Contribution ID: **378** Type: **Poster**

Characterization of the RD50-MPW4 HV-CMOS pixel sensor

Tuesday, 28 May 2024 15:56 (1 minute)

The RD50-MPW4, the latest iteration in the HV-CMOS pixel sensor series developed collaboratively by the CERN-RD50-CMOS working group, marks a significant advancement in the RD50-MPW series. Rooted in generic research and development, the RD50-MPW program aims to address challenges posed by future physics experiments, such as HL-LHC and FCC, focusing on radiation tolerance, granularity, and timing resolution. Fabricated by LFoundry using their 150nm High Voltage CMOS process and delivered in December 2023, this sensor incorporates an active matrix of 64 x 64 pixels with a pitch of 62μm. The chip uses a column-drain readout architecture in the FEI3 double-column style.

While the predecessor, the RD50-MPW3, is an advanced prototype in our R&D program (mid-sized pixel matrix, with advanced digital periphery), problems due to noise coupling effects between the digital periphery and the pixels, caused limitations on threshold settings to
$gtrsim5ke^-$ while also restricting matrix operation to the top half.

The improved architecture of RD50-MPW4 effectively mitigates crosstalk through carefully separated power domains between digital and analog components, enabling more sensitive threshold settings while simultaneously operating the entire matrix. A new post-processing step facilitating backside-biasing, as well as the implementation of an improved guard ring structure allowing the RD50-MPW4 to accommodate bias voltages of up to 600V further boost the radiation hardness of the revised design.

This presentation will summarize preliminary measurements and compare the results with the predecessor chip, highlighting the improvements in our latest design. Laboratory assessments, including I-V measurements, an in-depth exploration of the trimDAC capabilities in harmonizing pixel responses, and an examination of the impact of threshold settings on pixel response, will be presented. Additionally, insights from test beams conducted at DESY and the medical facility MedAustron will contribute valuable information on the sensor's spatial resolution, cluster-size distribution, and total as well as in-pixel efficiency.

Collaboration

CERN RD50 CMOS

Role of Submitter

I am the presenter

Primary author: PILSL, Bernhard (HEPHY Vienna)

Presenter: PILSL, Bernhard (HEPHY Vienna)

Session Classification: Solid State Detectors - Poster session

Track Classification: T3 - Solid State Detectors