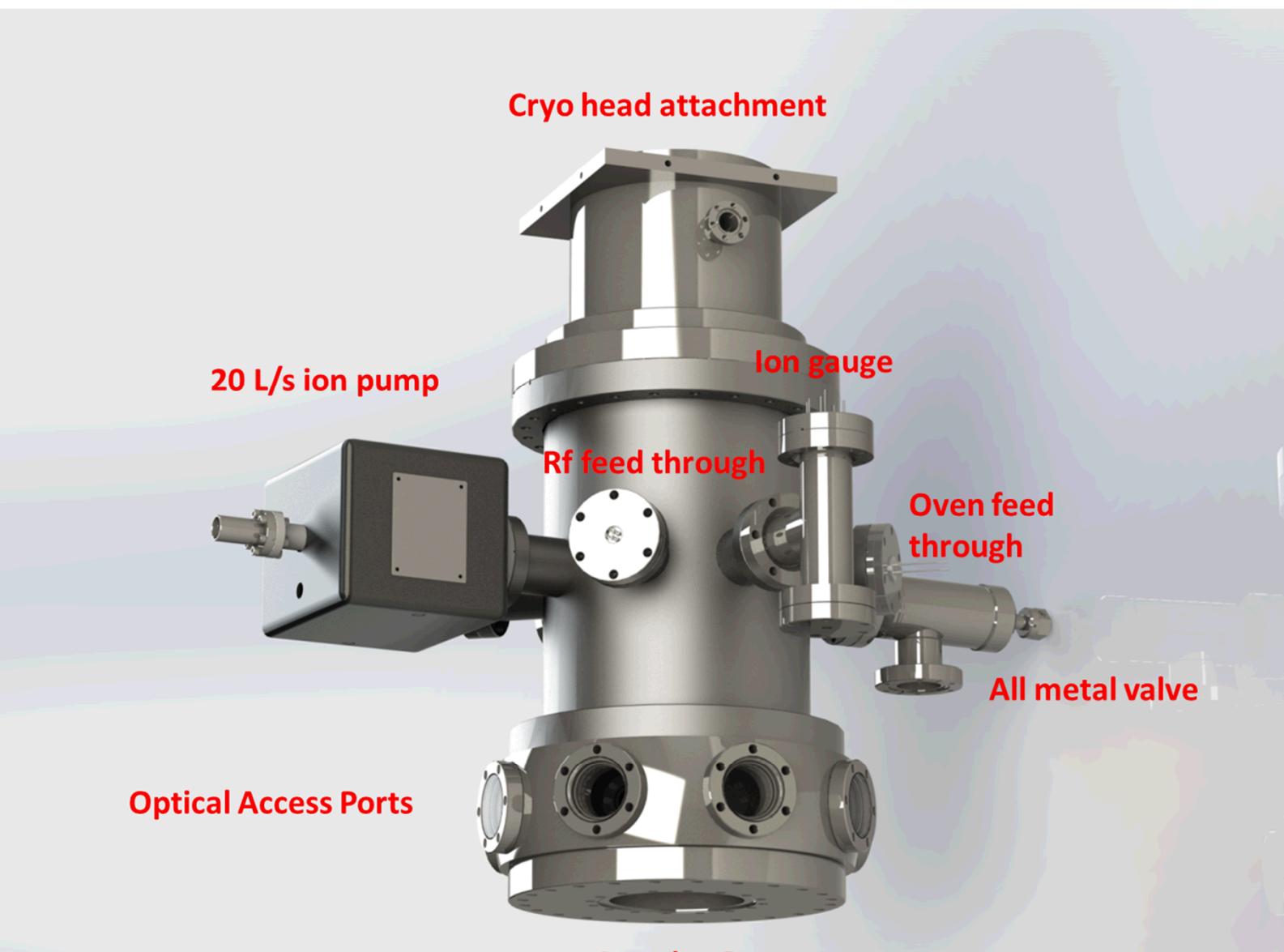


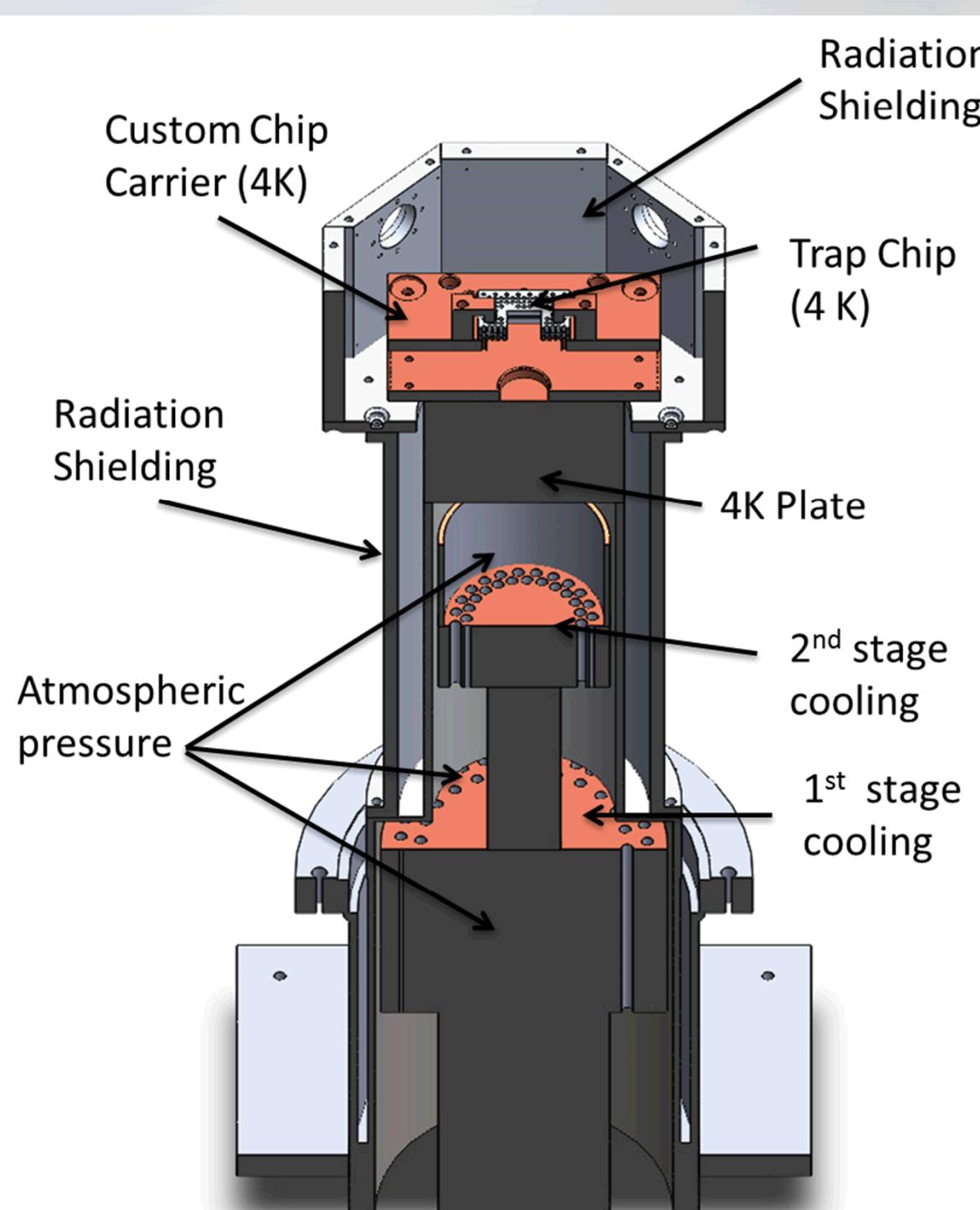
Over the last decade Sandia National Laboratories has developed surface electrode ion traps which are the building blocks for a Charge Coupled Device (CCD) Quantum Information processor. The Sprint project has three primary objectives: fabricating and test microfabricated surface electrode lattice traps, developing cryogenic trapping capabilities and developing small scale algorithms to be implemented on 4-10 qubits. In this presentation we will give an overview of the current status of our cryogenic trapping system. Additionally, we will present our results toward implementing quantum operations with calcium ions.

