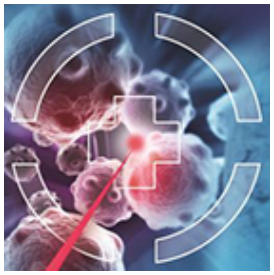

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Characterization of commercial photo-devices as dose-rate sensors

Characterization of commercial photo-devices as dose-rate sensors
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Introduction. The main application of photodiodes, phototransistors is to measure visible, ultraviolet or infrared light however some authors have reported their use as dose rate sensor with X-ray photon beams (M.S. Andjelkovic et al., Radiation Measurements 75, 2015).
Our research group previously developed a reader unit for MOSFET dosimeters (M.A. Carvajal et al., Sensors and Actuators A 247, 2016) and an external module to be able to measure the current produce by photo-devices by the radiation.
The aim of this work is to characterize commercial photodiodes and phototransistors as dose rate sensors for linear accelerators.
Method and materials.
The current voltage converter. It is based on the operational amplifier with a feedback resistor of 4.7 MΩ. The output is low pass filtered and adapted to our reader unit input, connected to our reader unit, achieving a resolution of 0.2 nA. The biasing voltage, -10 V, was obtained filtering the output of a DC-DC inverter.
Commercial devices under test. The devices selected as dose-rate sensor candidates were two photo-transistors, OP505 (Optek) and BPW85B (Vishay Siliconix); and one photodiode VTB8440BH (VTB Process Photodiode).
Experimental setup. Two experiments were carried out with an irradiation field of 10x10 cm2 in electronic equilibrium conditions, and placing the devices at the isocentre of the radiation sources (at 100 cm) of the linear accelerators:
- Siemens Artiste, 6 MV: Devices to test BPW85B and VTB8440BH.
- Siemens KDS, 18 MV: Device to test OP505.

Dose rates of 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 Gy/min were used to characterize the response of the reader module and the phototransistors. To study the effect of the accumulate dose, the response of the devices were monitored from high-to-low dose rate, and after, from low-to-high dose rates. In order to minimize the effect of ambient light the devices were painted with nails polish and placed into a black plastic box.
Results. Linear dependence of the current with dose-rate was found in all the experiments with high linearity, correlation factors (R^2) between 0.995 and 0.998. However a degradation of the sensitivity of from high-to-low study and low-to-high (after the first 12 Gy) was of 3% for the OP505, 29% for the BPW85B and 32% for the VTB8440BH.
Conclusions. The OP505 presented a better response to be used as dose rate sensor with our reader module, and it will be characterized with photon beams of 6 and 12 MV.
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