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Effect of an electronegative additive on the electroluminescence yield of a noble gas

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Gaseous detectors are versatile devices that, despite their longevity, have known recently increasing fields of application, namely in the demanding rare-event search large-scale experiments. This recent increase in popularity can mostly be accounted by their capability to accommodate the features required by these experiments. One of these features is tracking which allows for particle identification and efficient background rejection. In these large-scale experiments when event tracking is required, one of the biggest constraints is electron diffusion especially relevant when the detection medium is a noble gas. Molecular additives are the traditional solution but they don't come without side thus other solutions have been sought. One of these is considering the possibility of having negative ions as charge carriers through the use of the Negative Ion Time Projection Chambers (NITPCs), exploring the fact that anions have a much smaller diffusion than electrons. Another advantage of using the negative ions as charge carriers is the fact that different anion species can be formed, from which z-fiducialization can be achieved.
To consider the adoption of this technique, other conditions have to be met besides electron attachment and subsequent extraction efficiencies from the electronegative additive. One question to be addressed, is that gas detectors usually need an amplification stage, which can take the form of charge multiplication or electroluminescence production. The effect of the electronegative component in these processes must be investigated. Regarding electroluminescence, to our knowledge, no results exist. The goal of this presentation is to assess the effect of the addition of a small fraction of electronegative component (in our case SF6) on the electroluminescence yield of a noble gas (xenon). A systematic study will be presented, as a function of the negative additive concentration, for SF6-xenon mixtures at atmospheric pressure, using a gas proportional scintillation counter.

Collaboration

Role of Submitter

I am the presenter

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