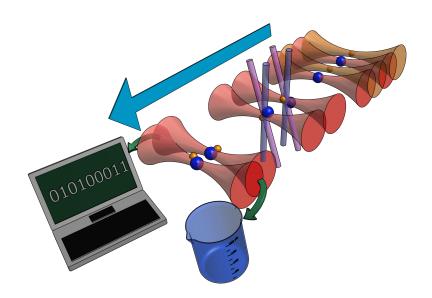
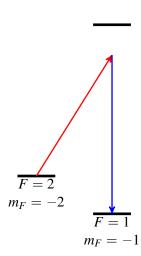
# NaCs lab update

Yichao Yu

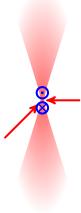
Ni Group/Harvard

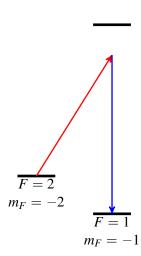
March 24, 2017

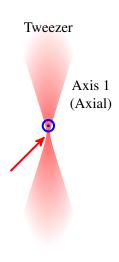


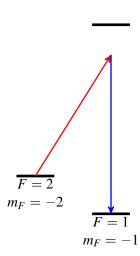




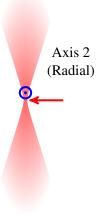


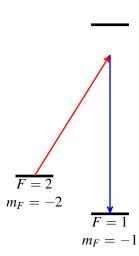




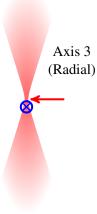












Axis	ν/kHz	$\eta$
1 (axial)	67	0.43
2 (radial)	420	0.35
3 (radial)	580	0.29

#### **Difficulties**

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

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

#### **Difficulties**

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Trup parameters			
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#### **Difficulties**

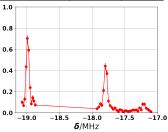
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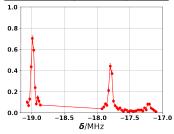
#### **Difficulties**

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

## **Improvements**

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

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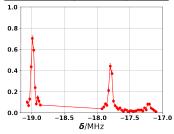
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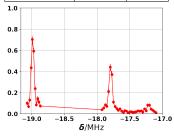
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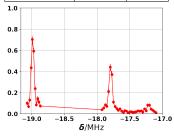
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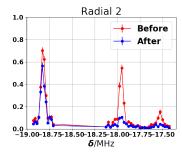
### **Cooling sequence**

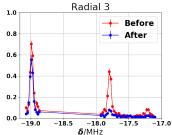
Axial: 8th	Axial: 7th
Axial: 7th	Axial: 6th
Radial A: 2nd	Radial A: 2nd
Axial: 8th	Axial: 7th
Axial: 7th	Axial: 6th
Radial B: 2nd	Radial B: 2nd
$\times 8$	$\times 8$
	•

Axial: 2nd
Axial: 1st
Radial A: 1st
Axial: 2nd
Axial: 1st
Radial B: 1st
×20

#### Status

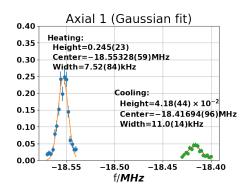
- Radial-only cooling
- Axial-only cooling
- 3D cooling (Survival:  $\approx 89\%$ )





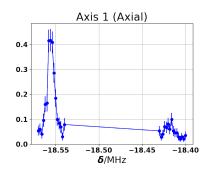
#### **Status**

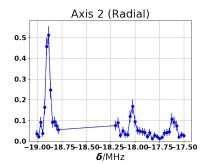
- Radial-only cooling
- Axial-only cooling
- 3D cooling (Survival: ≈ 89%)

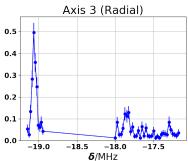


#### **Status**

- Radial-only cooling
- Axial-only cooling
- 3D cooling (Survival: ≈ 89%)

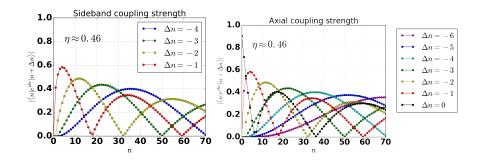






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#### **Axial matrix element**



#### Radial matrix element

