AbstractID: 8833 Title: Modelling the effect of optical pathlength on light scattering artefacts in optical CT for polymer gel dosimetry

INTRODUCTION: Dosimetric polymer gels (e.g. PAGAT [1]) undergo a change in opacity on exposure due to polymerisation and cross-linking. Cone beam optical CT is a simple, inexpensive method to read exposed gels. To ensure accuracy of dosimetry using optical CT, it is necessary to account for the effect of light scattering in a dosimeter as a function of optical pathlength. In this paper we report the results of modelling of experiments using a simulated gel phantom.

METHOD: As described earlier [2], opacity change in a dosimetric gel was simulated by adding known concentrations of Dettol^{TM} to gelatin. A phantom composed of a cylindrical PETE vessel (9.5 cm diameter, 13 cm high) containing two regions of different turbidity (optical density OD) was produced; an outer, low turbidity region surrounding a funnel-shaped, high turbidity region (simulating exposure). Different horizontal slices of the funnel phantom represent regions of uniform, high OD but with differing diameters (pathlengths).

The phantom was scanned with a Vista Optical CT Scanner (Modus Medical Devices Inc.). Horizontal profile slices were obtained from the reconstruction (resolution; 0.25 mm per voxel), each containing circular slices of the funnel of differing diameter.

RESULTS & DISCUSSION: Larger diameter slices of the funnel exhibited dishing artefacts - the central region of the slice showed an apparent reduction in OD, similar to the dishing artefact in X-ray CT. Lower diameter slices were found to exhibit the opposite - "doming" artefacts where the central region showed an apparent increase in OD. These effects are modelled by taking into account the back-reflection of scattered light.

REFERENCES:

[1] A.J. Venning, B. Hill, S. Brindha, C. Baldock, *Phys. Med. Biol.*, **50** (2005): 3875-3888
[2] S. Bosi, P. Naseri, A. Puran, J. Davies, C. Baldock, *Phys. Med. Biol.*, **52** (2007): 2893-2903