



Contribution ID : 19

Type : not specified

A compact and low cost dosimetry system based on MOSFET

Monday, 24 June 2013 12:00 (15)

In this work we present a handheld dosimetry system for radiotherapy developed at the Departamento de Electrónica y Tecnología de la Computación of the Universidad de Granada in collaboration with the Departamento de Física Atómica, Molecular y Nuclear also from Universidad de Granada and the Hospital Universitario “San Cecilio” of Granada.

The use of MOSFET dosimeters for in-vivo dosimetry has increased notably in the last few years due to some advantages such as their immediate and non-destructive readouts, low power consumption, easy calibration, and reasonable sensitivity and reproducibility [1]. The basis of these devices is that the absorbed dose is approximately proportional to the shifts in the threshold voltage of the MOSFET [2].

In our dosimetry system a general purpose commercial pMOS transistor is used as sensor to detect the ionizing radiation. This implies an important cost reduction. The reader unit implements several algorithms that permit to extend the linear range above mentioned [2] and to carry out a thermal compensation [3]. Thanks to these algorithms, and it can be seen in table 1, the resolution of system makes it feasible for in-vivo dosimetry even with the commercial transistor we have used [4]. Three groups of four dosimeters were irradiated in a 60Co source and in a LINAC with normal incidence with qualities photons of 6 and 18MV. The correlation factors found for these dosimeters were, at least, 0.993, and the medium sensitivity are summarized in the table 1.

Table 1: Technical specifications

Temperature range 20–36 °C Thermal drift < 3 mGy/°C
 Resolution 2 cGy Delay after irradiation 5 minutes
 Accuracy Maximum incidence angle (°)
 LINAC Angle <60° ± 3% Sensitivity (mV/Gy)
 60° < Angle < 75° ± 4% 60Co 24.3 ± 0.9
 60Co source Angle up to 90° ± 3% 6 MV () **20.1 ± 0.8**
Linear range 15 Gy 18 MV () 20.0 ± 1.7
 Use range () 50 Gy
 Angles: 60Co ± 90
 LINAC (up to 18MV) ± 75
 () With recalibrations
 (**) Build-up cap of 0.5 mm brass, irradiation field of 10x10cm² and individual calibration

Acknowledgements:

The authors acknowledge the Hospital Universitario “San Cecilio” for permitting us to use the LINAC installations. This work has been supported in part by the Junta de Andalucía (P09-FQM-0534 and P10-TIC-5997), the Ministerio de Ciencia e Innovación (FPA2009-14091-C02-02) and CEIBoITic Granada (Desarrollo de un sistema dosimétrico basado en MOSFETs comerciales para RIO).

References

- [1] Soubra et al., Med. Phys. 21 (1994), 567-572.
- [2] Carvajal et al., Sensors and Actuators A 157 (2010), 178–184.
- [3] Carvajal et al., Phys. Med. Biol. 56 (2011), 3535–3550.
- [4] Carvajal et al., Sensors and Actuators A 182 (2012), 146–152.

Summary

Oral or poster presentation

Oral

Primary author(s) : Dr. CARVAJAL RODRIGUEZ, Miguel Angel (UGR, Department of Electronics)

Co-author(s) : Prof. PALMA, Alberto (UGR, Department of Electronics); Prof. LALLENA, Antonio (UGR, Department of Atomic, Nuclear and Molecular Physics); Dr. GUIRADO, Damian (Universitary Hospital "San Cecilio" Granada); Mr. SIMANCAS, Fernando (UGR, Department of Atomic, Nuclear and Molecular Physics); Dr. BANQUERI, Jesús (UGR, Department of Electronics); Ms. MARTÍNEZ-GARCÍA, Sofía (UGR, Department of Electronics)

Presenter(s) : Dr. CARVAJAL RODRIGUEZ, Miguel Angel (UGR, Department of Electronics)