Barium Ion Trapping

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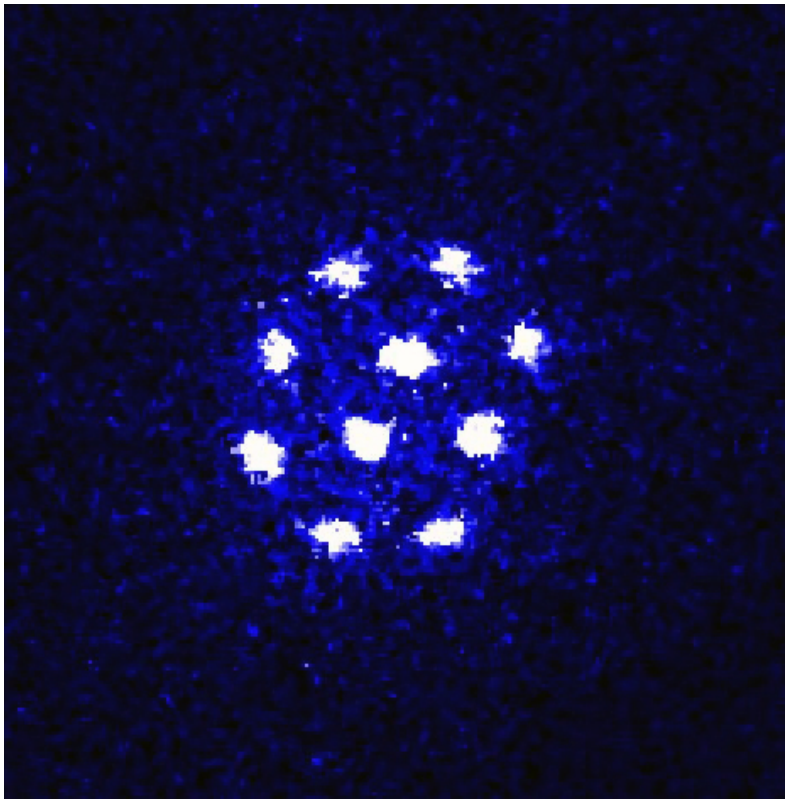
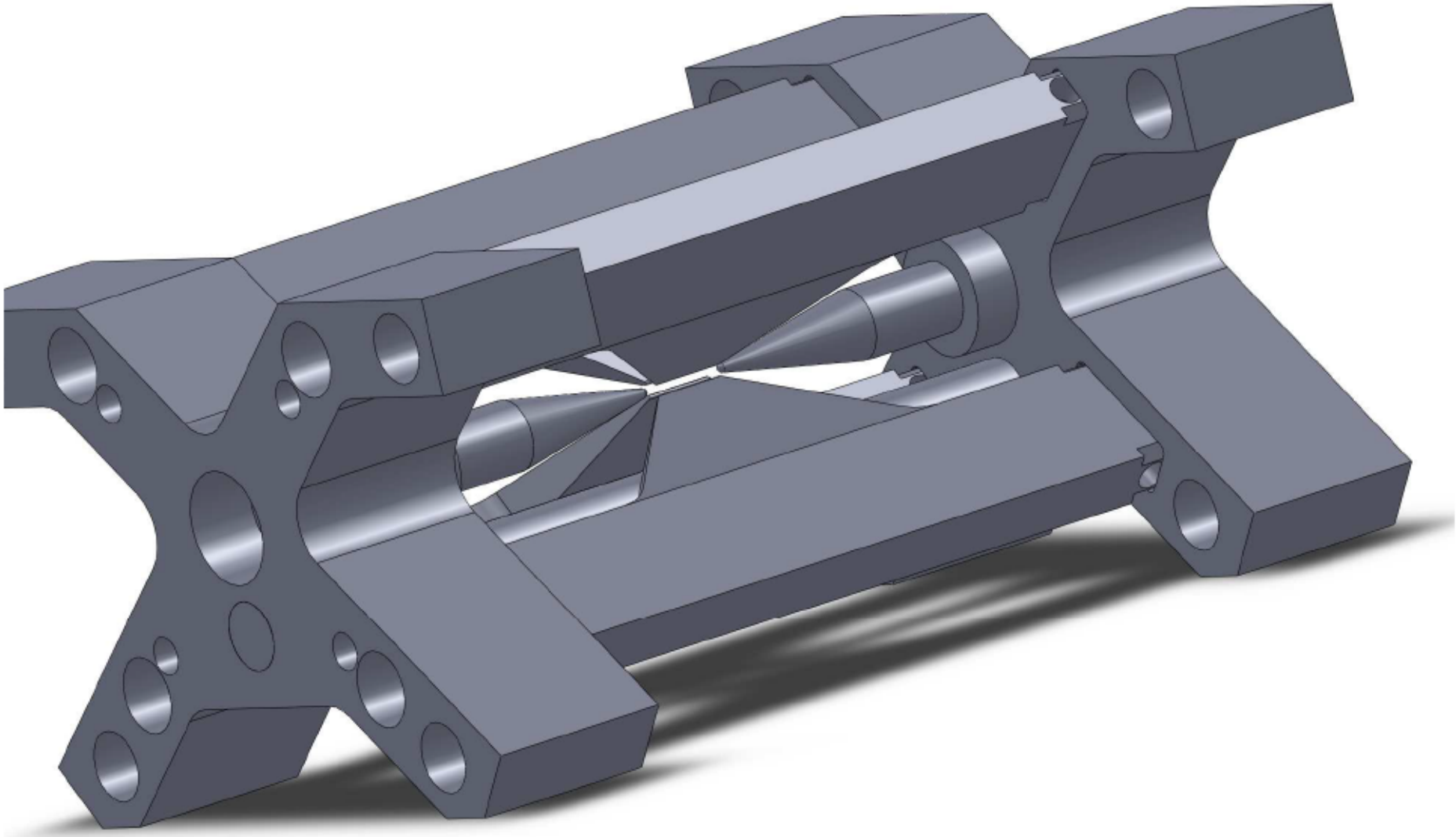
August 20, 2012