Cryogenic Vacuum Chamber

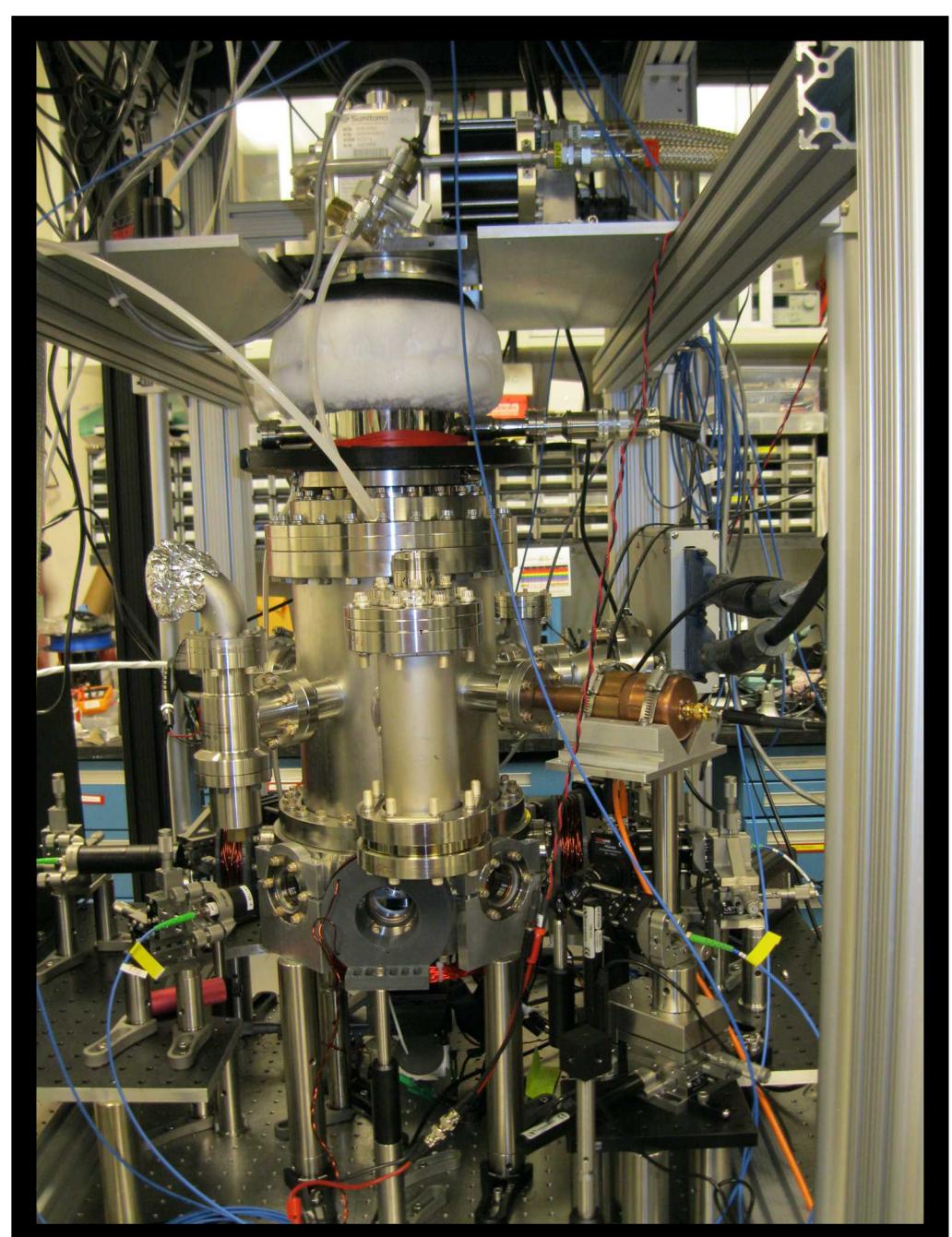


Cryo Specs

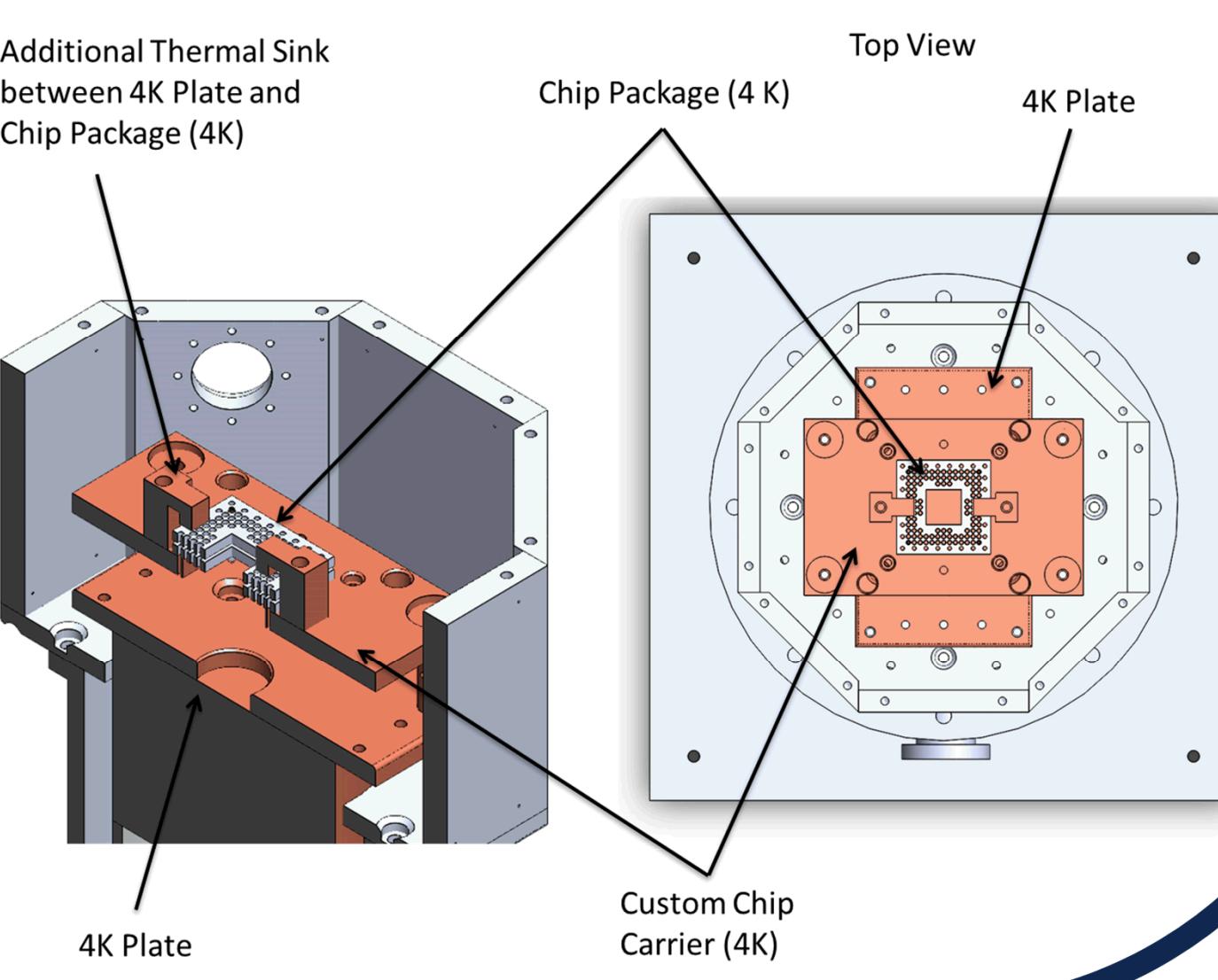
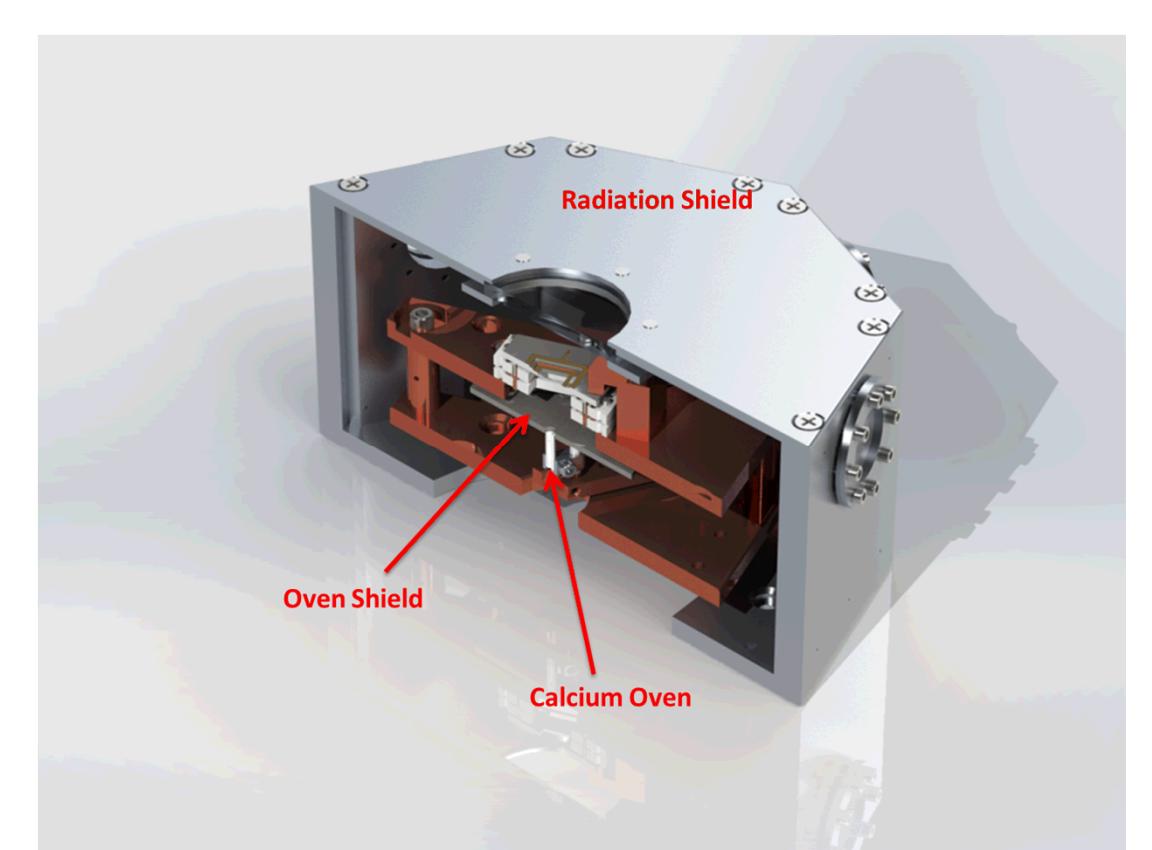
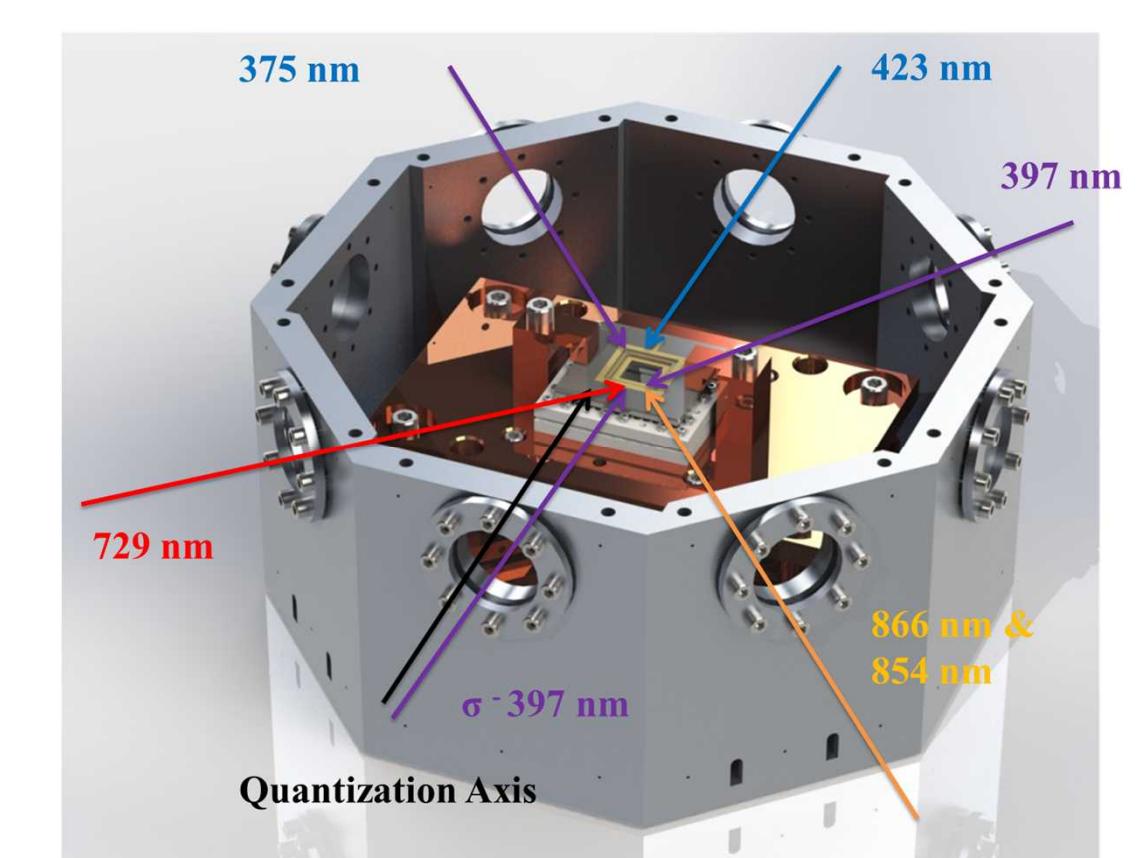
Cryo Industries of America
 • 1.0 Watt @ 4K – Cooling
 34.0 Watt @ 40K – Cooling
Gifford McMahon (GM) – Closed Cycle
Bellows Vibration Isolated Coldfinger
 • Exchange Gas Cooled



