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Advancements in Low-Gain Avalanche Diodes (LGADs) for the ALICE 3 timing layers

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The proposed ALICE 3 experiment requires outstanding Particle Identification (PID) based on Time-of-Flight (TOF), setting a highly ambitious timing resolution target of 20 ps. Achieving this goal necessitates intensive Research and Development (R&D) into next-generation silicon sensor technology for large-area systems.

Low-Gain Avalanche Diodes (LGADs) are primary candidates due to their excellent timing performance. Our R&D, conducted within the ALICE 3 collaboration, investigates the potential of optimizing these sensors through the exploration of very thin substrates, ranging from 15 to 50 µm. This study particularly focuses on the innovative concept of double-LGADs, where two sensors are coupled to generate an enhanced signal.

We present a comprehensive performance comparison between single and double LGAD configurations across tested thicknesses. The results obtained from beam tests and laboratory characterization demonstrate a significant advantage of the double-LGAD structure: a substantial enhancement in the output charge signal compared to single sensors (crucial for front-end electronics optimization) and the benefit of an improvement in time resolution, approaching or meeting (depending on the thickness) the 20 ps requirement.

These findings validate the double-LGAD configuration as a first proof of concept and make it a highly promising technology to meet the demanding timing specifications of future experiments.

Type of presentation (in-person/online)

in-person presentation

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

I. Presentation on scientific results

Author: CARNESECCHI, Francesca (INFN e Laboratori Nazionali di Frascati (IT))

Presenter: CARNESECCHI, Francesca (INFN e Laboratori Nazionali di Frascati (IT))

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