Uses for Ion Trapping

- Bell's Inequality tests
- Quantum Computing



Paul Traps



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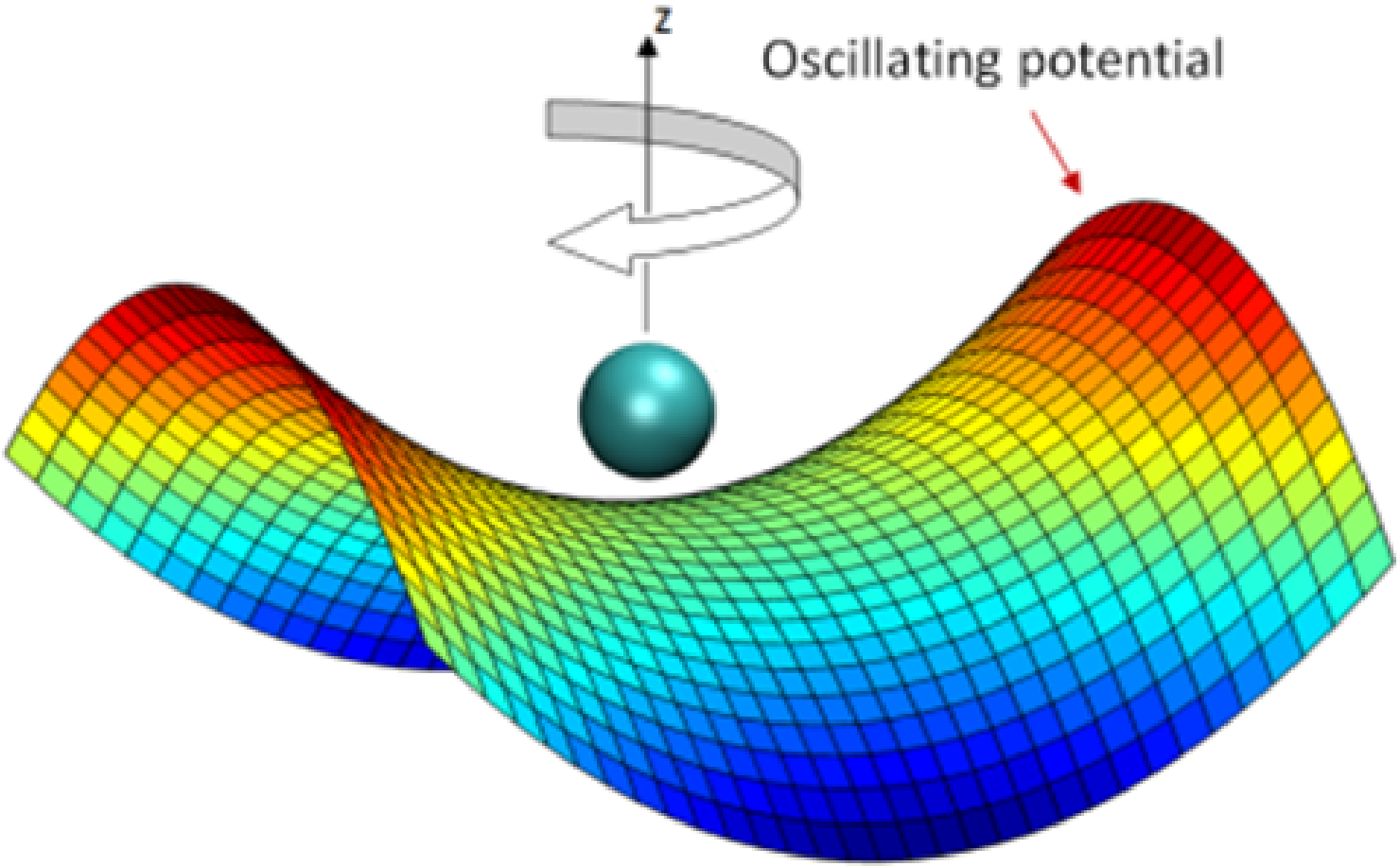
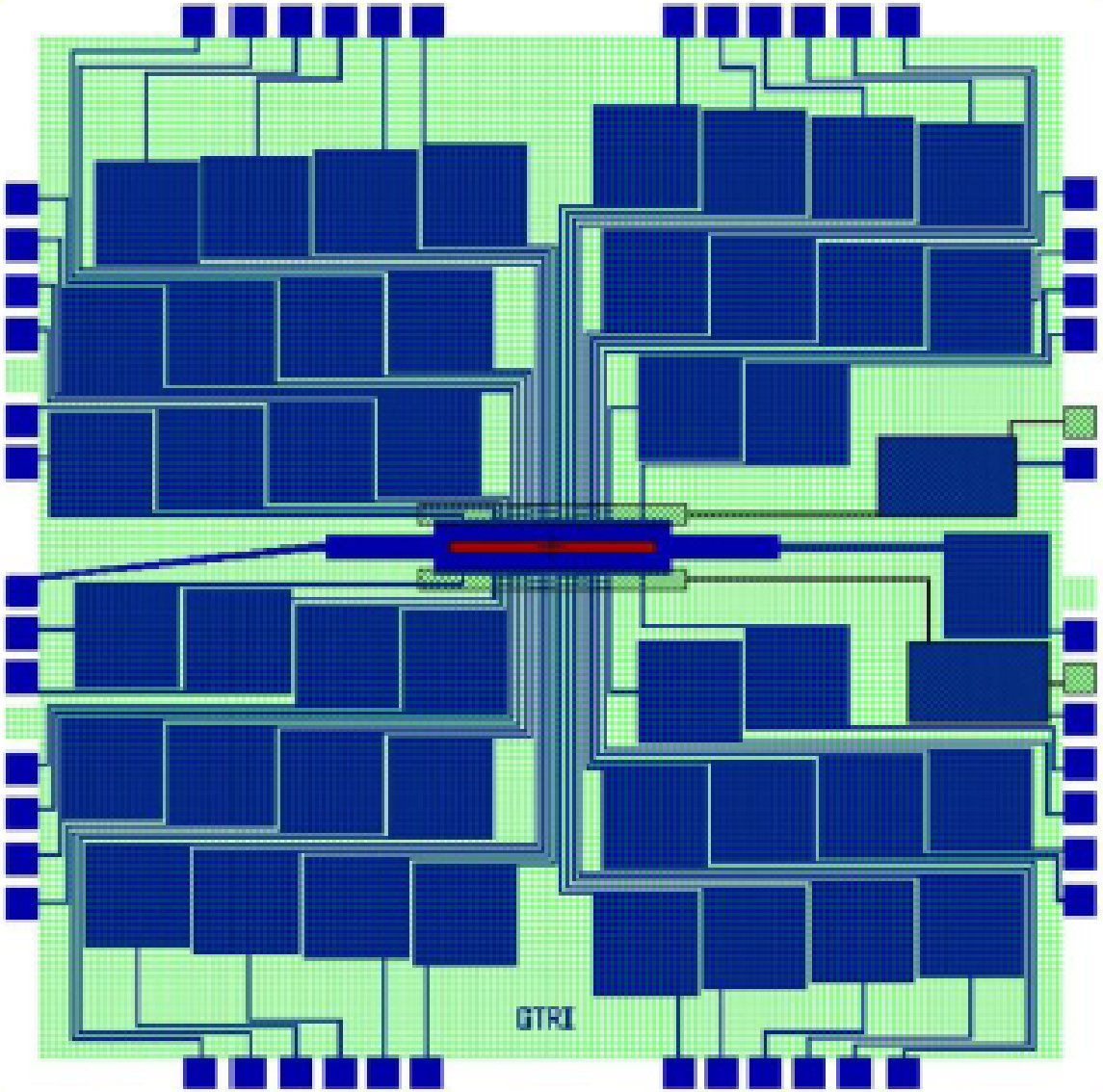