Experimental Setup

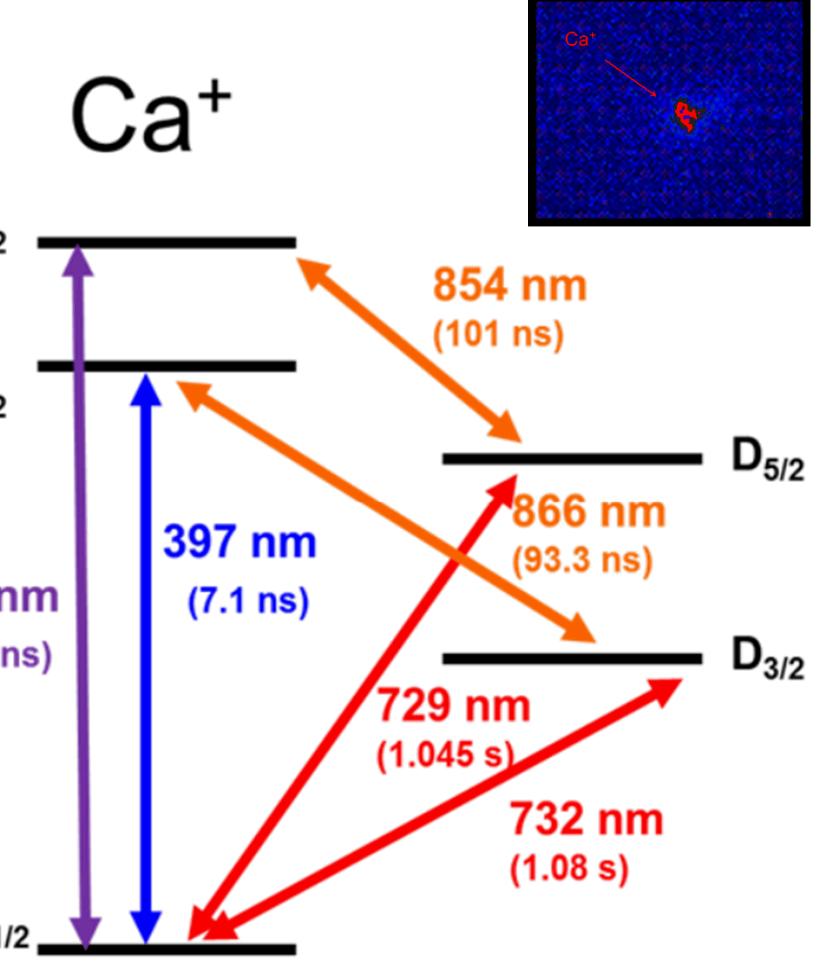


Trap Radiation Shield and Beam Geometry

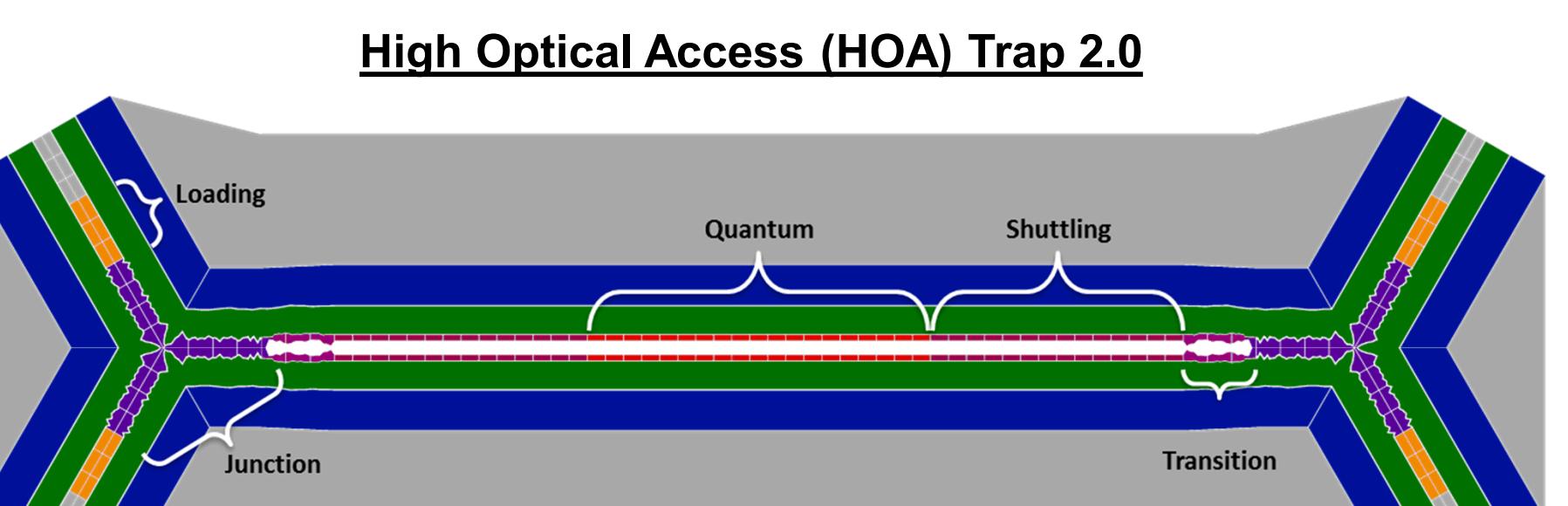


Trap Characterization

Ion Choice

