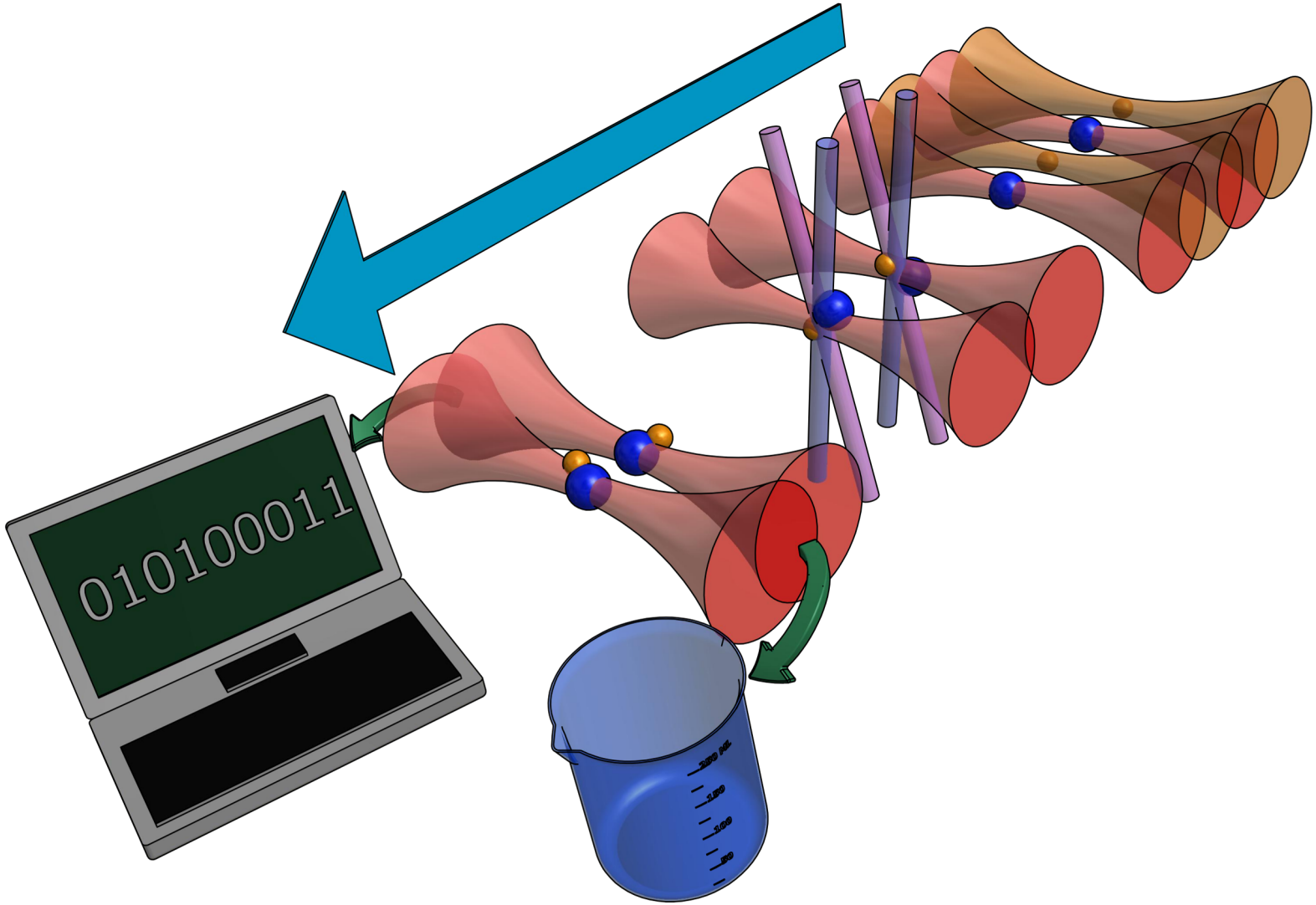
NaCs lab update

Yichao Yu

Ni Group/Harvard

March 24, 2017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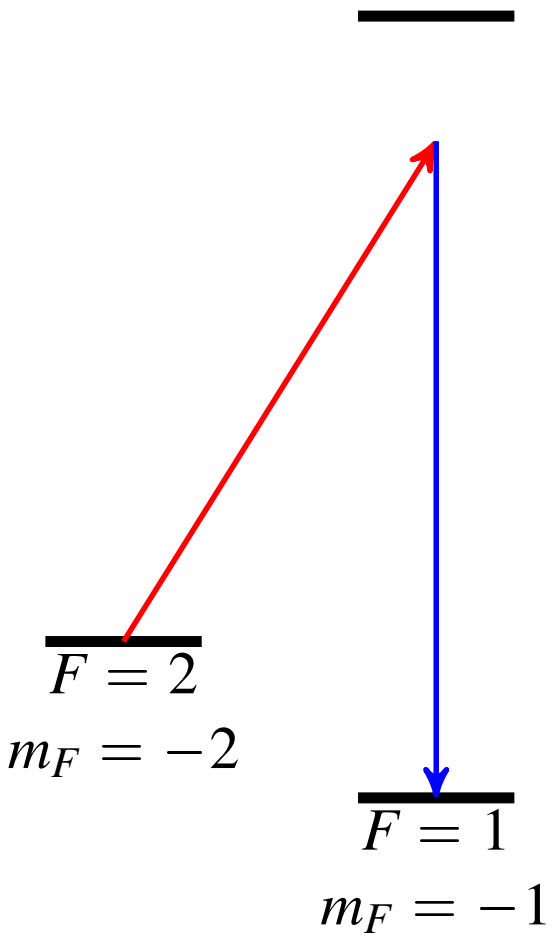