Source: Oak Ridge National Labratory
http://www.ornl.gov/info/press_releases/photos/Paul%20Trap%20pic.png

Chip traps



Loading the Trap

In order to load an ion trap we must:

1. Heat the barium oven
2. Ionize a barium atom
3. Cool the ion

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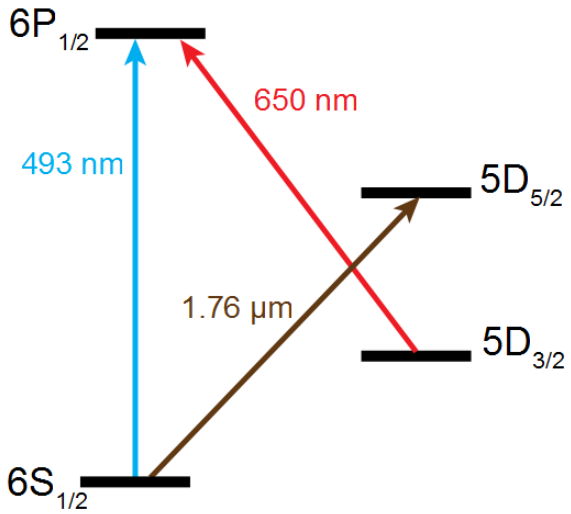
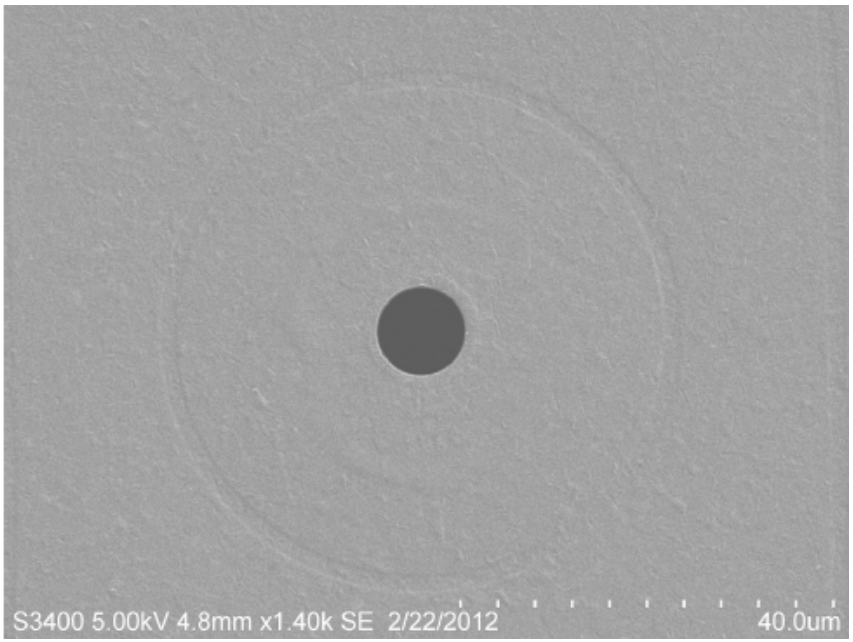