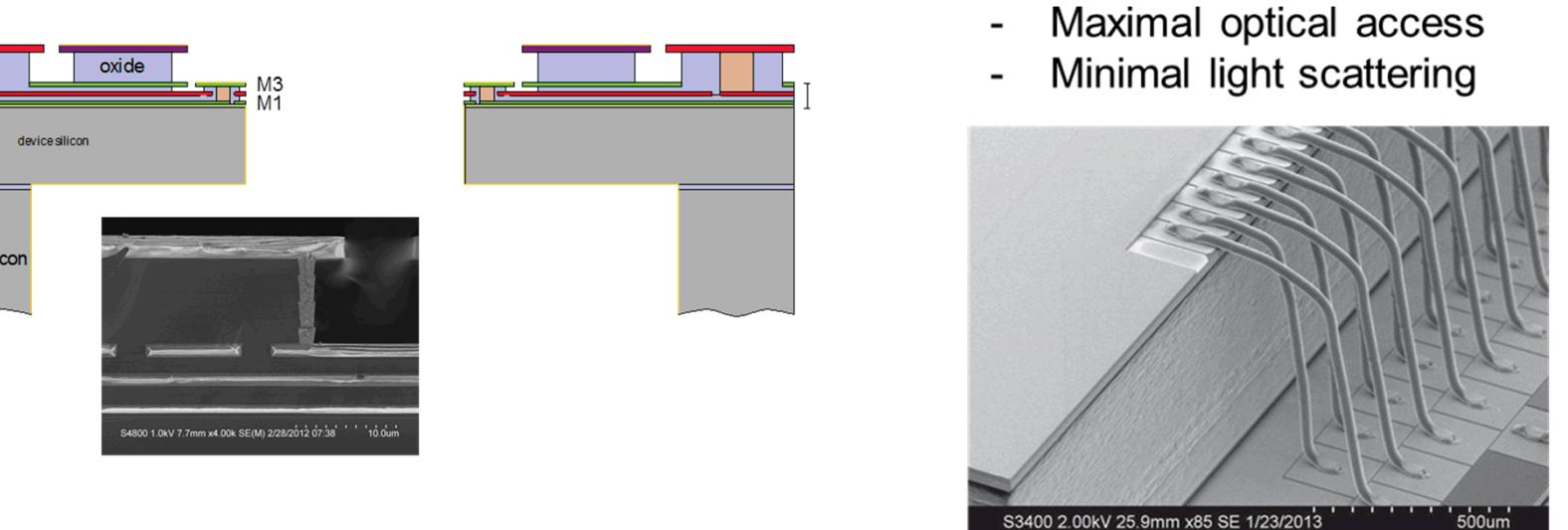


Trap Fabrication Capabilities

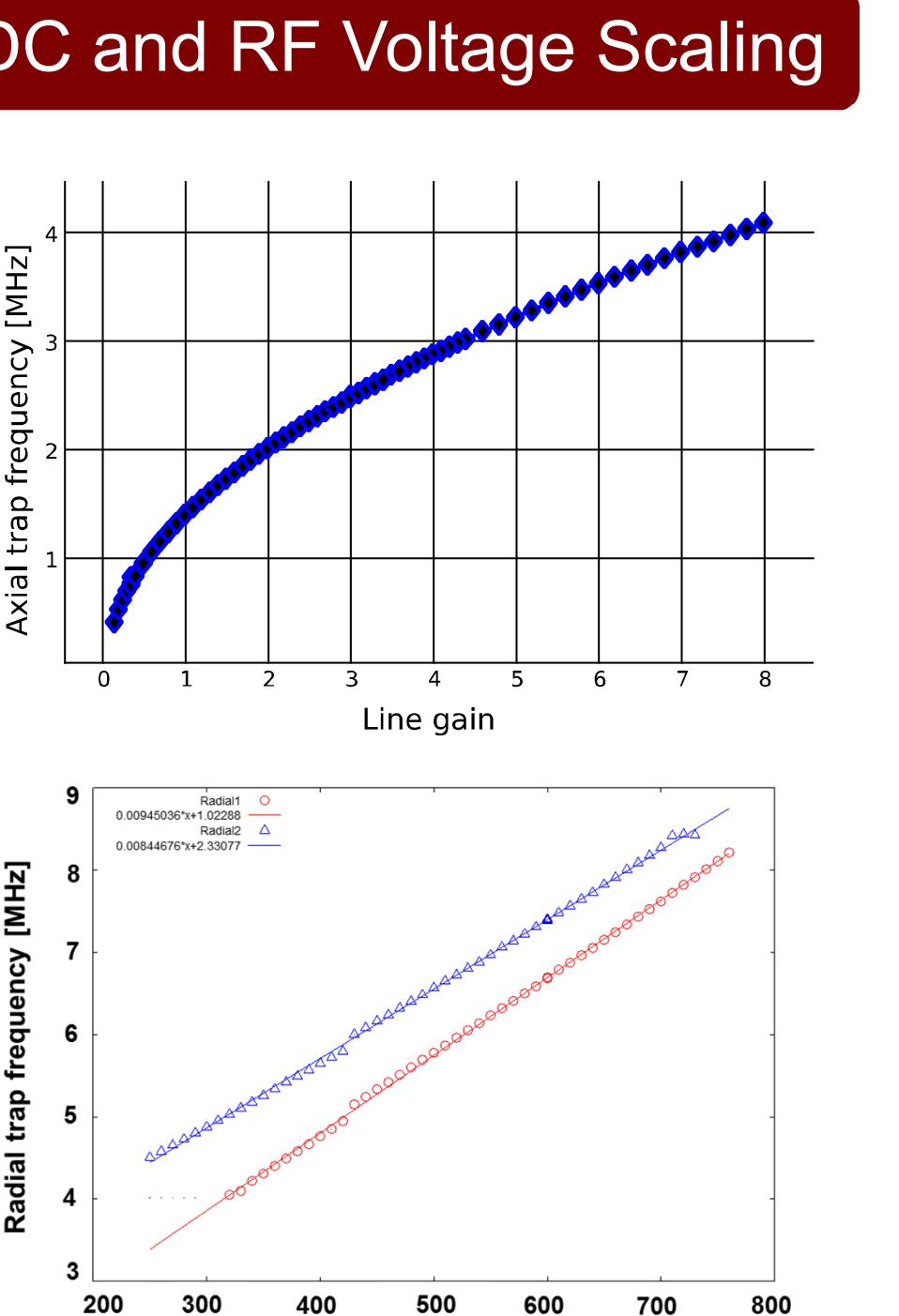


- Excellent optical access rivaling 3D traps
 - NA 0.11 across surface
 - NA 0.25 through slot

