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Precise Measurement of Gas Parameters in RPC Probes with Laser Induced Electrons

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All types of RPC are operating in very strong and homogeneous electric fields from 50 to 160 kV/cm and gas mixtures at atmospheric pressure. The width of the gas gaps vary between 140 µm and 2 mm. Especially crucial is the selection of gas mixtures to prevent permanent gas discharges and aging of the electrodes.
For a deeper understanding of the gas discharge under RPC conditions a high precision Laser test facility has been developed at the Helmholtz-Zentrum Dresden-Rossendorf.
In this work we present the performance of the test facility to create micro plasma inside gas gaps with a width of 300 µm up to 1 mm.
The new results for Electron drift velocity and Townsend coefficient will be compared with data from [1] at 100 kV/cm and from [2] at 50 kV/cm for gas-mixtures of R134a/SF6/iso-butane. The Townsend coefficient at 100 kV/cm still remains to low in comparision to Magboltz simulations [3]. Comparison of our results with Chiodini's measurements at 50 kV/cm shows deviations for both the electron drift velocity and the Townsend coefficient.
The test facility allows a fast and precise evaluation of gas mixtures for their suitability for RPC. This is also important for the substitution of all gases with a high global warming effect.

[1] L. Naumann et al., JINST 9 (2014) C10009
[2] G. Chiodini et al., Nucl. Instrum. Meth. A 602 (2009) 757
[3] W. Riegler et al., Nucl. Instrum. Meth. A 500 (2003) 144

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