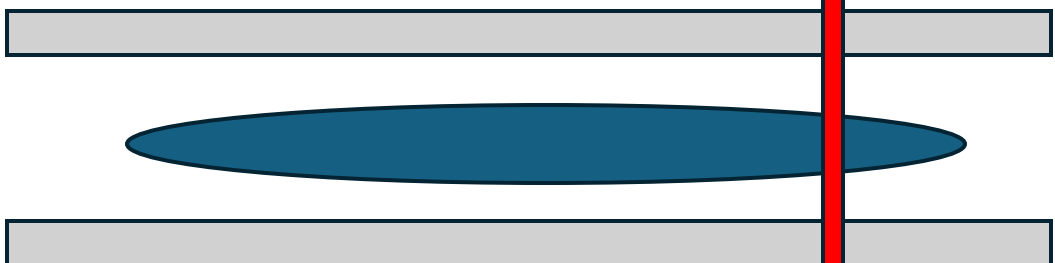# Raman Enr Measurement

- Last week, found a systematic error relating to the Raman pulse timing

- We believe we have partial explanation and have alternate scheme that should eliminate this error

15 ms delay time
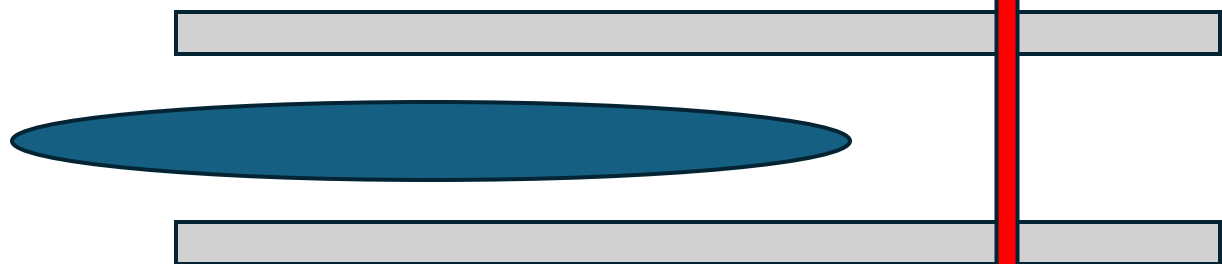
Electric field plates

Q->I nm readout with polarization switching

13.5 ms delay time

Electric field plates

Q->I nm readout with polarization switching

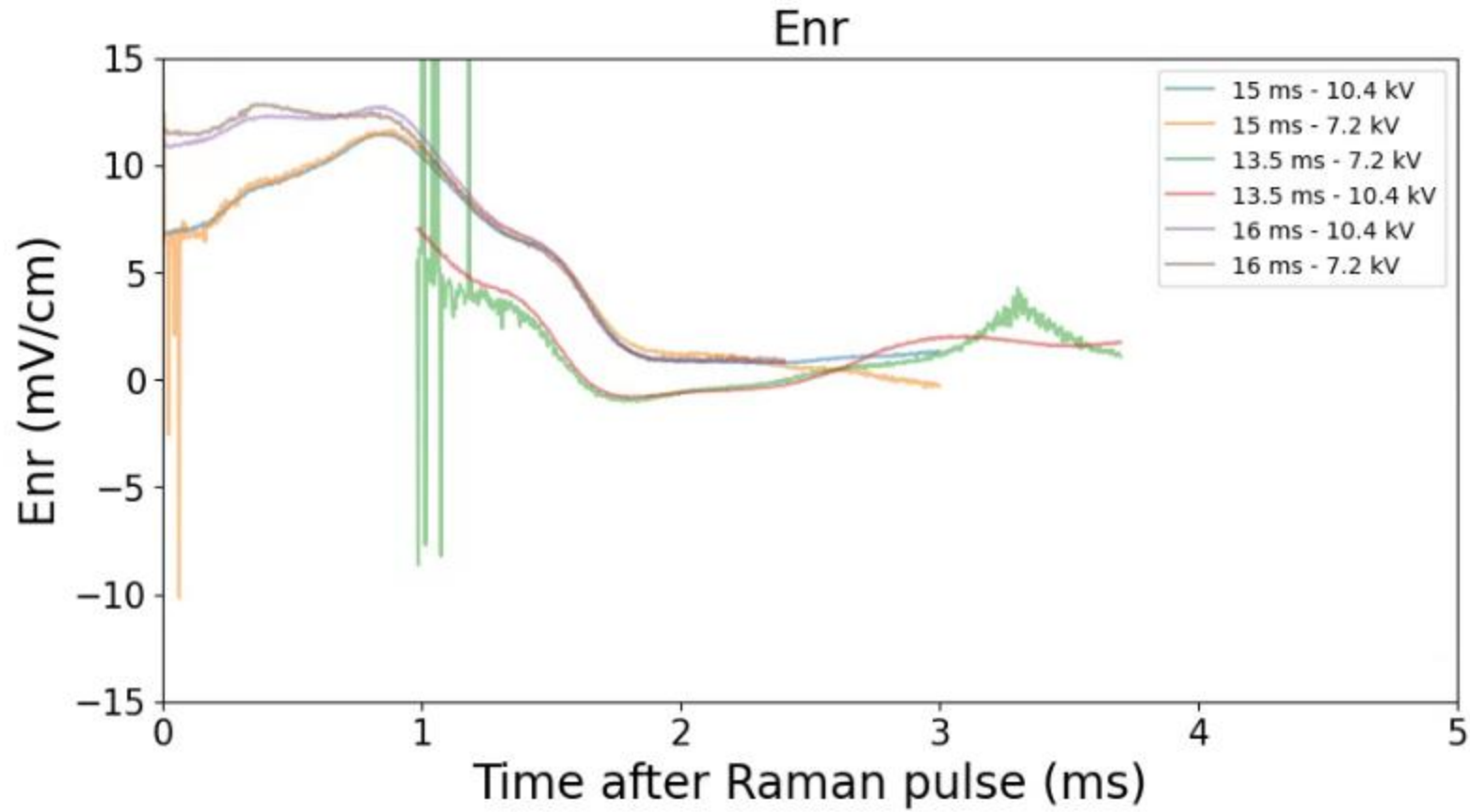Shorter Raman pulse delay time = prepare same molecules at position further upstream

