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Quantum efficiency measurements of FBK sensors with optimized entrance window for soft X-Rays

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Single photon detection of X-rays in the energy range from 250 eV to 1 keV for hybrid detectors is difficult due to two main reasons, namely the low quantum efficiency (QE) and the low signal-to-noise ratio (SNR). Combining LGADs technology, which will increase the SNR, with an optimized entrance window (EW) technology for soft X-rays will allow hybrid detectors to become a useful tool also for soft X-ray detection.

In the present work, the QE of single pad silicon p-i-n diodes with nine different EW variations is studied. The sensors were characterized at the Surface Interfaces Microscopy (SIM) beamline of the Swiss Light Source (SLS) using soft X-rays ranging from 200 eV to 1250 eV. From the investigation, a QE of 62.5% at 250 eV is obtained with one of the variations.

In addition, the QE of inverse LGADs (iLGAD) with a thin entrance window were also investigated. The first measurements show QE values, which are similar to the optimized QE technology for p-on-n sensors without multiplication, thus demonstrating the feasibility of implementing optimized QE technology into LGAD technology. Further studies on the iLGADs optimized for soft X-rays, in particular their gain variation as a function of the photon absorption depth, will be presented as well.

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