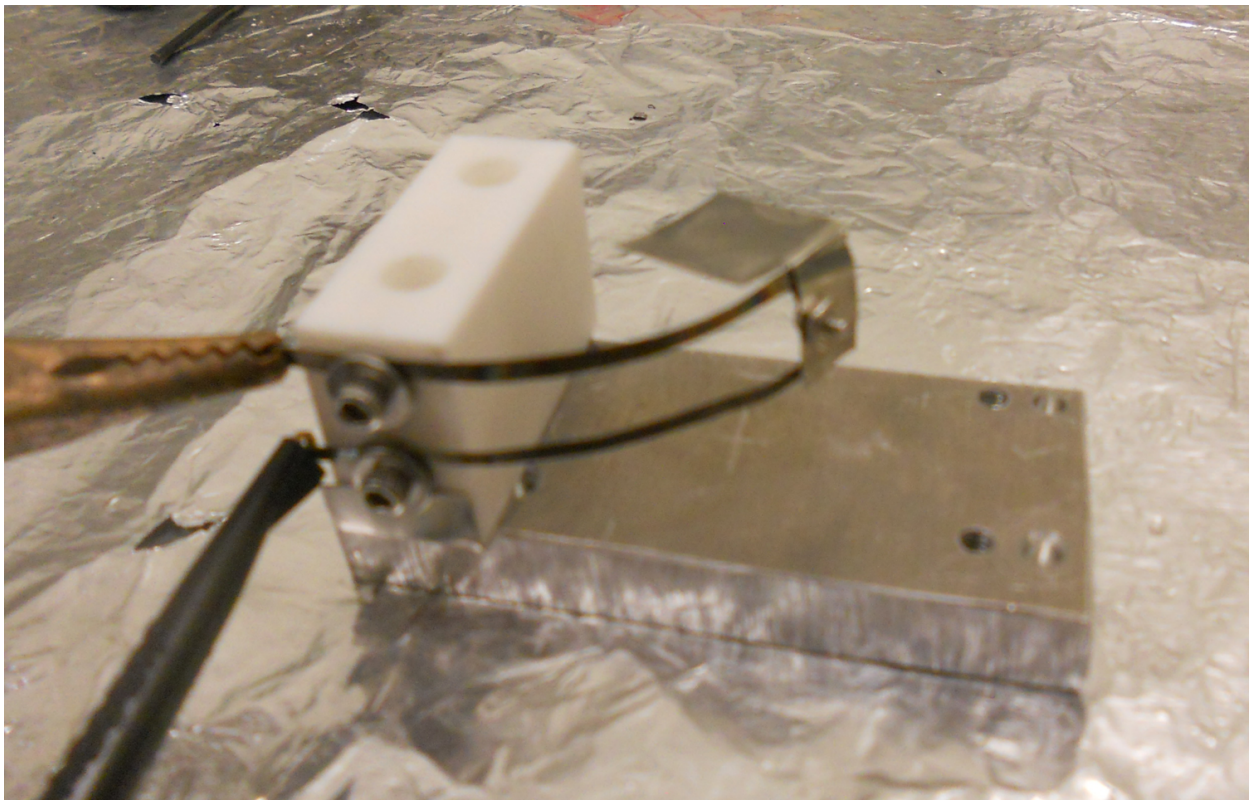
Problem

- Barium atoms are not making it into the chip trap
- The hole that the atoms should be traveling through is blocked
- The oven is producing large barium chunks while it heats up. These chunks block the hole and prevent any trapping.



Movable Shield

- Actuated using a bimetal strip



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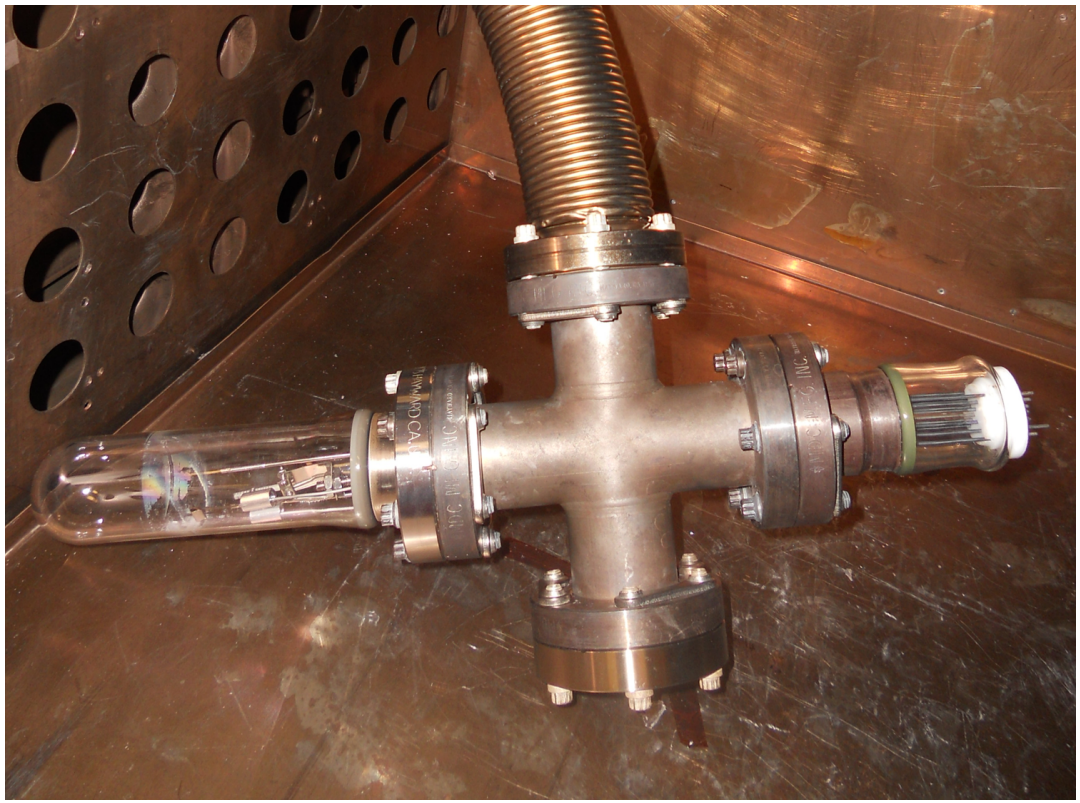