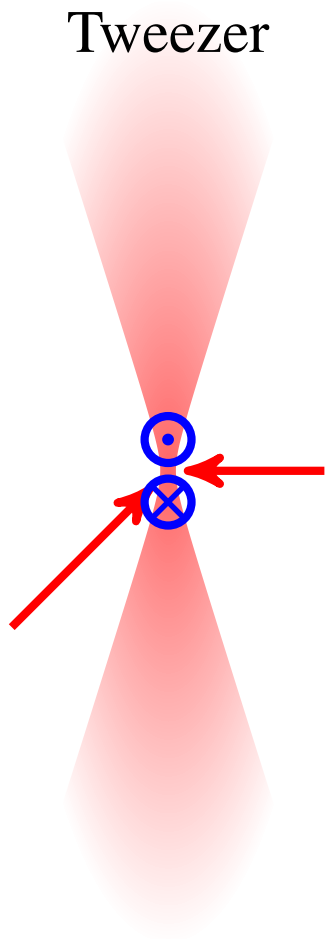
Raman sideband cooling of Sodium

- Setup





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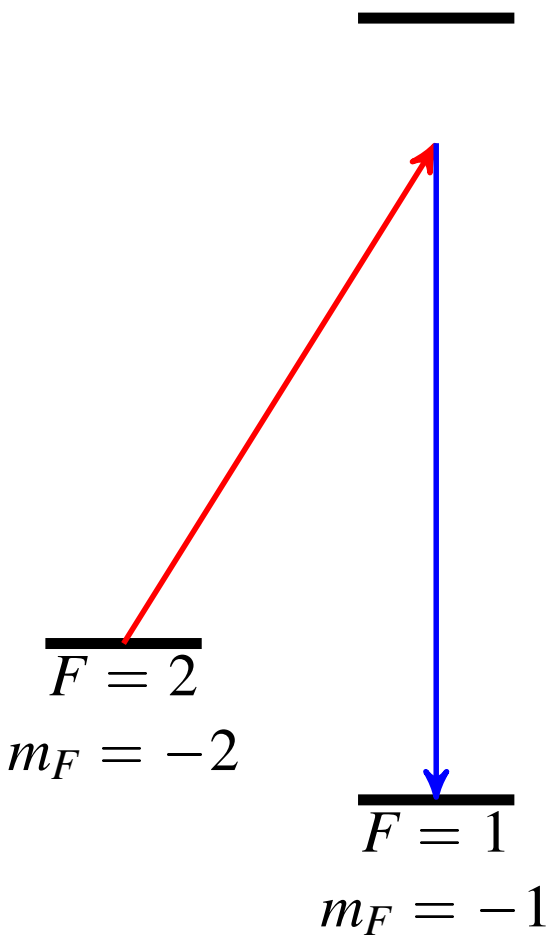

