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Charge carrier generation in RNDR-DePFET Detectors

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DEPFET detectors with repetitive-non-destructive readout (RNDR) achieve a deep sub-electron noise by averaging several independent measurements of the signal of one single event. As an active pixel sensor, this technology performs the corresponding charge transfer between two readout nodes, within in each pixel, which enables a high level of parallelization and fast readout. The capability to distinguish the number of collected electrons within the signal enables experiments for the direct detection of light dark matter candidates by investigating electron scattering processes of dark matter candidates as event signature.

We present the experimental characterization of a 64x64 RNDR-DEPFET pixel detector with a focus on the charge carrier generation rate and the achievable time resolution to detect single electrons. As an active pixel detector, RNDR-DEPFETs can be continuously operated in order to measure the signal during the collection process and consequently achieve a time resolution in the order of several 100 micro seconds. The sensitivity of the detector on rare events with a signal of two or more electrons depends on the time resolution and generation rate. The impact of both parameter on the performance is studied by modelling the measurements for different operation conditions.

Primary experiment

DANAE

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