AbstractID: 13011 Title: Dosimetrical characterization of an X-ray microbeam–grid based therapy (MRT) for treatments of deep-seated lesions

Purpose: Spatially-fractionated X-ray microbeam-grid therapy (MRT) is being developed at a few synchrotron laboratories around the world. To evaluate this new technique, small experimental animals, e.g., rodents, some bearing a transplanted tumour, have been treated. Preclinical trials, ultimately aimed at treating humans, are now moving forward with the intermediate goal of treating larger animals, *e.g.*, rabbits, cats, dogs, and monkeys. Here, we compare the dose distributions obtained from Monte Carlo simulations of irradiations of phantoms representing small and large animal heads.

Method and Materials: The microbeams used for MRT are linearly-polarized, extremely intense, and of relatively low-energy (100's of keV). We used the PENELOPE Monte Carlo code, which is particularly suitable for this application because it implements accurate low-energy X-ray and electron cross sections and allows incorporation of the beam polarization.

Results: The dose enhancement in the skull bone on the entrance and exit sides was determined. The variation of the peak and valley doses (doses inside and in between the microbeams) with depth was found to depend on the size of the microbeam array used, an increase in array size leads to a shift in the dose profiles towards larger depths. The salient finding of this study is that for larger microbeam arrays, necessary for treating larger animals, valley doses are increased by more than 100%, while the peak doses were considerably less affected.

Conclusion: This work shows the relationships between the absolute microbeam array dimensions and the doses to targeted lesions and normal tissues at various depths in large and small animals – both in the paths of the microbeams and in between them. The results predict that the doses between the microbeams, within the irradiated targets, are significantly increased in larger animals compared to smaller ones, suggesting a potentially increased therapeutic effect for the larger animals.