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First results on monolithic CMOS sensor with internal gain in 110nm technology node

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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 in 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 the Low Gain Avalanche Diode one (LGAD), where a silicon sensor with an internal gain is connected to a custom electronics in a hybrid way.
The recent developments exploit 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 a vigorous R&D is necessary.

This presentation will focus on the structures with internal gain fabricated in a standard 110nm CMOS technology for the third run of the ARCADIA project. An overview on the recently produced passive structures will be provided together with the results obtained in the laboratory. Then, a description of the first prototype with integrated electronics will follow along with its characterisation. Measurements obtained using an infrared laser and a Sr90 radioactive source will be presented. Finally, the future perspectives of the next steps and an insight into the ongoing R&D will be given.

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