

Design of a detection system to obtain 2D axial dose maps for complex radiotherapy treatment verification

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TWO DETECTORS

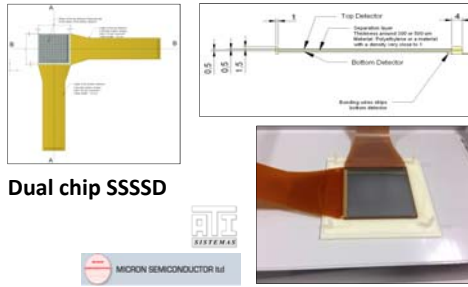
A feasibility study^{(1),(2),(3)}:
First detector (W1-SS 500)



Single Sided Silicon Strip Detector (SSSD)

New detector (BB7 technology)

Designed considering clinical constraints.
Developed by RADIA collaboration and the companies:
Micron Semiconductor Ltd. & ATI Sistemas S. L.



Dual chip SSSSD

DETECTORS CHARACTERISTICS

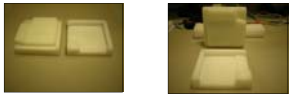
Characteristics	W1(SS)-500 detector	Dual chip SSSSD BB7
Nº Wafers	1	2
Nº Junction elements on Wafer 1	16	32
Nº Junction elements on Wafer 2	N/A	32 (perpendicular to strips on wafer 1)
Element length	49.5 mm	64 mm
Element pitch	3.1 mm	2.1 mm
Element width	3000.0 µm	2000.0 µm
Active Area	50x50mm ²	64x64mm ²
Wafer Thickness	500 µm	500 µm
Element active volume	49.5x3.0x0.5mm ³	64.0x2.0x0.5 mm ³
Metallization	Aluminum 0.3 µm	Aluminum 0.3 µm
Package	PCB with edge connections	Kapton with 20cm cables
Structure material	FR4 (1.85g/cm ³)	Kapton (1.6 g/cm ³)

FIRST TESTS: CHARACTERIZATION OF THE DETECTOR IN STANDARD REFERENCE CONDITIONS:

Material and Method:

Mechanical system

Box



Slab phantom



Inside

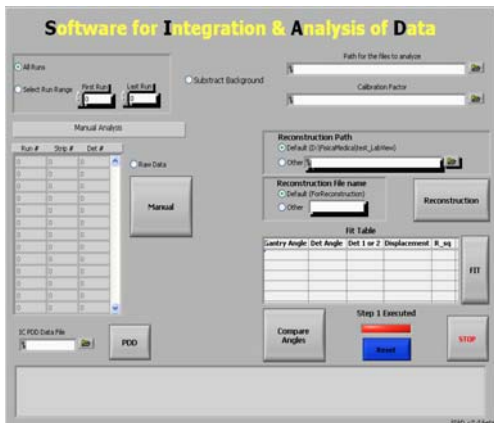
- ✓ Siemens PRIMUS Linear Accelerator (linac) (6 MV photon beam irradiation);
- ✓ Slab phantom;
- ✓ Detector + polyethylene box (orthogonal irradiation);
- ✓ Associated electronics (in-house developed);
- ✓ Labview platform for data acquisition.

Experimental setup

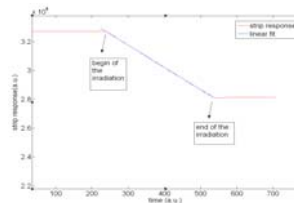


Preliminary data and analysis:

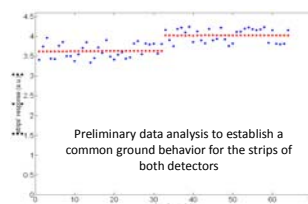
Designed software interface



Strip's response



Uniformity



Linear response to the irradiation

- Under calibration conditions:
- Source to Surface Distance=100cm
- 1.5cm of solid water

1MU of irradiation corresponds to 1cGy

First qualitative calibration in dose

BIBLIOGRAPHY:

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 - (2) Z. Abou-Haidar, A. Bocci, M. A. G. Alvarez, J.M. Espino, M.I. Gallardo, M.A. Cortés-Giraldo, M.C. Ovejero, J.M. Quesada, R. Arráns, M. Ruiz Prieto, A. Pérez Vega-Leal y F.J. Pérez Nieto. "Output factor determination for dose measurements in axial and perpendicular planes using a silicon strip detector", Phys. Rev. ST Accel. Beams 15, 042802 (2012).
 - (3) M.A. Cortés-Giraldo, M.I. Gallardo, R. Arráns, J.M. Quesada, A. Bocci, J.M. Espino, Z. Abou-Haidar and M. A. G. Alvarez, "Geant4 simulation to study the sensitivity of a Micron silicon strip detector irradiated by a Siemens PRIMUS linac", Progress in Nuclear Science and Technology, Vol. 2, pp. 191-196 (2011).
 - (4) Patent at the OEMP - Oficina Española de Patentes y Marcas - Ministry of Industry & Commerce: Number P201101009 (13/09/2011).
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(Dr Susanne Walsh Design /Colin D.Wilburn Director) and ATI Sistemas S. L., www.atistemas.com (Mrs. Marta Trueba).