AbstractID: 12585 Title: An in-house developed MOSFET dosimeter with reset capabilities

Background and purpose: To report the feasibility and clinical validation of an in-house developed MOSFET dosimetry system and describing an integrated non-destructive reset procedure.

Material and Methods: Off-the-shelf MOSFETs are connected to a common PC using an 18bit/analogue-input and 16bit/output data acquisition card. A reading algorithm was developed defining the Zero-Temperature-Coefficient point to determine the threshold voltage. A wireless interface was established for ease-of-use. The reset procedure consists of an internal circuit generating a local heating induced by an electrical current. Sensitivity has been investigated as a function of bias voltage (0V-9V) to the gate. Dosimetric properties have been evaluated for 6MV and 15MV clinical photon beams and *in vivo* benchmarking was performed against TLD for conventional treatments (2 groups of 10 patients for each energy) and TBI.

Results: MOSFETS were pre-irradiated with 20Gy. Sensitivity of 0.08mV/cGy can be obtained for 200cGy irradiations at 5V bias voltage. Ten consecutive measurements at 200cGy yield a SD of 2.08cGy (1.05%). Increasing dose in steps from 5cGy to 1000cGy yields a 1.00 Pearson correlation coefficient and agreement within 2.0%. Dose rate dependence (160-800cGy/min) was within 2.5%, temperature dependence within 2.0% (25-37ºC). A strong angular dependence has been observed for gantry incidences exceeding ±30º. Dose response is stable up to 50Gy (saturation occurs at approximately 90Gy), which is used as threshold dose before resetting the MOSFET. An average measured-over-calculated dose ratio within 1.05 (SD: 0.04) has been obtained *in vivo*. TBI midplane-dose assessed by entrance and exit dose measurements agreed within 1.9% with ionisation chamber in phantom, and within 1.0% with TLD *in vivo*.

Conclusions: An in-house developed resettable MOSFET-based dosimetry system is proposed. The system has been validated and is currently used for *in vivo* entrance dose measurement in clinical routine for simple (open field) treatment configurations.