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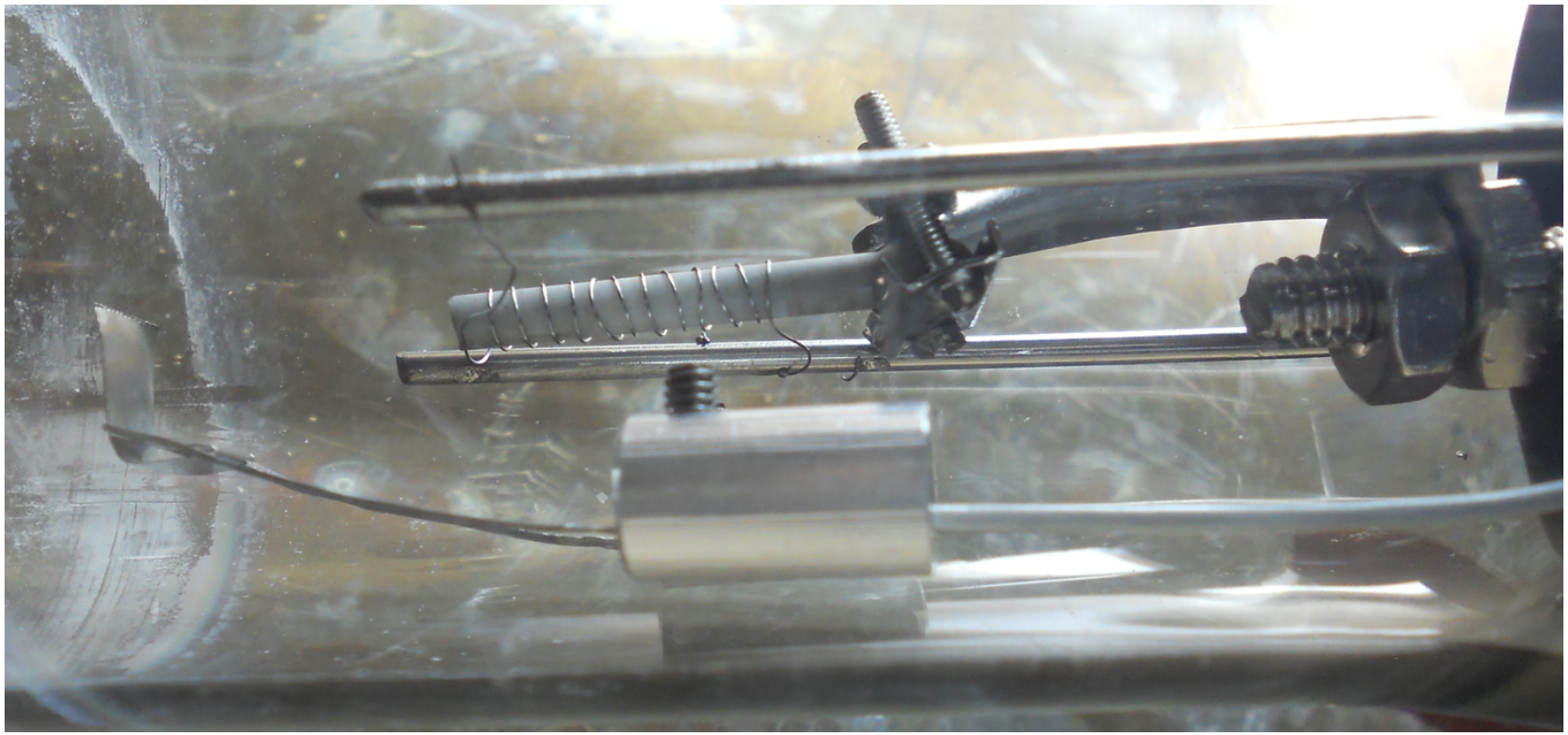

