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Simulation and testing of thin silicon microdosimeters realized with planar technology

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Modern cancer treatments have become increasingly more sophisticated in the past years and therefore require a real-time, reliable radiation dose monitoring system. Silicon microdosimeters are excellent candidates as they are small in size and have high spatial resolution. The ease of coupling to readout electronics makes them the first choice for a real time on-line system.

The devices in this study were realized with a standard planar technology and were thinned down to ˜10μm using a wet chemical etchant to achieve the best possible tissue equivalency. The device layout was based on information from previous microdosimeters developed by the Centre for Medical Radiaton Physics at the University of Wollongong, Australia based on silicon-on-insulator technology. The fabricated process is set as a benchmark for the design and fabrication of a novel type of silicon microdosimeters to be realized with state of the art full 3D technology.

Electrical, functional testing and comparison with numerical simulations will be presented and discussed. The functional tests were performed at the ESRF, Grenoble, France, using a sub-micron X-ray beam, up to ˜10ˆ10 ph/s. The aim of these tests was to investigate the uniformity and reliability of the fabricated devices in addition to the heavy ion experiments at HIMAC (Japan) using Carbon-12 Ions, and at ANSTO (Australia) with Helium atoms.

Author: POVOLI, Marco (University of Oslo)

Co-authors: Mr ROSENFELD, Anatoly (Centre for Medical Radiation Physics, University of Wollongong, Wollongong, Australia); KOK, Angela (SINTEF); STUGU, Bjarne (University of Bergen (NO)); ROEHRICH, Dieter (University of Bergen (NO)); Dr MONAKHOV, Eduard (University of Oslo); ALAGOZ, Enver (University of Bergen (NO)); SANDAKER, Heidi (University of Oslo (NO)); Dr CORNELIUS, Iwan (Centre for Medical Radiation Physics, University of Wollongong, Wollongong, Australia); MORSE, John (ESRF); PETASECCA, Marco (University of Wollongong); LERCH, Michael (University of Wollongong); Mrs SALOME, Murielle (European Synchrotron Radiation Facility (ESRF), Grenoble, France); Ms FOURNIER, Pauline (Centre for Medical Radiation Physics, University of Wollongong, Wollongong, Australia); Dr HANSEN, Thor-Erik (SINTEF)

Presenter: POVOLI, Marco (University of Oslo)

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