Five level metallization

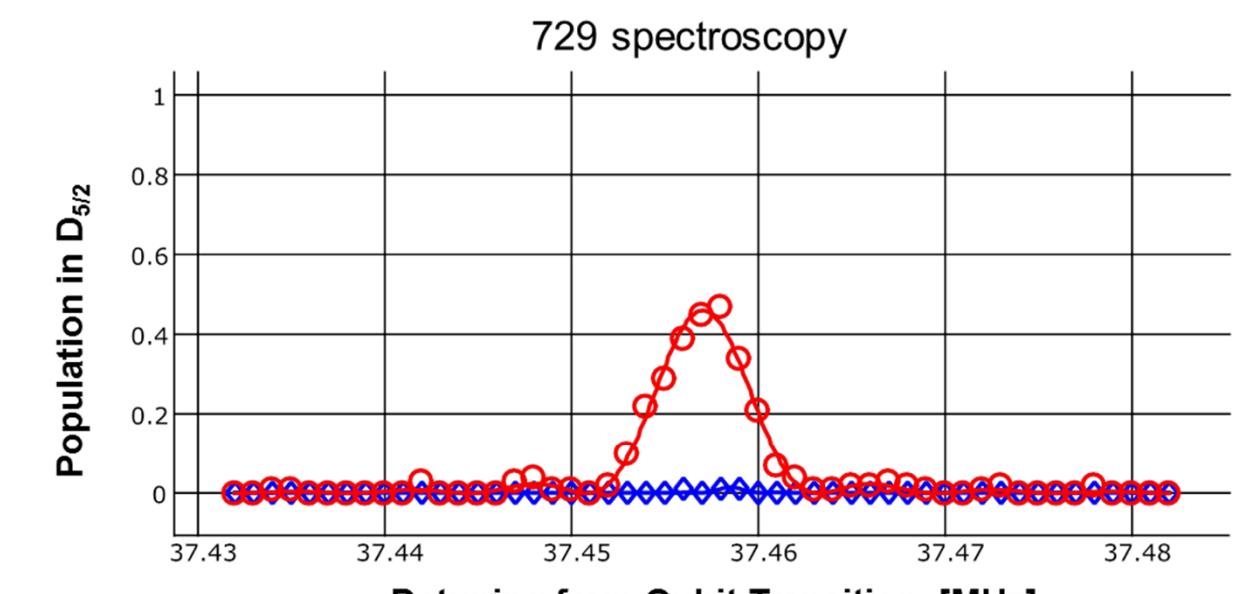


DC and RF Voltage Scaling

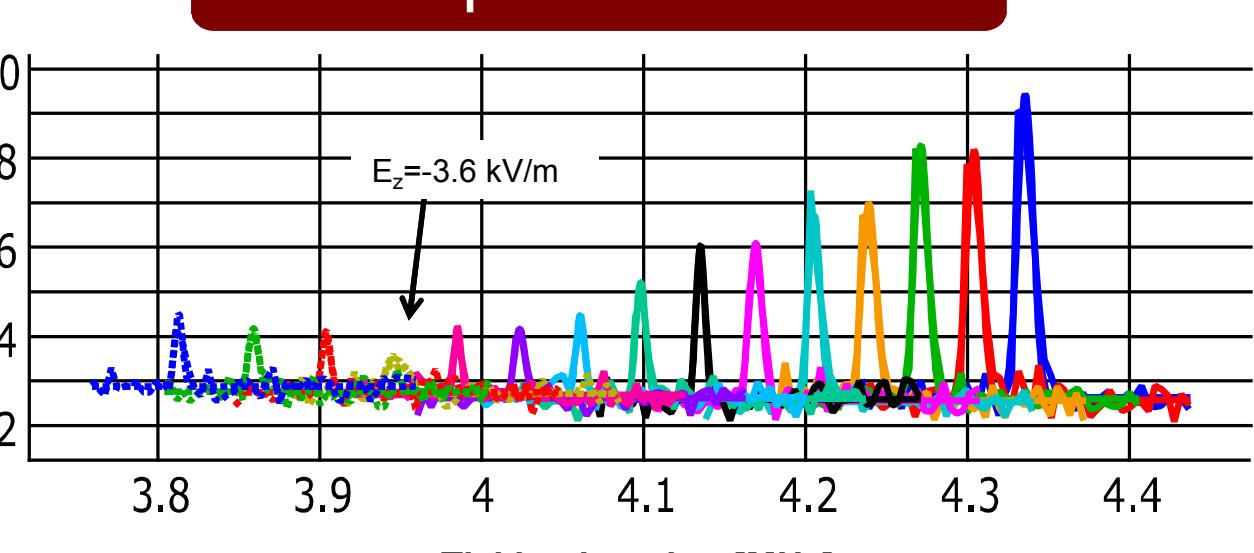


Trap Compensation

