

Ion Transport Optimization in ITLCS: A Study of the Conical Octupole Ion Guide System

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Abstract

We previously developed an ion trap-laser cooling spectrometer (ITLCS) for Sr-90 trace analysis using resonance ionization and quadrupole mass spectrometer (QMS)-based mass selection [1]. To improve ion transport efficiency, the system was upgraded with a conical octupole ion guide system, enabling more effective ion delivery into the trap for laser cooling.

Keywords: ITLCS, conical octupole ion guide, ion transport optimization

Introduction

The conical ion guide system consists of two conical octupole ion guides (COIGs) and three einzel lenses (ELs) arranged sequentially along the z-axis: EL1, COIG1, EL2, COIG2, and EL3. COIG1 features an 85 mm conical structure for initial focusing, followed by a 400 mm section with helium gas for ion deceleration. COIG2, 193 mm long, refocuses ions for delivery to the trap.

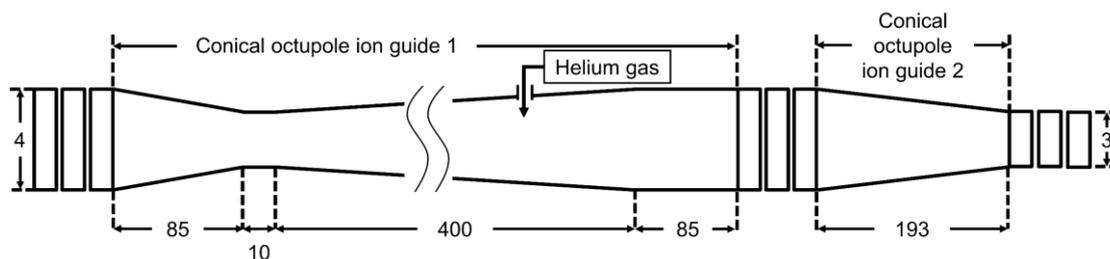


Figure 1. The schematic of the conical ion guide system (mm).

Results and conclusion

We designed and built an RF/DC power supply for the COIG system, enabling precise adjustment of voltage parameters applied to the octupole electrodes. This allows control over ion transmission rates. The results validate its reliability and establish a foundation for future laser cooling-ion trap experiments. Experimental results are shown in Figure 2.

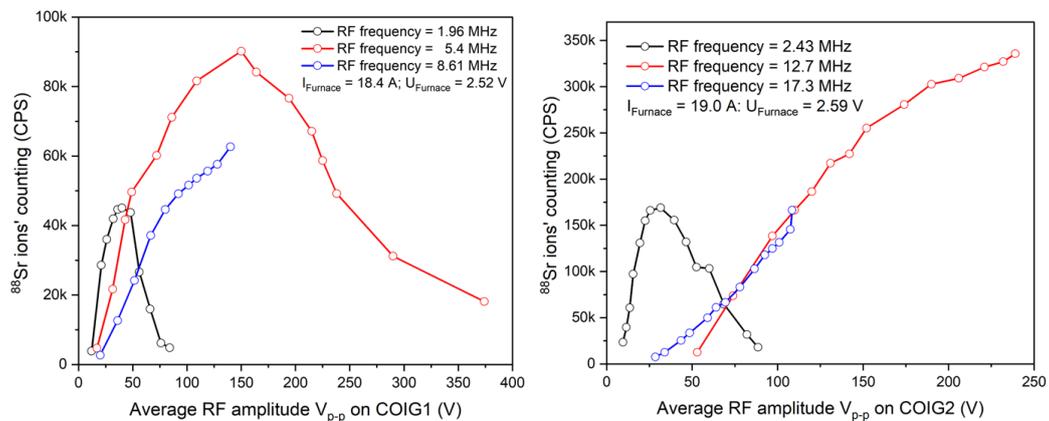


Figure 2. The relationship between the average RF amplitude (peak-to-peak) on COIG1 (Left panel) /COIG2 (Right panel) and the ⁸⁸Sr ions' counting rate.

Reference

[1] Jung, K, et al. *Physical Review A* 96.4 (2017): 043424.