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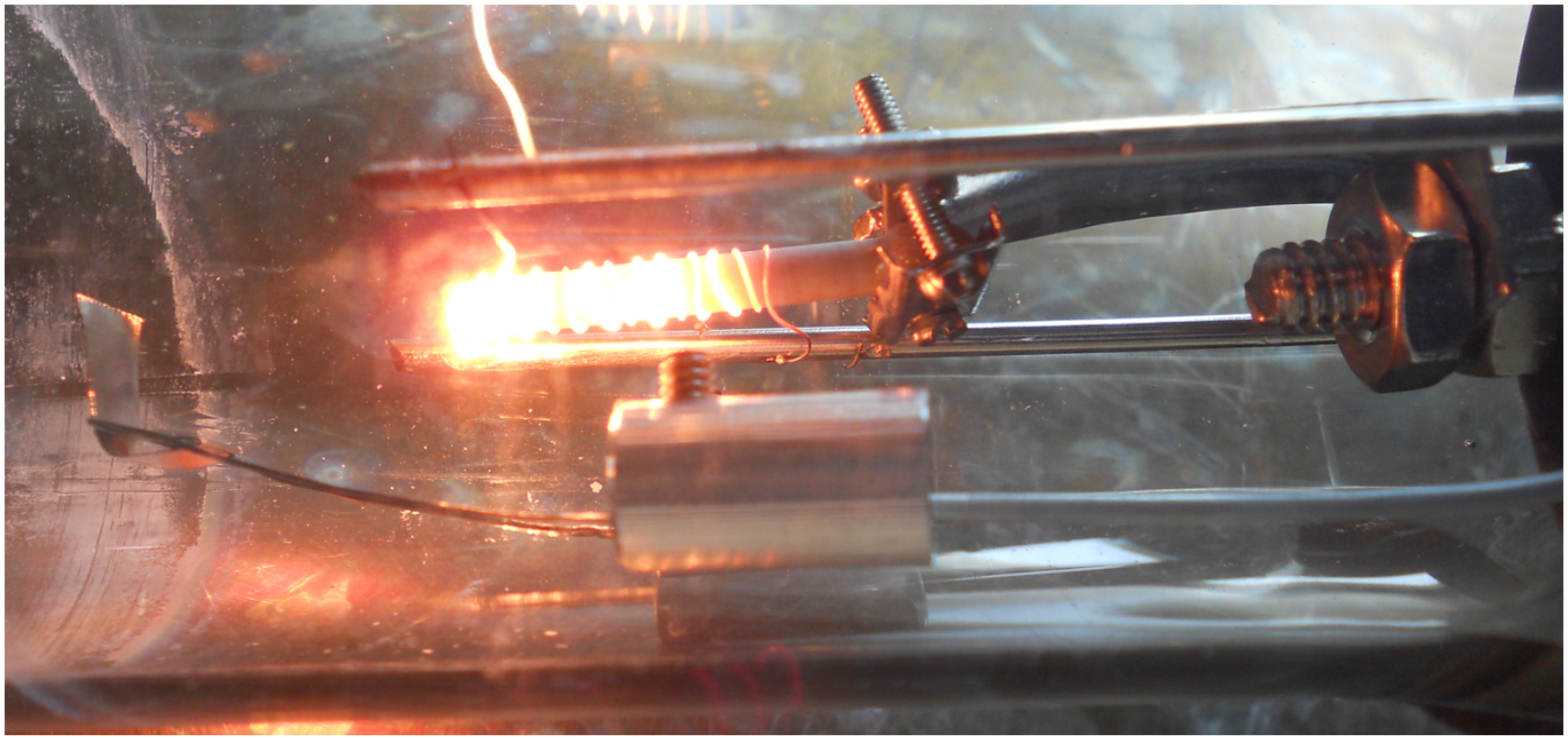

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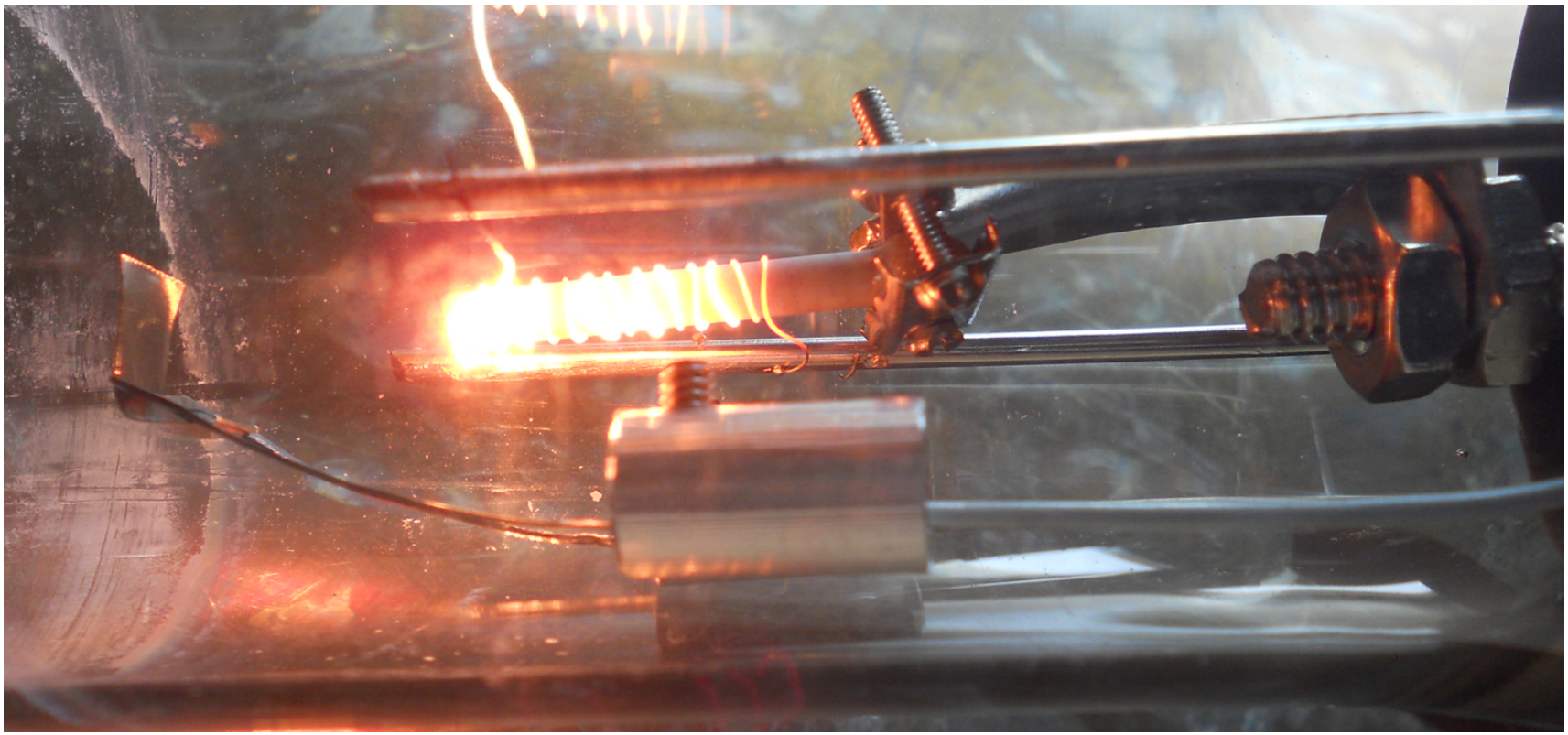

