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Studies of primary and secondary scintillation yield in krypton

The krypton electroluminescence yield was studied, at room temperature, as a function of electric field in the gas scintillation gap. A large area avalanche photodiode has been used to allow the simultaneous detection of the electroluminescence pulses as well as the direct interaction of x-rays, the latter being used as a reference for the calculation of the number of charge carriers produced by the electroluminescence pulses and, thus, the determination of the number of photons impinging the photodiode. An amplification parameter of 113 photons per kV per drifting electron and a scintillation threshold of 2.7 Td (0.7 kV cm-1 bar-1 at 293 K) was obtained, in good agreement with the simulation data reported in the literature. On the other hand, the ionisation threshold in krypton was found to be around 13.5 Td (3.4 kV cm-1 bar-1), less than what had been obtained by the most recent simulation work-package. The krypton amplification parameter is about 80% and 140% of those measured for xenon and argon, respectively. The electroluminescence yield in krypton is of great importance for modeling krypton-based double-phase or high-pressure gas detectors, which may be used in future rare event detection experiments. Preliminary results for the primary scintillation yield in gaseous krypton will also be presented.

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