm cone). More verification is performed for 4mm, and 6mm cones. A 5-cm long cylinder with a radius of 1.5 cm is modeled as the head of mouse. We have calculated the dose distribution inside this cylinder for 1-portal, 4-portal, and 192 degree arc irradiation.

RESULTS:

The PDD and profile from measurement and simulation agree to each other for 14mm cone within 0.5% or 0.5 mm. If fitting PDD, we can observe that the curves after D_{max} decays exponentially. The dose distribution inside the cylinder modeling mouse's head is too sharp for 1-portal and 4-portal exposures, which recommends the arc technique as a better approach.

CONCLUSION:

We have demonstrated that it is feasible to build a small animal RT system using Varian Clinac 2100 with cones and Monte Carlo dose calculation kernel.