



Contribution ID: 179

Type: **Poster**

Cluster ions in gas-based detectors

Wednesday, May 27, 2015 9:20 AM (0 minutes)

Avalanches in gas-based detectors using

Ar-CO₂ or

Ne-CO₂ as drift medium

produce in a first instance Ar⁺, Ne⁺ and CO₂⁺ ions.

Although there is a wealth of information in the literature about ion transport and ion chemistry,

some gas-detector simulations simplify the treatment of ions to excess,

e.g. by taking only the noble gas ions into account,

neglecting the role of the quencher.

The noble gas ions transfer their charge to CO₂ in a few ns.

Over the next few ns the CO₂⁺ ions pick up CO₂ molecules

and thus cluster ions, in particular CO₂⁺ · (CO₂)_n are formed.

Since the cluster ions are ~ 20 % slower than the initial ions, the

ion-induced signals are substantially altered.

The effect is shown to be present in constant-field detectors

(LIP-Coimbra) and TPC readout chambers (ALICE and NA49), and is expected to affect devices such as Mi-

cromegas and

drift tubes.

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Session Classification: Gas Detectors - Poster Session

Track Classification: S7 - Gas detectors