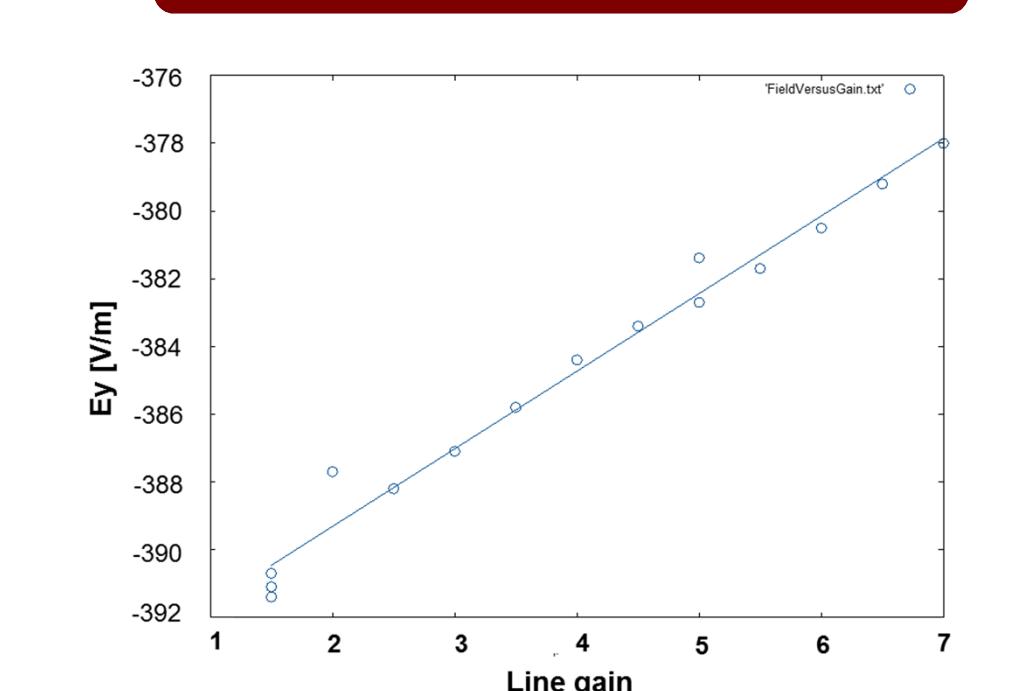
Compensation Ey



Compensation Ez

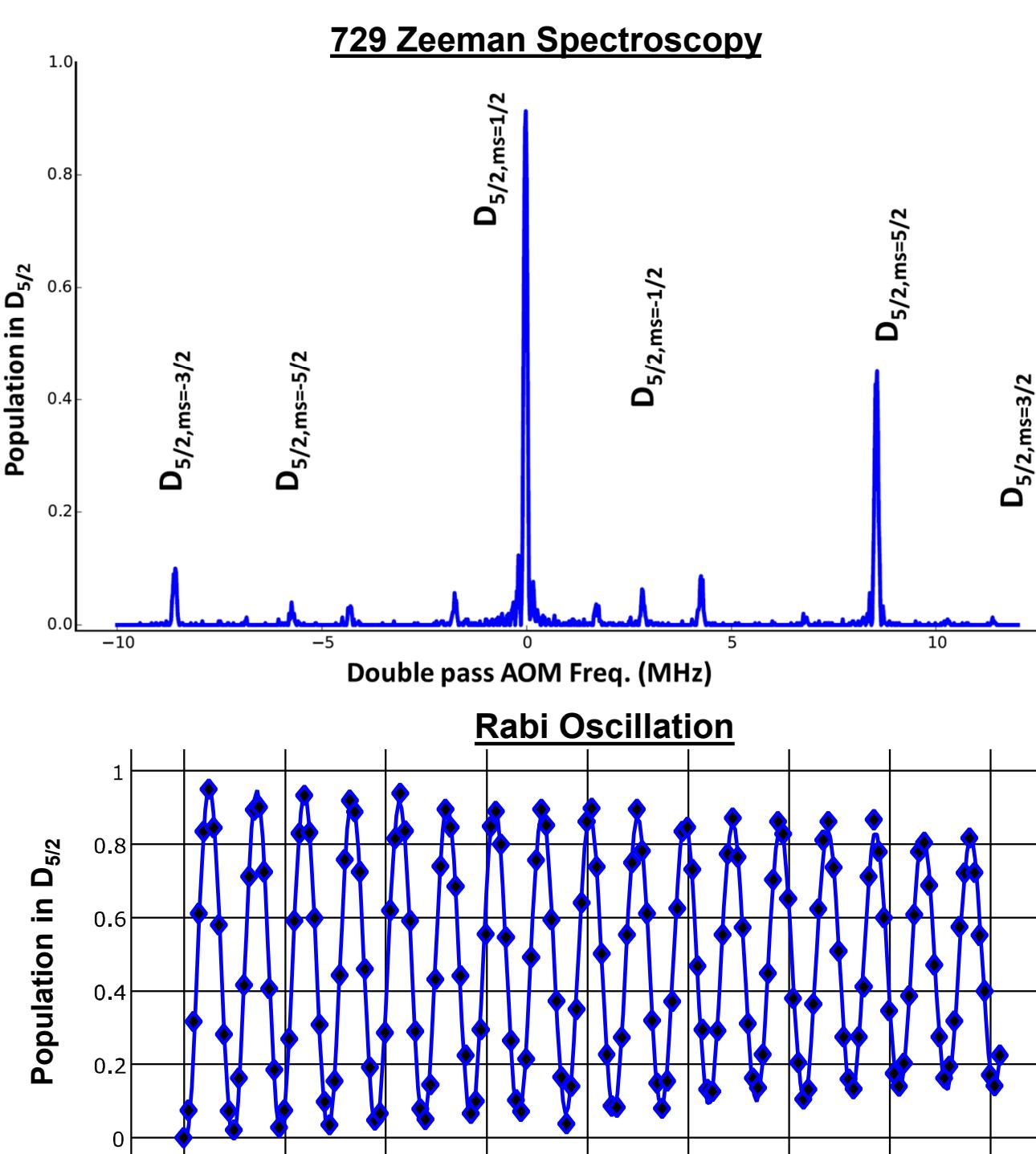
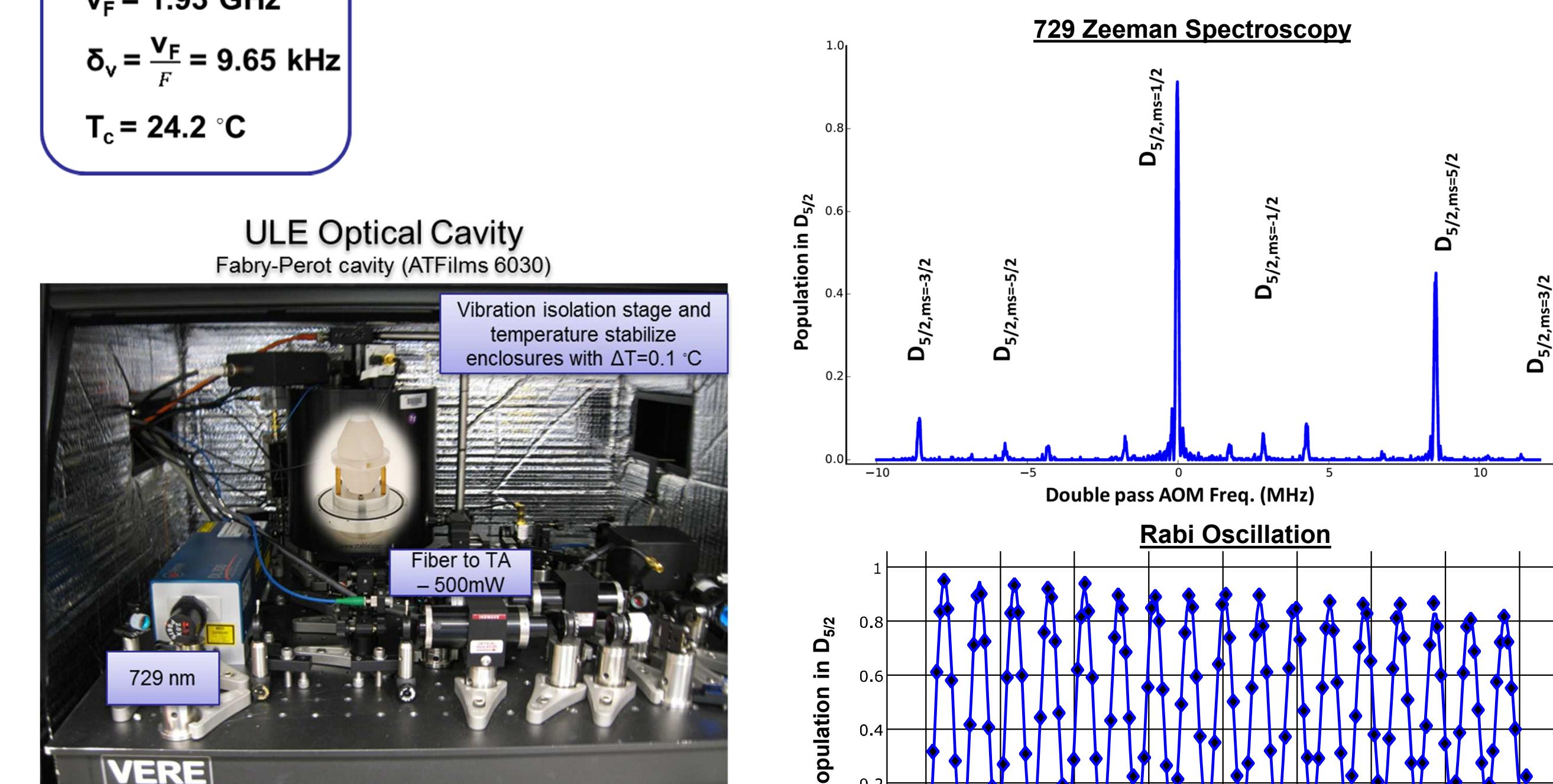


