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ROSINA DFMS instrument modeling with SIMION

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The ROSETTA mission was launched on March 2nd 2004 to its journey to the comet 67P/Churyumov-Gerasimenko. ROSINA, the Rosetta Orbiter Sensor for Ion and Neutral Analysis, consists of two mass spectrometers and a pressure sensor. ROSINA will perform molecular, elemental and isotopic composition analysis of the volatile material in the cometary coma. The Double Focusing Mass Spectrometer (DFMS) with its high mass resolution of dm/m 3000 is especially suited to study isotopic ratios and elemental abundances. It will be able to resolve CO from $\mathrm{N_2}$ and $^{13}\mathrm{C}$ from $^{12}\mathrm{CH}$. However, for this the instrument parameters have to be optimized to get the best possible resolution and the instrument has to be calibrated so the individual sensitivities of the elements and molecules are known.

This is where numerical models come into play. Since the DFMS is a very complex array of electrostatic lenses it is nearly impossible to analytically predict the most efficient setup, because the instrument has to be treated as a black box. It is even more important because it is expected that some parameters may change with time (ageing of electronics, temperature, etc.). By modeling specific regions of the instrument, for example the ion source, dependencies between parameters can be investigated and the performance of the whole instrument can be understood and also be improved. In this presentation modeling results and comparison with the actual instrument performance will be given.