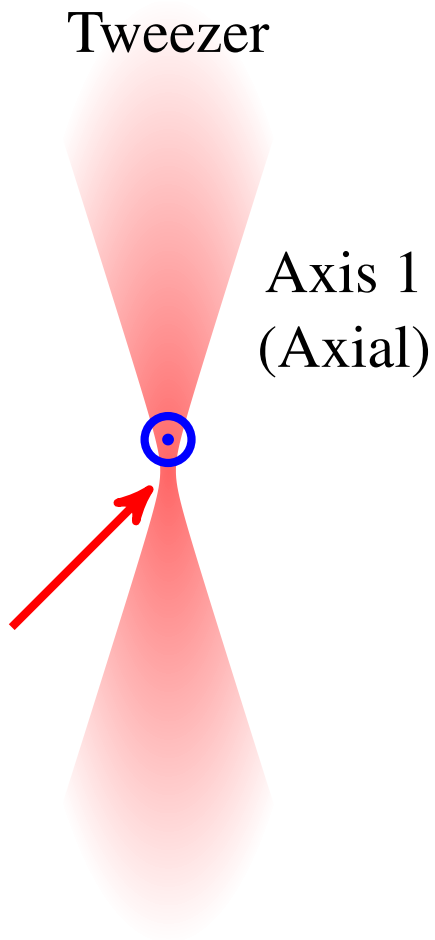

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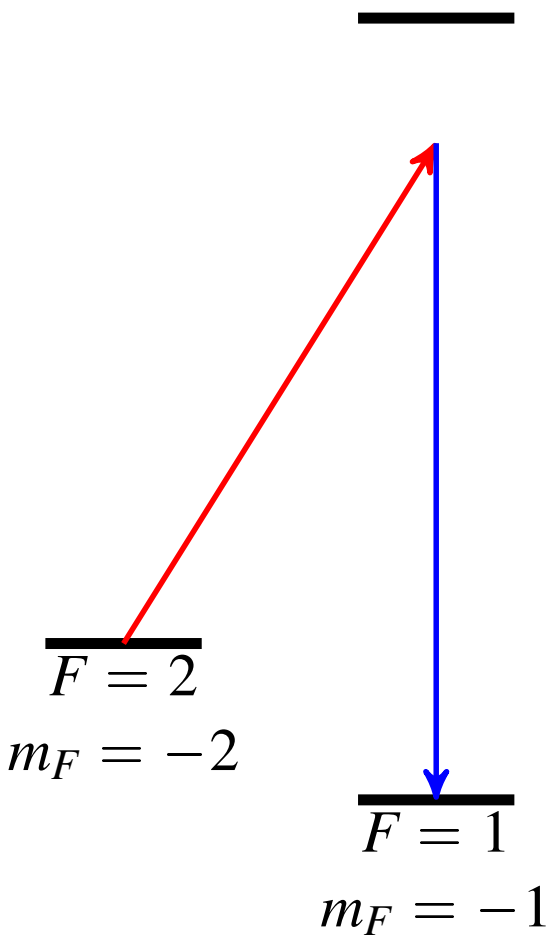