DV Voltage Scaling

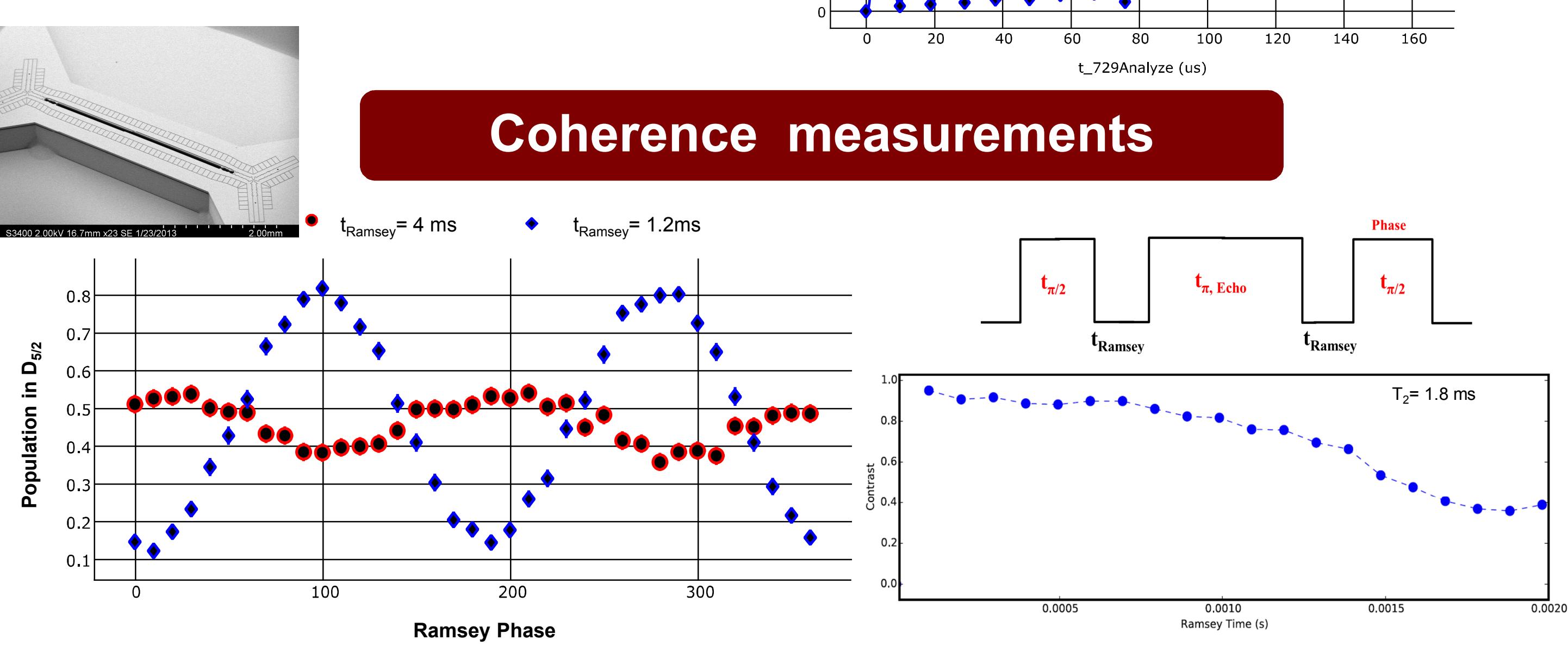


Experimental Results

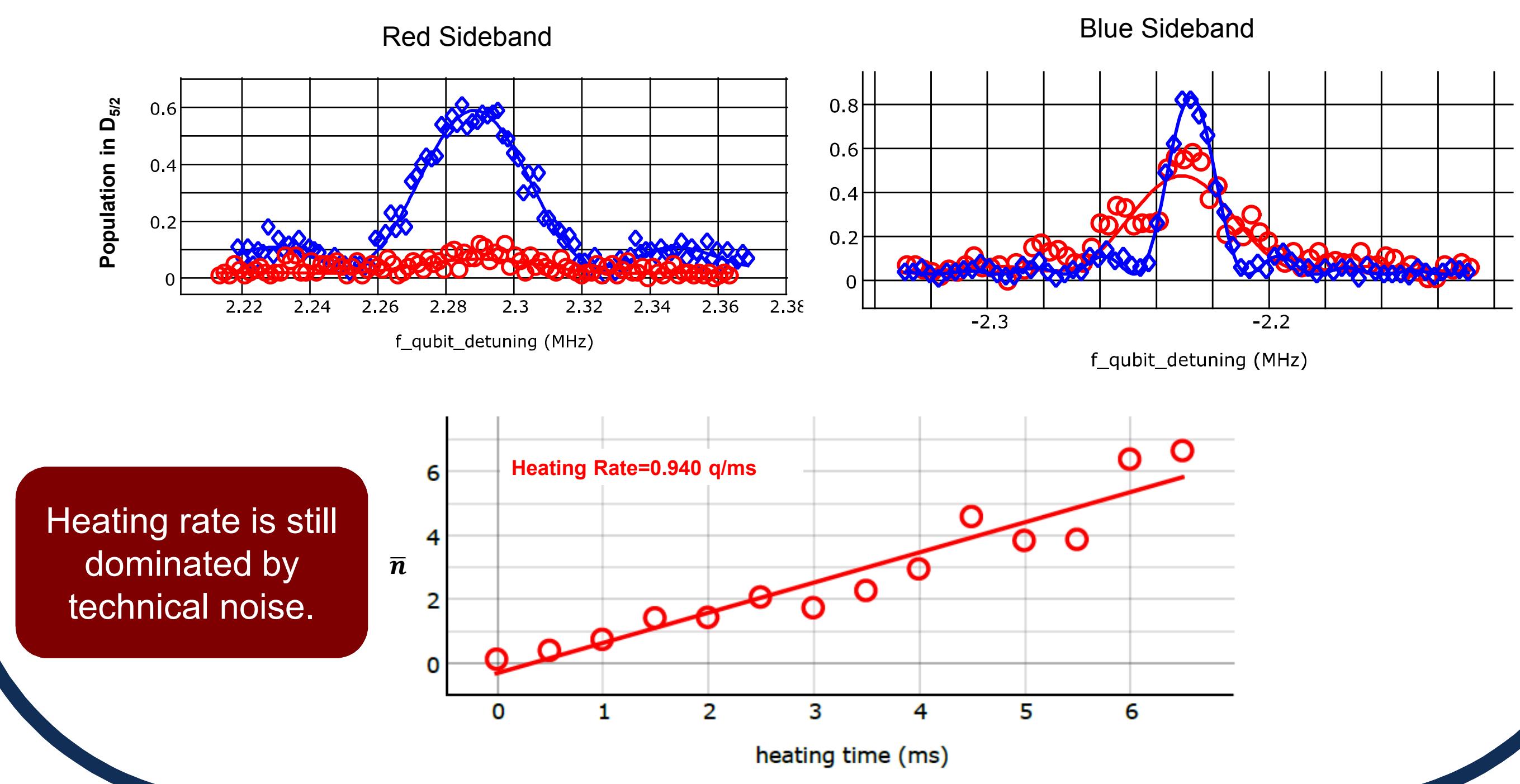
729 Laser Setup – (Optical Qubit)



Coherence measurements



Heating rate measurements



Heating rate is still dominated by technical noise.