

Comprehensive technology study of radiation hard LGADs

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Towards radiation tolerant sensors for pico-second timing, several dopants are explored. Using a common mask, CNM produced LGADs with Boron, Boron+Carbon and Gallium implanted gain layers are studied under neutron and proton irradiation. With fluences ranging from $1e14$ to $6e15$ n_{eq}/cm^2 on both species, reported results focus on breakdown voltage-mode, acceptor removal and gain reduction via electrical characterization. Timing performance, charge collection, gain and relative efficiency are treated through charged particle measurements, including signal Fourier analysis and noise characterization. An accent is placed on stability, via dark rate and operating voltage studies while, radiation related gain reduction mechanisms are examined comparing gain estimations using different approaches. Finally, With data at -10C, -20C and -30C, temperature dependence is assessed while investigating sensor failure modes under different conditions, including macro- and microscopic inspection.

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