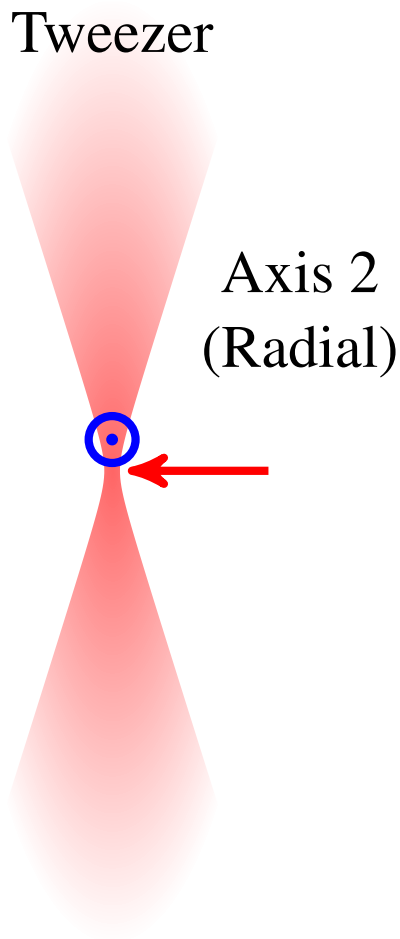

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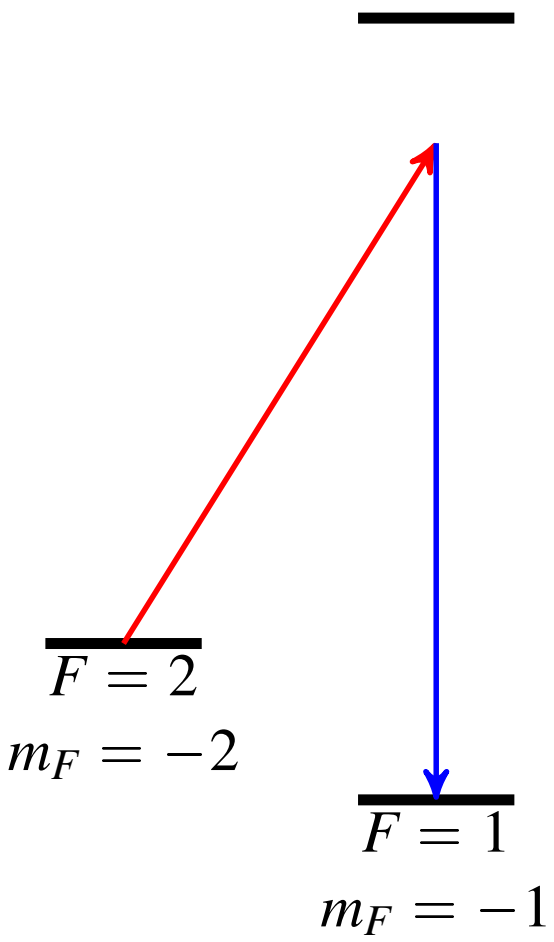

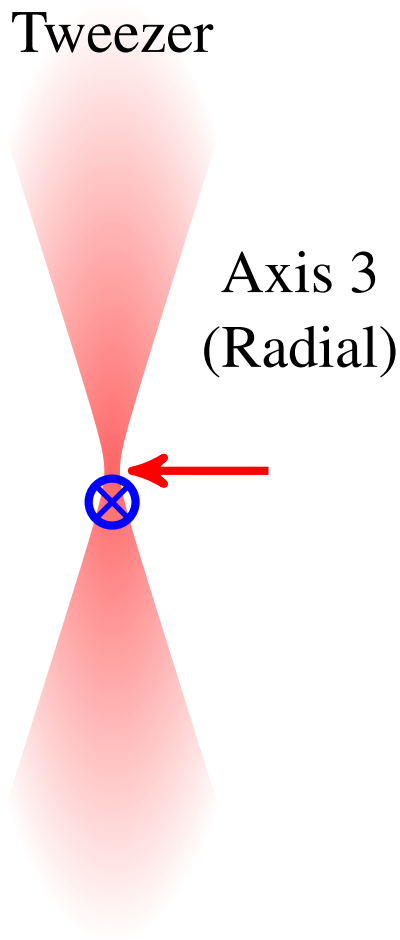

Raman sideband cooling of Sodium

Trap parameters

Axis	ν/kHz	η
1 (axial)	67	0.43
2 (radial)	420	0.35
3 (radial)	580	0.29

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Difficulties

- High initial temperature ($40\mu K$)
- High Lamb-Dicke parameter
- Trap anharmonicity

