

Quadrupole Miniaturization: Measured Performance for Different Size Quadrupoles

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There are a number of research groups and companies currently focused on miniaturizing quadrupole mass filters to enhance their portability, by reducing their size, weight and power requirements. It is generally acknowledged that there will be a reduction in performance anticipated with the reduction in quadrupole size. In this work, we fabricated seven quadrupoles with different rod diameters (1, 2, 4, 6, 9, 12, and 20 mm rod diameters), and measured their absolute sensitivities to measure the actual relationship. We maintained constant conditions of argon partial pressures, using the same ionizer and detector for all seven quadrupoles, and experimentally determined the relationship between rod diameter and absolute sensitivity at various mass resolutions. We also determined the relationship between measured absolute sensitivity as a function of RF frequency, by operating four different rod diameter quadrupoles at five different RF frequencies. This presentation will also include a discussion of other practical aspects of quadrupole miniaturization, with specific focus on Paschen Curve implications, which ultimately limit the maximum usable voltage with regards to operating pressure.