AbstractID: 9012 Title: Monte Carlo simulation of small electron fields for small animal irradiation

Purpose:
This work studies beam characteristics of small electron fields using Monte Carlo methods and evaluate its feasibility for small animal irradiation.

Method and Materials:
Small electron fields with diameters 4, 6, 14 and 30 mm were generated with 1.5-cm-thick Cerrobend inserts on a Varian 2100 C/D linear accelerator. Full simulations were performed using the BEAMnrc and DOSXYZ codes for geometries including the treatment head, electron cones, block inserts and water phantom. Input parameters of the initial energy, angular and spacial distrbutions at the beam exit window for 6 and 18 MeV beams were optimized to insure depth dose discrepancy with measurement to less than 2 % for a 6 x 6 cm field. Dependence of PDDs, lateral profiles and beam outputs at d_{max} on beam energy, beam diameter and photon jaw setting were studied.

Results:
Results revealed that photon jaw setting has minimum impact on lateral dose distributions except for , however, it can changes beam outputs dramatically. With photon jaws fixed at 3 x 3 cm, relative output for 4, 6, 14 and 30 mm inserts are 0.13, 0.26, 0.64, 0.88 for 6 MeV and 0.61, 0.78, 0.92, 0.97 for 18 MeV beams when normalized to the output for a open 6 x 6 cm cone. Two effects of reducing beam sizes on PDD were observed: (1) d_{max} shiftes toward the surface and (2) the beams become less penetrating. For beam energy selection, 18 MeV beams can generate broder area of uniform dose distribution than 6 MeV beams which makes them more favorable for small animal irradiation.

Conclusion:
Investigations were performed to study beam characteristics of small electron fields. We have concluded that 18 MeV beams are more favorable than 6 MeV beams for small animal irradiation.

Conflict of Interest (only if applicable):