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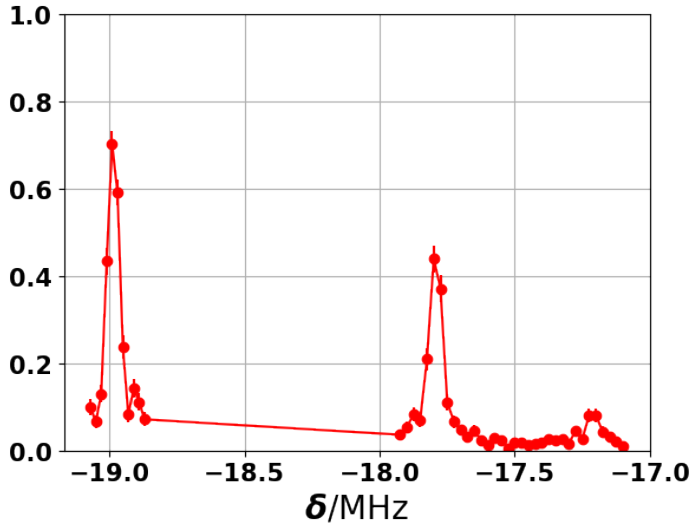

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- Stabilize trap power
- Add Raman beam for axis 3
- Increase Rabi frequency
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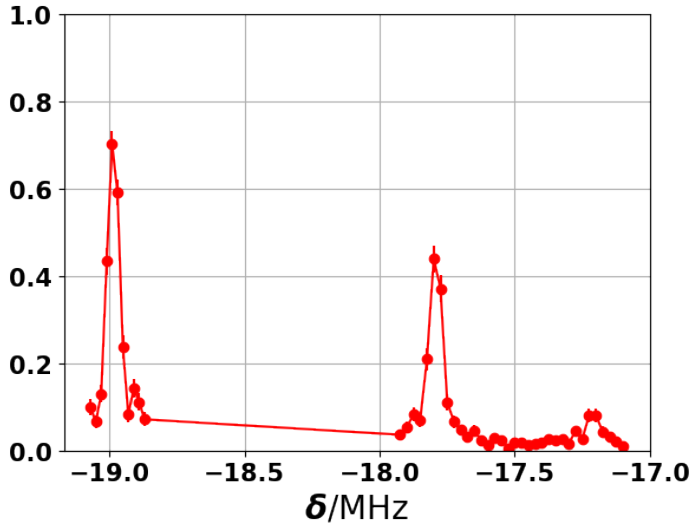

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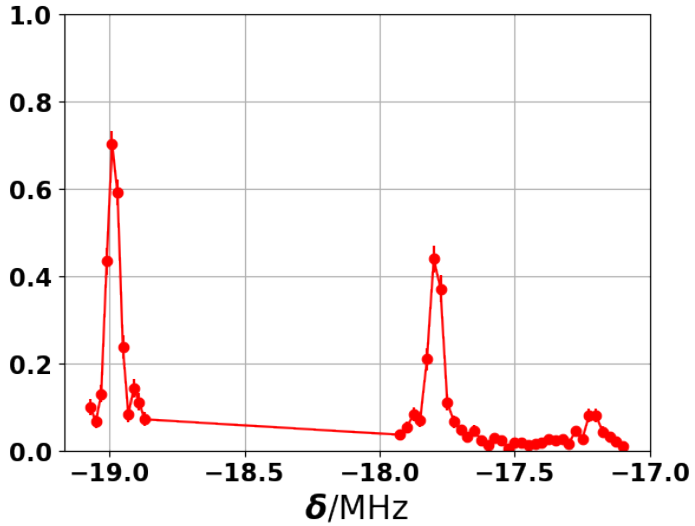

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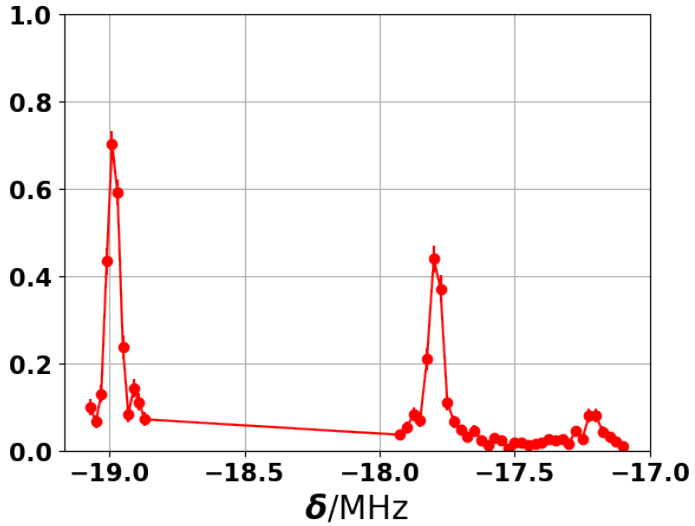

