AbstractID: 10639 Title: Investigation of doped quartz fibre detectors for radiotherapy dosimetry applications

Purpose: The measurement of radiation dose and dose distributions is key to the delivery of safe radiotherapy treatments. The effectiveness of new radiation dosimeters manufactured by doping quartz fibres with copper and terbium has been investigated for a range of applications.

Method and Materials: Doped quartz fibres exhibit spontaneous phosphorescence when irradiated. A prototype commercial system has been developed by splicing such a fibre has been to a commercial fibre optic cable and measuring the signal using a photomultiplier tube. The collection of the phosphorescence can be triggered using a number of methods such as using the linear accelerator current pulse or the detection of scattered radiation.

Results: The gated signal from the fibre was averaged to determine the signal from the copper and terbium doped detectors. The half-lives of the decay were found to be 0.08ms and 1.75ms for the copper and terbium detectors retrospectively. The slower decay of the terbium allows a higher signal to be collected but at standard accelerator pulse rates the signal of the fibre has not fully decayed before the next current pulse.

The integrated signal from the fibres gives a repeatable measure of radiation dose. Fibres have been tested for a number of applications including IMRT point dosimetry for which there small volume is an advantage. The property of the dosimeters is dependant on the doping used. Terbium detectors will require correction of the signal when used at default dose rates for linear accelerators. Variation of the signal property with field size and energy will be presented.

Conclusion: Doped quartz fibres have the potential to be an effective small volume dosimeter for a range of radiotherapy applications.

Conflict of Interest (only if applicable) The detectors used in these experiments have been supplied by Global Dosimetry.