

THE COULOMB REPULSION ACCOUNTING PROCEDURE INTEGRATED ON PORTABLE IMS

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Ion Mobility Spectrometry (IMS) is a traditional analytical method for the detection of explosives, drugs and toxic industrial compounds [1-4]. Today IMS research activity in the world focuses on medical topics, the task of noninvasive medical diagnostics of diseases by substances-biomarkers contained in the exhaled air [4]. The method has such advantages as high sensitivity, compact construction and low cost. Ion Mobility Spectrometry method based on measuring of ion mobility in the constant electric field in the presence of atmosphere. Coulomb's repulsion is an important effect of Ion Mobility Spectrometry data distortion. Consequently, the Coulomb Repulsion Accounting at IMS Data Processing is described. Trend to increase ion charge for higher signal to noise ratio and stability of ion source results in electric field interaction between parts of ion bunch. Initially, after a mixture of ions injection, ions of different mobility are not spatially separated, and electrical repulsion is maximal. The interaction becomes lower while ions move along drift tube. Drift time of certain probe ion peak t_{probe} depends on the movement in basic drift field E_{drift} superposed with the induced field from all surrounding ions. On the one hand, faster ions cause a delay of probe ions; on the other hand, slower ions make probe ions faster. Total influence of certain neighbor ions on probe ions is an integral function of their interaction during the drift time. The function of induced field can be obtained as a result of 3D modeling of induced electric field in drift tube with specified inner channel diameter and diameter of disc-shaped ion bunch. The integral function was calculated for drift tube with inner diameter of 30mm and ion bunch disc diameter of 10mm. All functions and coefficients were tabulated and transformed to integer form for faster processing. Total time of one peak position correction for IMS data set of 2000 points at Intel 1GHz embedded processor is not higher than 0.5ms. The supposed procedure essentially improves the accuracy of a peak position and substances recognizing.

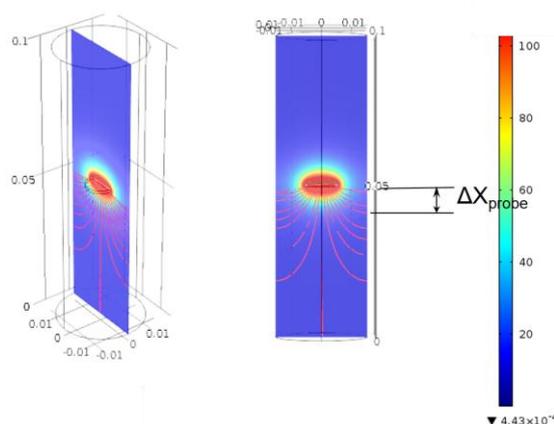


Figure 1. 2D modeling in cylindrical coordinates streamline: +Electric field Slice: Electric field norm (V/m).

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