HardHaQ '25 Trapped Ion Problem Set Submission

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November 22 2025

1 Introduction

Briefly state the objective of your design (e.g., maximize trap depth while minimizing RF power). Mention the starting point (the provided COMSOL file) and your overall strategy.

2 Design Choices

- **Geometry modifications:** [Describe changes to rod spacing, rod length, endcap placement, or custom shapes.]
- **Parameter tuning:** [List RF voltage, DC endcap voltages, or other editable parameters you adjusted.]
- **Rationale:** [Explain why you made these changes — symmetry improvement, deeper potential well, reduced offset, etc.]

3 Trap Metrics Results

Insert your exported Trap Metrics table here. Example format:

Metric	Value	Notes
depth_eV	[ ]	Trap depth (higher = stronger confinement)
minU_eV	[ ]	Minimum effective potential
maxU_eV	[ ]	Maximum effective potential
trap_x, y, z	[ ]	Coordinates of trap minimum
offset_mm	[ ]	Distance from geometric center
P_est_mW	[ ]	Estimated RF power

Highlight improvements compared to the default configuration. If possible, show before vs. after values.

4 Visual Evidence

Include at least one screenshot of your trap geometry and potential distribution. Example:

5 Analysis & Discussion

Explain how your design affected confinement quality:

- Did trap depth increase?
- Was the ion better centered?
- Did RF power efficiency improve?

Discuss trade-offs (e.g., deeper trap but higher power, symmetry vs. complexity). Note any unexpected artifacts or limitations.

6 Conclusion

Summarize why your design is effective. State the main improvement achieved (e.g., "Our design reduced offset by 40% while maintaining comparable depth").

7 Optional Extensions

If you explored unconventional geometries, parameter sweeps, or anisotropic traps, describe them briefly. Mention any future directions or open questions.

Deliverables Checklist

- Exported Trap Metrics table (.txt file)
- Screenshot(s) of geometry and potential distribution
- Modified COMSOL file (.mph)
- Written summary (this document)

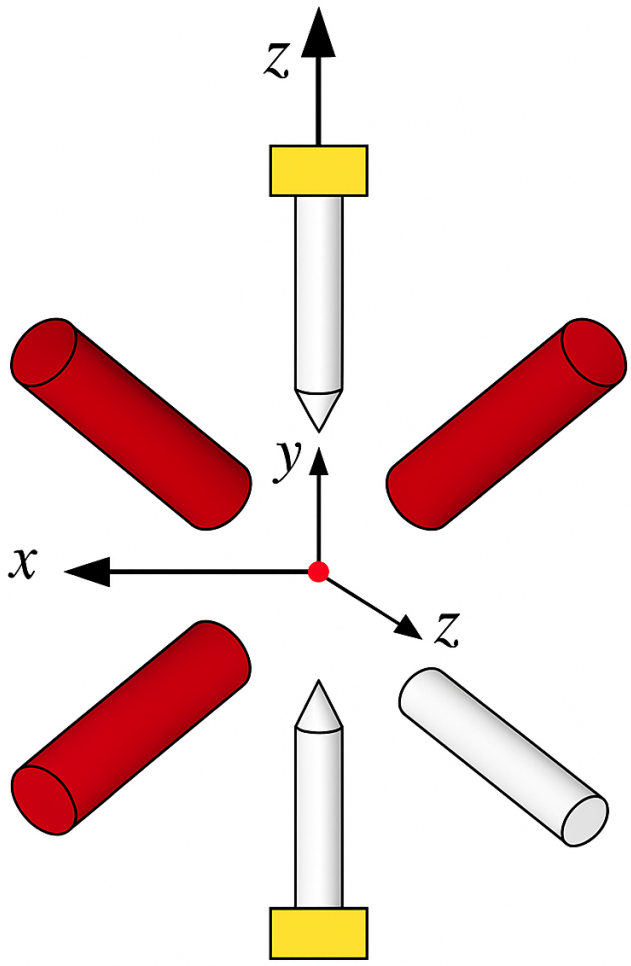

Figure 1: Modified trap geometry with reduced offset

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