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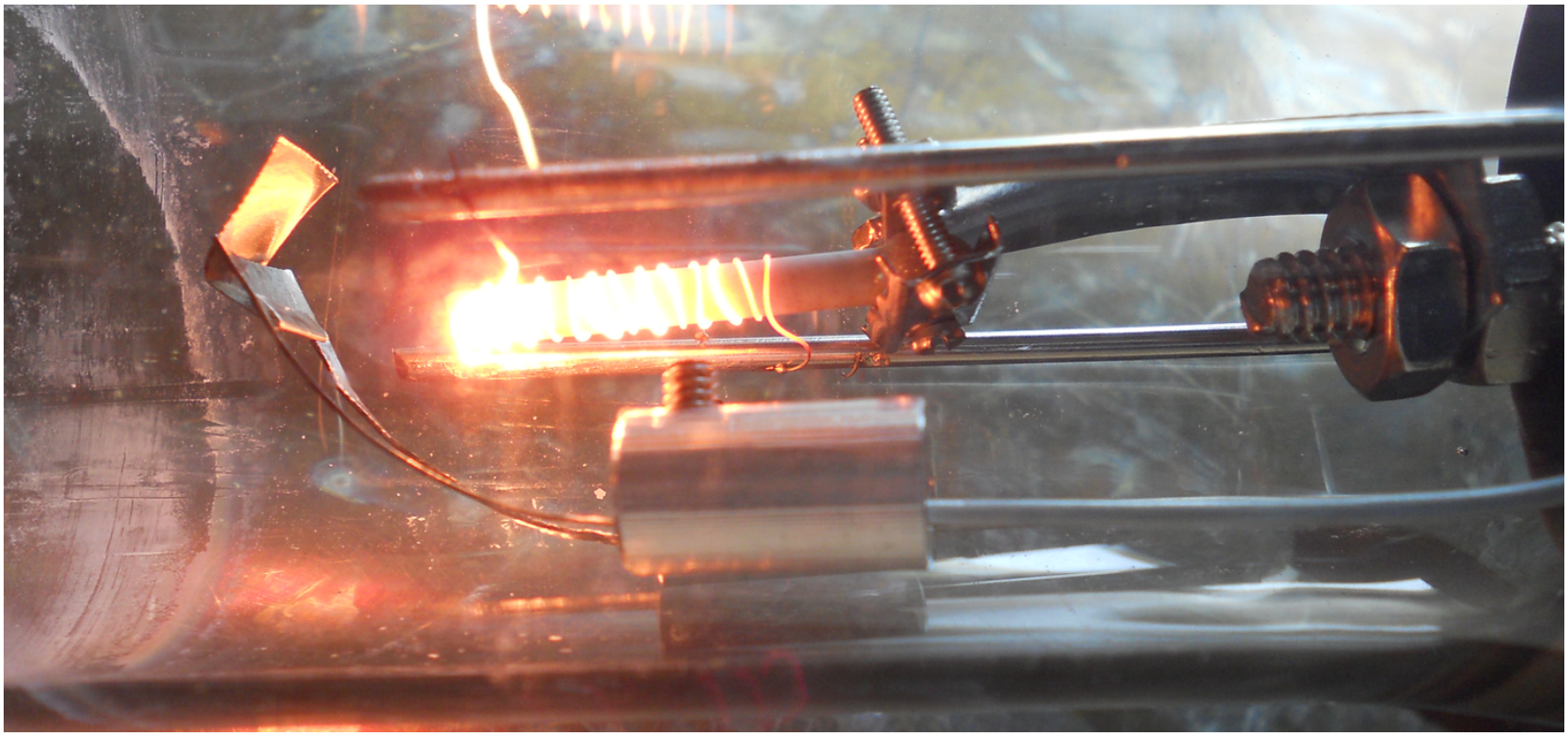

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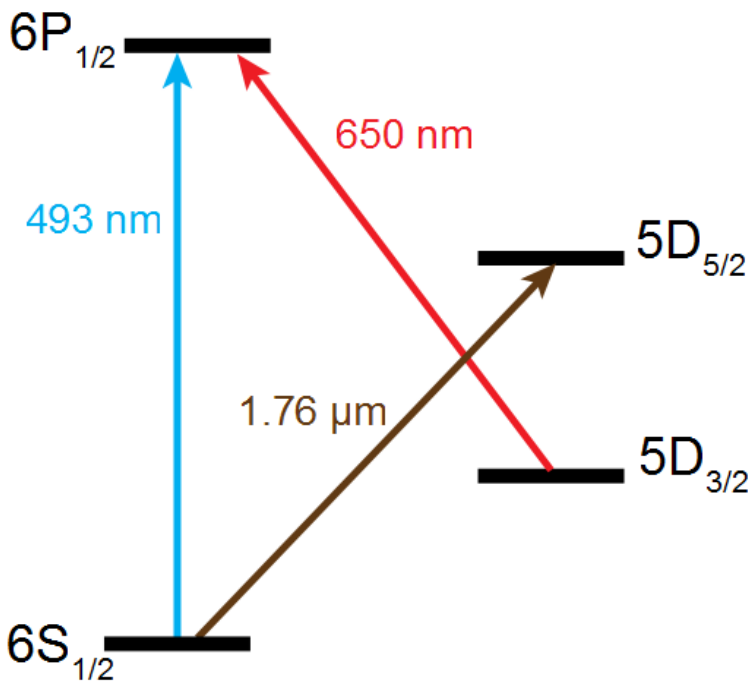
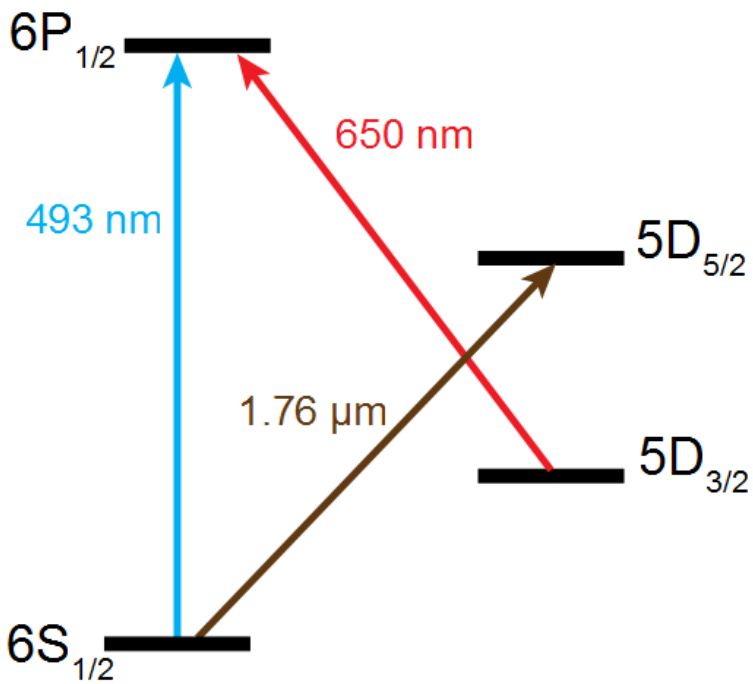


