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Measurements and calculations of electron avalanche growth in ternary mixtures of Ne + CO₂ + N₂

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The ternary gas mixtures of Ne + CO₂ + N₂ is used in TPC, in the main tracking detector of ALICE at LHC accelerator. This mixture has a small diffusion constants, small thickness, reasonable value of electron drift velocity, small multiple scattering. A small addition of N₂ increases the electron drift velocity and reduces the micro-sparking.

In this mixtures, besides the direct ionization, gas multiplication is enhanced by Penning transfer both with CO₂ and N₂. Up to now, the range of measured gas gain is limited by $2 \cdot 10^3 - 5 \cdot 10^4$.

In this work, we want to present the gas gain curves in a wide range beginning from the ionization regime to the breakdown limit (few $\cdot 10^5$), for mixtures pressures from 400 hPa to 1800 hPa, gas composition of Ne + CO₂ (10%) + N₂ (2.5 ; 5 and 7.5%, respectively) and for Ne + N₂ (2.5; 5 and 7.5%, respectively). The measured data have been fitted using Magboltz simulation program to determine the Penning transfer rates.

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