

Simulations and characterisation of the first monolithic CMOS LGAD implemented in 110nm

Thursday 5 December 2024 16:50 (20 minutes)

Monolithic CMOS silicon sensors represent an important innovation for high-energy physics experiments due to their cheaper production and assembly cost compared to hybrid ones. Indeed, in hybrid devices, the electronics and the sensor are produced on different silicon substrates, which must be later connected using bonding techniques. However, as far as the time resolution is concerned, the most mature and high-performance technology today is represented by the Low Gain Avalanche Diode (LGAD), where a silicon sensor with an internal gain is connected to a custom electronics in a hybrid way.

The last ARCADIA submission exploited the integration of the LGAD concept in CMOS Monolithic Active Pixel Sensors (MAPS) to obtain the benefits provided by both technologies. The multiplication of the signals in MAPS has a major impact on the signal-to-noise ratio; hence, the power consumption of the in-pixel front-end can be lowered to achieve the same performances. In addition, this feature increases the attractiveness of these devices for space applications where low power absorption is desired. Nevertheless, the union of the two technologies still lies in its early stages, and vigorous R&D is necessary.

This presentation will focus on the structures with internal gain fabricated in a standard 110 nm CMOS technology within the ARCADIA project. An overview of the recently produced passive structures will be provided together with the first prototype with integrated electronics. Measurements obtained using an infrared laser and in a test beam will be presented and compared with the simulations. The expected gain between 5 and 14 was confirmed by the measurements, and a time resolution below 100 ps was achieved. Finally, the future perspectives of the next steps and an insight into the ongoing R&D will be given.

Type of presentation (in-person/online)

online presentation (zoom)

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

I. Presentation on scientific results

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Session Classification: WG1 - CMOS technologies