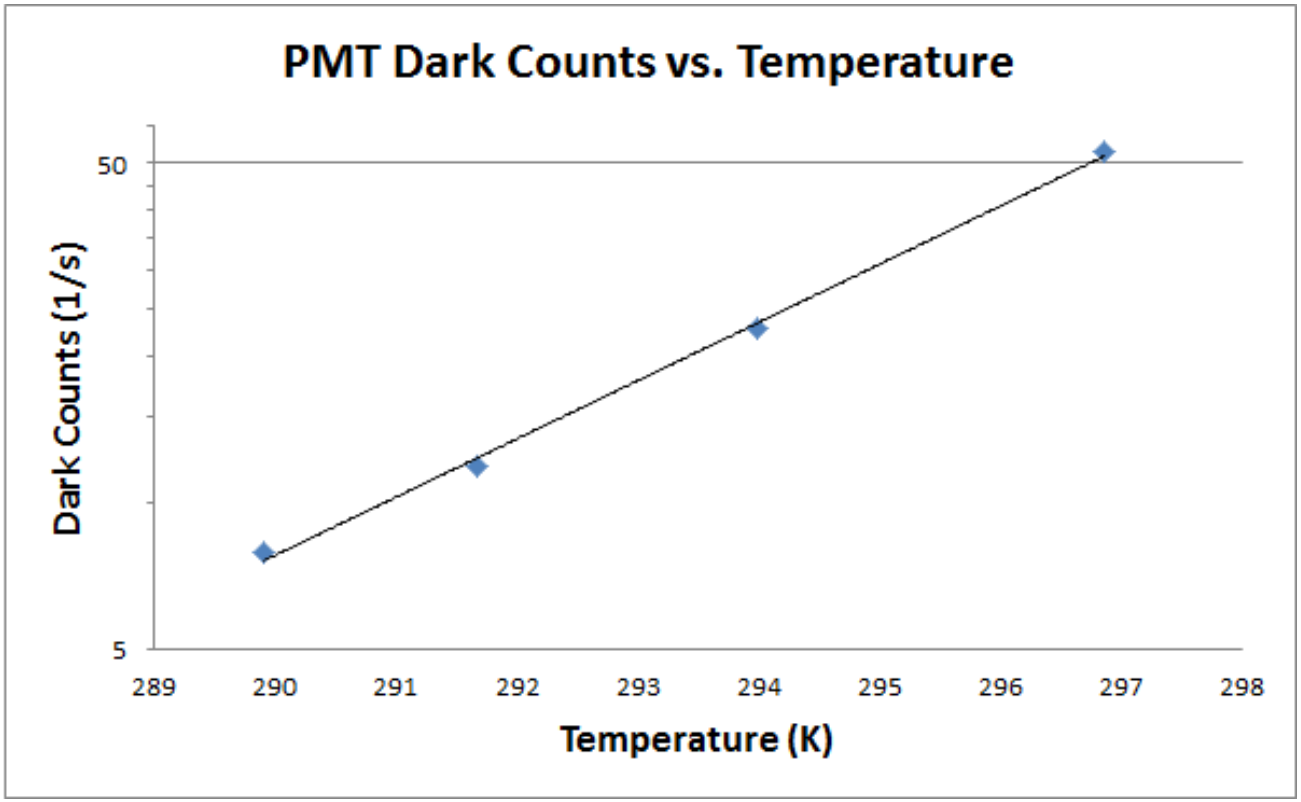
Detecting the Ions

- PMTs detect photons emitted by the ions
- For entanglement experiments, we want to be able to detect single emitted photons
  - Therefore, we need a very high sensitivity and a very low noise level



Lowering the noise level

- Dark counts are false positive readings from the PMT
- They constitute a significant fraction of our noise level



Summary

Improvements to ion trapping system:

- Movable shield
  - Prevents blockage of the hole that allows ions into the trap
  - Allows repeated re-loading of trap
- Lowered noise from PMT

Acknowledgements

Thank you to:

- Boris Blinov for being my advisor
- Tom, Carolyn, Matt, Spencer, John, Tomasz and the rest of the Trapped Ion Quantum Computing Group for helping me with my project and teaching me so much about theirs
- Emma, Rachel, Emily, Hunter, Eli, Scott and Jarret for being awesome people to spend my summer with
- Deep, Alejandro, Linda and Janine for organizing the REU program and making this all possible

Questions?