AbstractID: 4573 Title: Dose dependence of MOSFET calibration factor between 30kV and cobalt-60 irradiation

Purpose: To characterize the behavior of MOSFETs under radiation of various clinically relevant energies used in radiotherapy and radiology by evaluating its sensitivity or threshold voltage shift (CF) with regard to total integrated dose.

Method and Materials: Seven p-type, duals bias MOSFETs from Thomson & Nielsen were investigated. They were exposed to four radiations sources: (1) ^{60}Co unit ($<E>_{\gamma}$: 1.25 MeV), (2) ^{192}Ir HDR unit ($<E>_{\gamma}$: 0.38 MeV), 30 kV beam ($<E>_{\gamma}$: 14.8 keV) and (4) 150 kV beam ($<E>_{\gamma}$: 70.1 keV). The MOSFET's sensitivity (CF_w) was evaluated at various moments in time and was calculated as the ratio of the measurement M_w (mV) over the estimated dose value D_w (cGy) both in water.

Results: The sensitivity of MOSFET is express by their calibration factor (CF_w), and allows the user to associate the reading displayed by the device (mV) to a dose value (cGy). The CF_w value diminishes with increasing threshold voltage, especially for low energy radiation. It is stable for ^{60}Co irradiations, while it decreases of 6%, 5% and 15% for beam energies of ^{192}Ir, 150 kV and 30 kV respectively. This behavior is explained by an alteration of the effective field applied on the MOSFET (bias), caused by the accumulation of holes at the SiO_2 interface. It is strongly dependent on the radiation nature (LET) and particularly affects low x-ray energies.

Conclusions: Those results are of major interest since, following the company recommendations to calibrate the device every 7 000 mV, it could lead to a significantly underestimated dose. A calibration of the device before every use and performing more than one measurement (thus using a mean dose value) should compensate the observed behavior.