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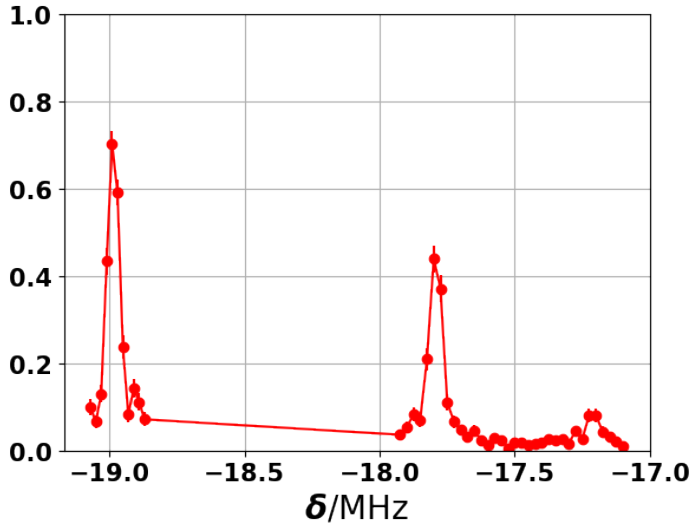
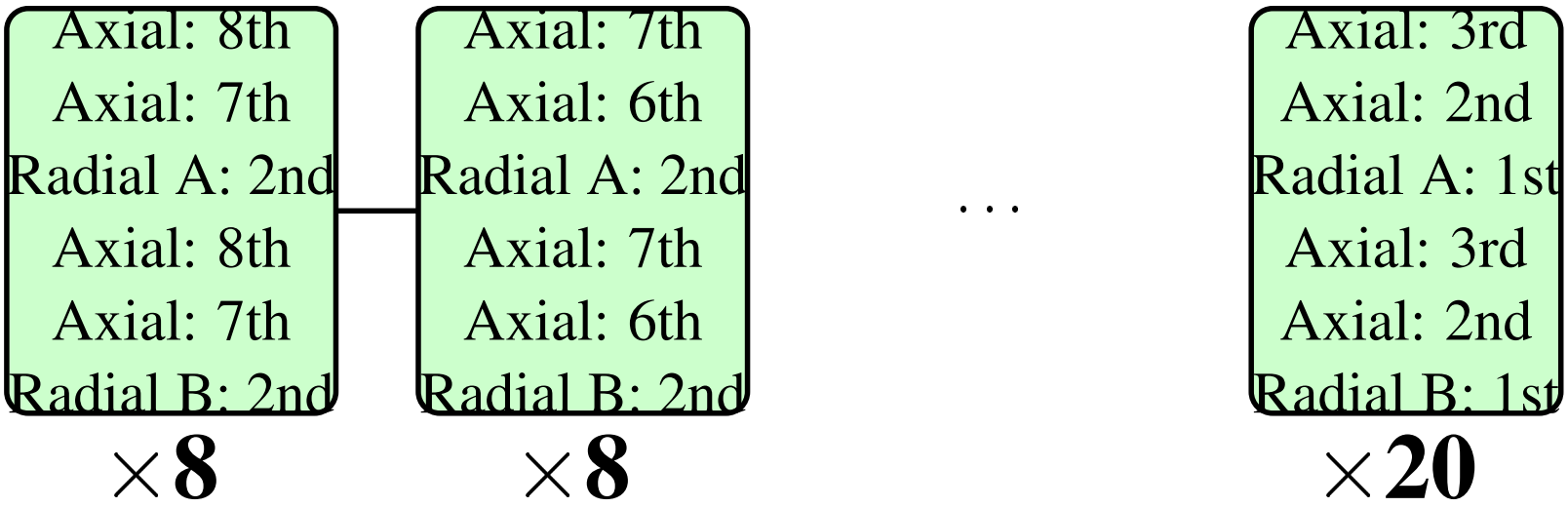
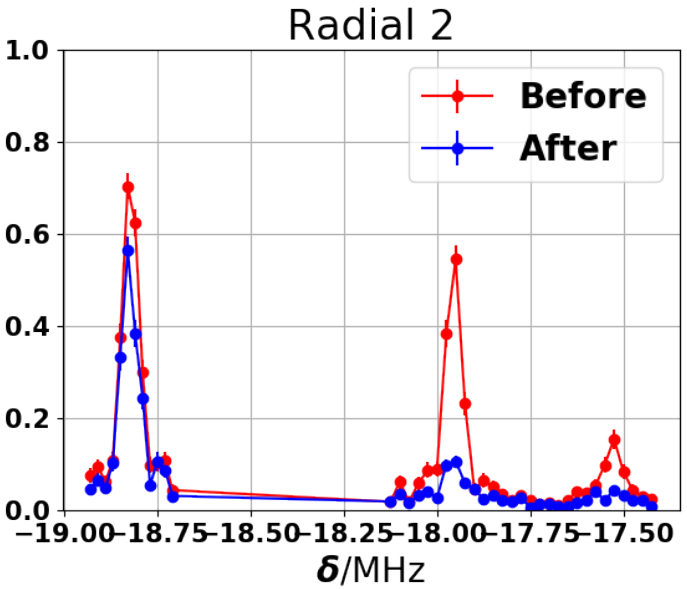


