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Parametrisation of the response of ALPIDE Monolithic Active Pixel Sensors to low energy nuclei

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We report on the characterisation of the response of the ALPIDE MAP sensor to nuclei of energy 20-220 MeV/a.m.u.. ALPIDE has been designed for the upgrade of ALICE experiment at the LHC: the new tracker will be fully efficient, with improved sensitivity, for particles with transverse velocity larger than 0.7c and charge ±1. The operating regime considered in this work is really different: slower nuclei release much more energy in silicon, proportionally to $Z2/\beta2$, increasing signals by up to orders of magnitude in amplitude and spatial extension. Since the only available observable quantity is the cluster size understanding and parametrising the response of front-end electronics for different settings of current thresholds, bias potential and acquisition time, is far from trivial. We provide here results from measurements taken in Trento (protons 20-220 MeV) and in Catania (H, He, C, O nuclei 62 MeV/a.m.u.). The agreement with predictions from Geant4 Monte Carlo simulations and TCAD calculations proved sufficiently good to analytically parametrise the response of ALPIDE to low energy nuclei.

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