Dual Polarity Ion Drift Chamber: Results with Xe-SF_6 mixtures

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A new experimental system was recently developed at LIP-Coimbra to measure the mobility of both positive and negative ions: the Dual-Polarity Ion Drift Chamber (DP-IDC). This new system is intended to foster the understanding of transport properties of ions in gases, as these are specially relevant for the performance of gaseous detectors, namely in large volume ones, in particular for the development/optimization of the performance of Negative Ion Time Projection Chambers (NITPCs) for rare event searches such as the experiments CYGNUS, XENON or NEXT. The optimization/fine tuning of gas mixtures for such detectors gains special relevance as drift of negative ions in these detectors can significantly affect the signal formation, the tracking capability and spatial resolution, eventually limiting their rate capability. In addition, a comprehensive understanding of the different ion species expected in particular gas mixtures, can also be of extreme importance as it may allow to identify potential minority charge carriers (negative ions) which are the basis for the development of additional internal trigger methods in NITPCs while enabling to further reduce the background on such detectors.

In this work, we present a description of the experimental setup and technique used, and the initial studies carried out in mixtures of interest in NITPC's, namely in Xe-SF_6 mixtures, whose interest has attracted attention as a possible alternative in searches for the neutrinoless double-beta decay.

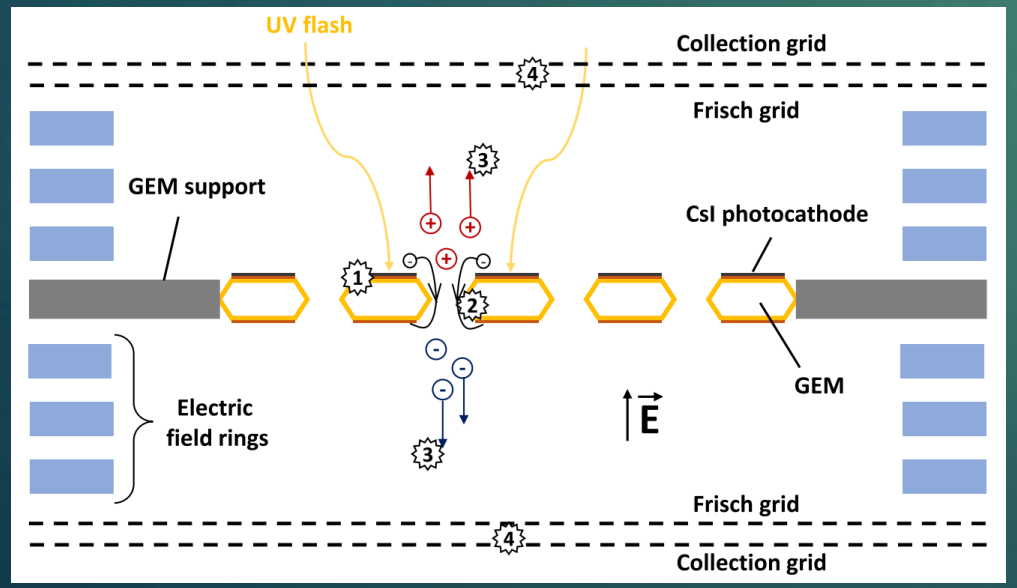

Fig. 1 – Schematic of the DP-IDC

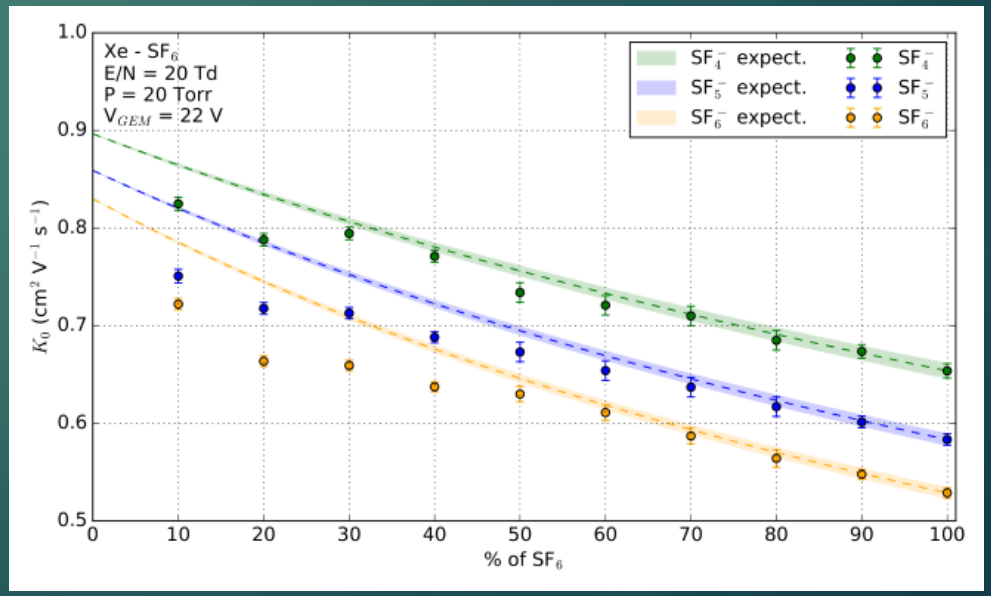

Fig. 2 – Ion mobility for Xe-SF_6 mixtures