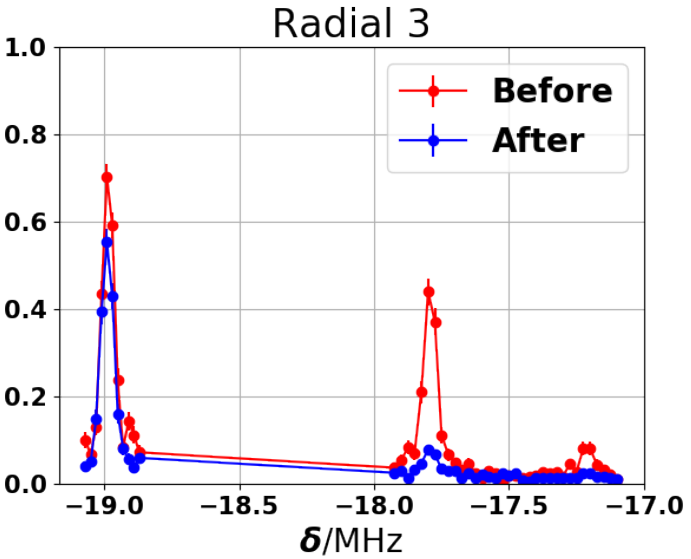
Cooling sequence



Status

- Radial-only cooling
- Axial-only cooling
- 3D cooling





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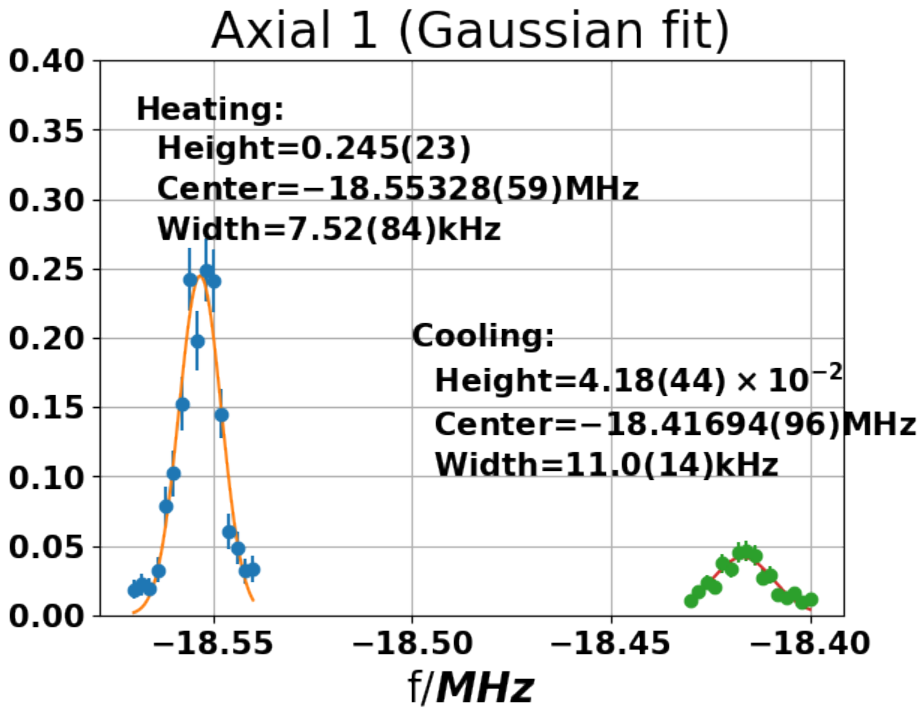

