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Study of 2 P-stop layout of standard segmented LGAD with decreased gain to gain distance using TCT-Single Photon Absorption with microscopic resolution enabled by femtosecond laser from ELI Beamlines: Case study of LGAD Type 10

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Low Gain Avalanche Detectors (LGAD) represent a remarkable advance in high energy particle detection, since they provide a moderate increase (gain ˜10) of the collected charge, thus leading to a notable improvement of the signal-to-noise ratio, which largely extends the possible application of Silicon detectors beyond their present working field. The optimum detection performance requires a careful implementation of the multiplication junction, in order to obtain the desired gain on the read out signal, but also a proper design of the edge termination and the peripheral region, which prevents the LGAD detectors from premature breakdown and large leakage current.

This work deals with the latest optimization of standard LGAD and solutions for the peripheral region improvement. LGAD Type 10 was tested. This sensor has 2 P-stop layout (each pixel is surrounded by a proper p-stop). Noticeable, here the nominal inter-pad distance is a bit different vs the same structures produced in the baches UFSD 4.0 and UFSD 3.2. The nominal IP width (gain-gain distance) is 49 microns.

As research tool we used TCT technique with Single Photon Absorption method but with microscopic resolution enabled by excellent optics and beam focus of femtosecond laser from ELI Beamlines laser infrastructure in Prague.

Through talk we will emphasize how sensor processing parameters are reflected in TCT measurements with microscopic resolution. One of the results we are presenting in this presentation is also an interesting behavior of sensor in no-gain region (gain to gain between pixels) corresponding to JTE and p-stops; observed effect is enhanced with increased laser power. IP vs bias, measured for the first time with microscopic resolution will be also shown.

Authors: LASTOVICKA MEDIN, Gordana (University of Montenegro (ME)); BOZOVIC, Ivona (University of Montenegro); DOKNIC, Jovana (University of Montenegro); MATEUSZ, Rebarz (ELI Beamlines); Dr KRAMBERGER, Gregor (Jozef Stefan Institute); ANDREASSON, Jakob (ELI Beamlines); KROLL, Jiri (Institute for Physics. The Czech Academy of Science)

Presenter: LASTOVICKA MEDIN, Gordana (University of Montenegro (ME))

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