



Contribution ID: 67

Type: WG2 - Hybrid silicon sensors

Progress on 2PA-TCT analysis and the first demonstration of 3PA-TCT on 3D Si Double Sided Double Column (CNM RD50) structures tuned for fast timing

Wednesday 4 June 2025 12:35 (20 minutes)

This contribution has three distinguished parts all devoted to understanding the timing parameters of 3D Si CNM sensors and artefacts affecting the TPA -TCT measurements.

In contrast to planar detectors, 3D Si Double Sided Double Column devices were designed with n and p columns etched through the bulk, minimizing charge drift distance and improving timing. However, the peculiar geometry and electrode configuration of these sensors create non uniformities in both the internal electric field and the weighting field, resulting in a broader time-walk and compromising the sensor's time resolution. The complex three-dimensional distribution of electrodes and sensitive detector volumes presents significant challenges for detailed microscopic characterization of charge transport properties, which is indispensable for architecture optimization. Here, we present the first study allowing for the generation of comprehensive 3D mappings of timing parameters across the 3D pixel sensors volume. The micrometer spatial resolution was obtained by using laser-based transient current technique (TCT) with two-photon absorption (TPA). Two prototypic detectors with alternative electrode configurations, quadratic and hexagonal, have been examined and compared. The spread of time of signal arrival (ToA) vs. bias and laser power at the different depths has been systematically evaluated, by illuminating device with fs-laser from the front side. The effect of amplifier was studied too.

In the second part of this contribution, we will show the results from our study where 3D Si device was illuminated by the fs-laser (TPA-TCT) from the back side with removed metalized part.

In the third part we will present our preliminary results on the 3D Si with the Three Photon Absorption-TCT technique. We expect this technique to be more suitable for irradiated 3D samples than 2PA since 1PA (Single Photon absorption) contributes to 2PA in irradiated samples and this contribution increases with increased fluency affecting the precision of measurements.

Type of presentation (in-person/online)

in-person presentation

Type of presentation (I. scientific results or II. project proposal)

I. Presentation on scientific results

Authors: LASTOVICKA-MEDIN, Gordana (University of Montenegro (ME)); Dr REBARZ, Mateusz (ELI Beam-lines, ELI ERIC)

Co-author: KRAMBERGER, Gregor (Jozef Stefan Institute)

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

Session Classification: WG2/WP2 - Hybrid Silicon Technologies