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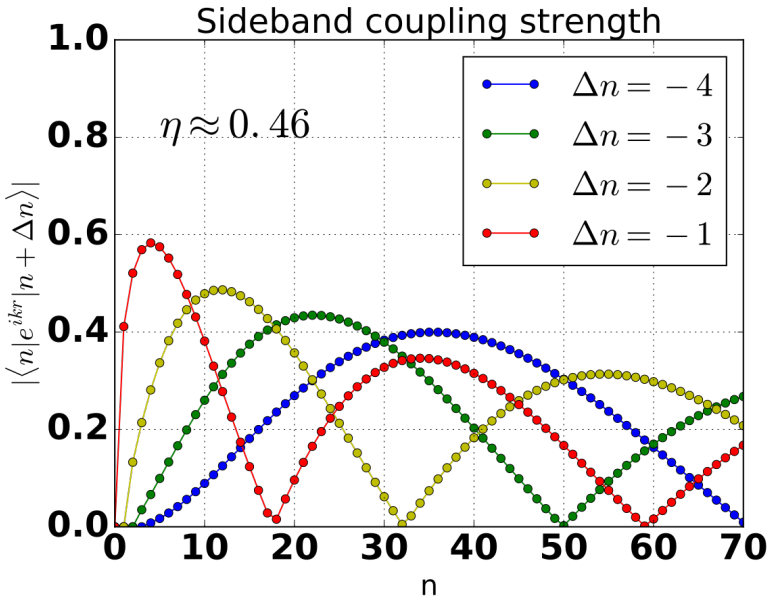
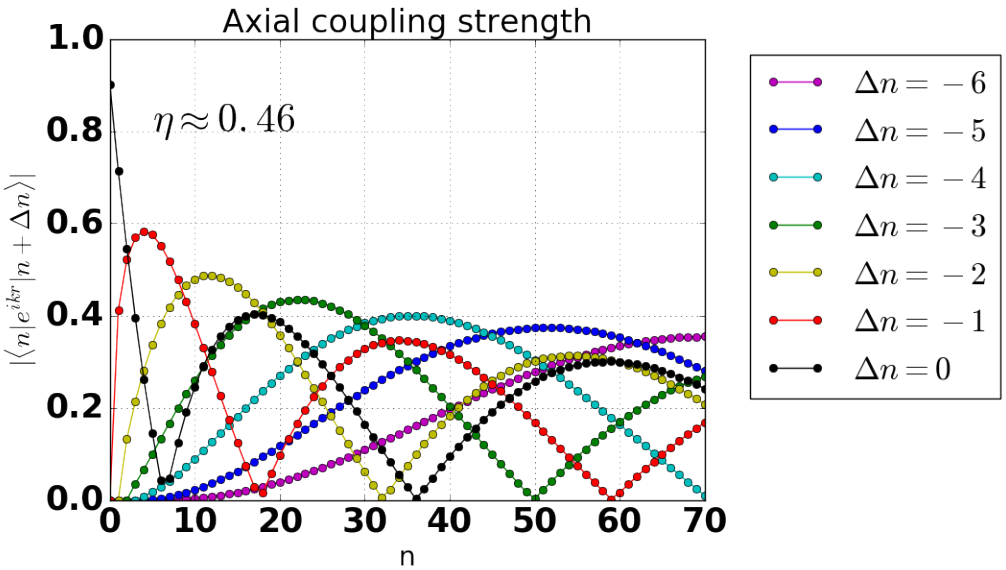
- Overall survival
  $\approx 89\%$
- Good sideband ratios
  $3 \sim 4$
- Heating sideband not high enough
  $30 \sim 40\%$

Axial matrix element





Radial matrix element