Contribution ID: **170** Type: **Poster**

Charge collection parameterization of MALTA2, a Depleted Monolithic Active Pixel Sensor

Tuesday, 7 October 2025 15:00 (20 minutes)

In this work, MALTA2 sensors were tested at the CERN SPS Test Beam using the MALTA beam telescope, as well as with a pulsed laser employing the Edge Transient Current Technique (Edge-TCT). Sensors irradiated up to a fluence of 5×10^{15} 1 MeV $n_{\mathrm{eq}}/\mathrm{cm}^2$ were characterized in terms of tracking efficiency and cluster size, using the grazing angle technique. The active depth of the MALTA2 sensor was estimated through both grazing angle and Edge-TCT methods. Finally, progress on the next generation of MALTA sensors will be discussed.

Summary (500 words)

MALTA2 is a Depleted Monolithic Active Pixel Sensor (DMAPS) developed to meet the demanding requirements of future collider experiments, particularly in terms of radiation tolerance and high hit-rate capability. It is fabricated using a 180 nm CMOS imaging technology to mitigate performance degradation due to irradiation up to 100 MRad of Total Ionizing Dose (TID) and 3×10^{15} 1 MeV $n_{\mathrm{eq}}/\mathrm{cm}^2$ of Non-Ionizing Energy Loss (NIEL). The pixel architecture features a small octagonal charge collection electrode with a 3 μm diameter, minimizing the input capacitance, and leading to lower noise, higher signal amplitude, and reduced power consumption.

MALTA2 comprises a 224×512 pixel matrix, covering an area of $1 \times 2\ \mathrm{cm}^2$ with a 36.4 μm pixel pitch. The sensors are produced on both epitaxial silicon and high-resistivity Czochralski silicon, enabling efficient charge collection and excellent timing performance, especially after irradiation. Additionally, process modifications have been implemented to further enhance tracking performance and radiation hardness.

In this work, MALTA2 sensors were tested at the CERN SPS Test Beam using the MALTA beam telescope, as well as with a pulsed laser employing the Edge Transient Current Technique (Edge-TCT). Sensors irradiated up to a fluence of 5×10^{15} 1 MeV $n_{\mathrm{eq}}/\mathrm{cm}^2$ were characterized in terms of tracking efficiency and cluster size, using the grazing angle technique. The active depth of the MALTA2 sensor was estimated through both grazing angle and Edge-TCT methods, and the latest performance results are presented. These measurements indicate that MALTA2 is a promising candidate for future collider experiments, offering robust tracking performance and exceptional radiation hardness. Finally, progress on the next generation of MALTA sensors will be discussed.

Author: FASSELT, Lucian (DESY)

Co-authors: SOLANS SANCHEZ, Carlos (CERN); KRIZKA, Karol (University of Birmingham (GB)); Dr LI, Long (University of Birmingham(UK)); WORM, Steven (Deutsches Elektronen-Synchrotron (DE))

Presenter: FASSELT, Lucian (DESY)

Session Classification: Poster 1

Track Classification: ASIC