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Techniques for mass resolution improvement achieved by typical plasma mass analyzers: Modeling and simulations

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Mass separation and particularly distinction between atomic ions and molecular ions are essential in understanding a wide range of plasma environments, with each consisted of different species with various properties.
In this study we present the optimization results of light-weight (about 2 kg) magnetic mass analyzers with high g-factor for Rosetta (Ion Composition Analyser: ICA) and for Mars Express and Venus Express (Ion Mass Analyser: IMA). For the instrument's optimization we use SIMION, a 3D ion tracing software in which we can trace particle beams of several energies and directions, passing through the instrument's units.
We first reproduced ICA and IMA results, which turned out to be different from simple models for low energy (< 100 eV). We then change the mechanical structure of several units of the instrument and we quantify the new mass resolution achieved with each change. Our goal is to find the optimal instrument's structure, which will allow us to achieve a proper mass resolution to distinguish atomic nitrogen from atomic oxygen for the purposes of a future magnetospheric mission.