Contribution ID: **84** Type: **not specified**

Advancements in Simulating C3H2F4-Based Gas Mixtures for Resistive Plate Chambers

Thursday 12 September 2024 10:50 (20 minutes)

One of the primary objectives of R&D strategies for Resistive Plate Chambers (RPCs) is to replace the currently used gases with more environmentally friendly alternatives. Current research is particularly focused on substituting C2H2F4, which is widely used in high concentrations in RPCs, with C3H2F4, a more environmentally friendly gas.
This contribution presents a comprehensive set of scattering cross sections for electrons in C3H2F4. These cross sections are validated through a systematic comparison of electron swarm parameters calculated using the Monte Carlo simulation MATOQ with experimental data obtained from a pulsed Townsend experiment. Furthermore, we demonstrate that simulation results for the effective Townsend coefficient and drift velocity are in good agreement with measurements obtained directly from an RPC using a laser beam to ionize C3H2F4-based mixtures. Finally, we discuss the dependence of the effective Townsend coefficient and drift velocity on the electric field for gas mixtures currently under study in the RPC community, especially those investigated by the RPC-ECOGAS@GIF++ collaboration.
The findings from this work can contribute to simulating the behavior of RPCs operating with gas mixtures containing C3H2F4. These results have the potential to significantly advance experimental research aimed at identifying environmentally friendly gas mixtures for RPCs.

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Session Classification: Physics and simulations (part I)