To compare different delay times, look at time after Raman pulse for molecule preparation position

Not due to slight focusing from the lens

Current method of prep for comag/Enr

Beam box

Rotational cooling/lens

Electric field plates

molecules

~10's microsecond pi-pulse (Y-polarize

Q->I nm readout with polarization switching
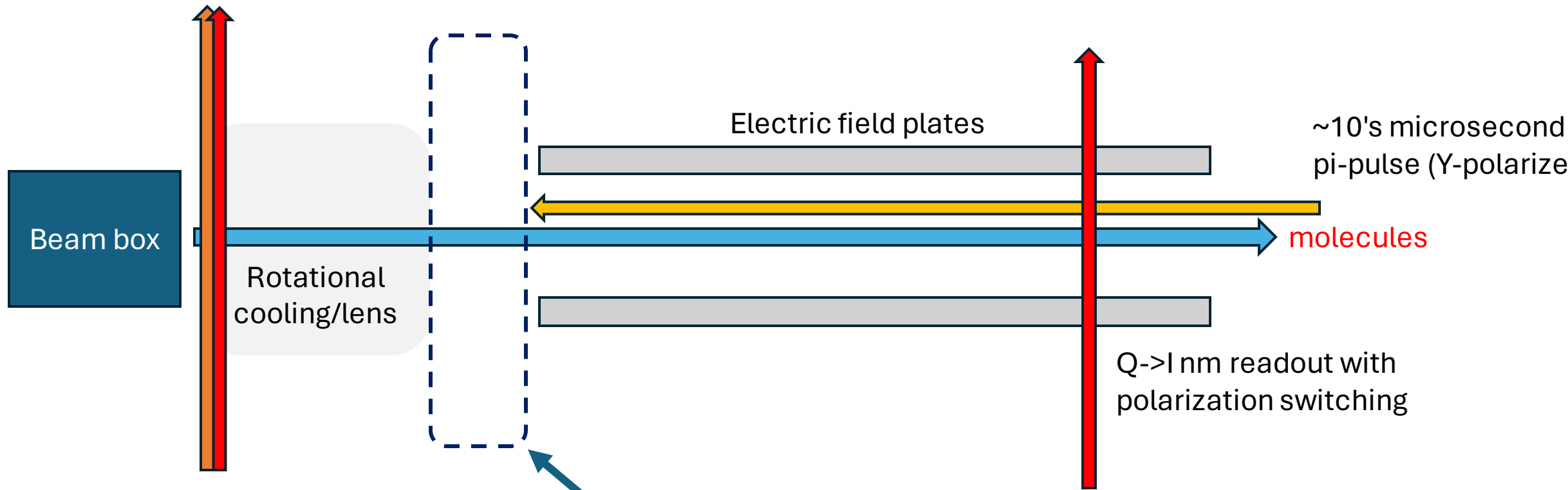
STIRAP I prepare
Q, J=2, **M=+2**

- Rely on some nonadiabatic transfer into Q, M=+/-1 between the lens and the interaction region
- Not a well-controlled process!
- No guarantee that populations transferred into M=+/-1 are identical

Asymmetry vs. time and two-photon detuning
First set
LE=11
Transverse prep on
100 us Raman pulse

Asymmetry vs. time and two-photon detuning
First set
LE=10
Transverse prep on
100 us Raman pulse

Observe some apparent E-correlated Rabi frequency

$$\Omega_{raman} = \frac{\Omega_1 \Omega_2}{2\Delta}$$

Hard to imagine a model gives rise to E correlated one-photon rabi frequency (laser power is constant)

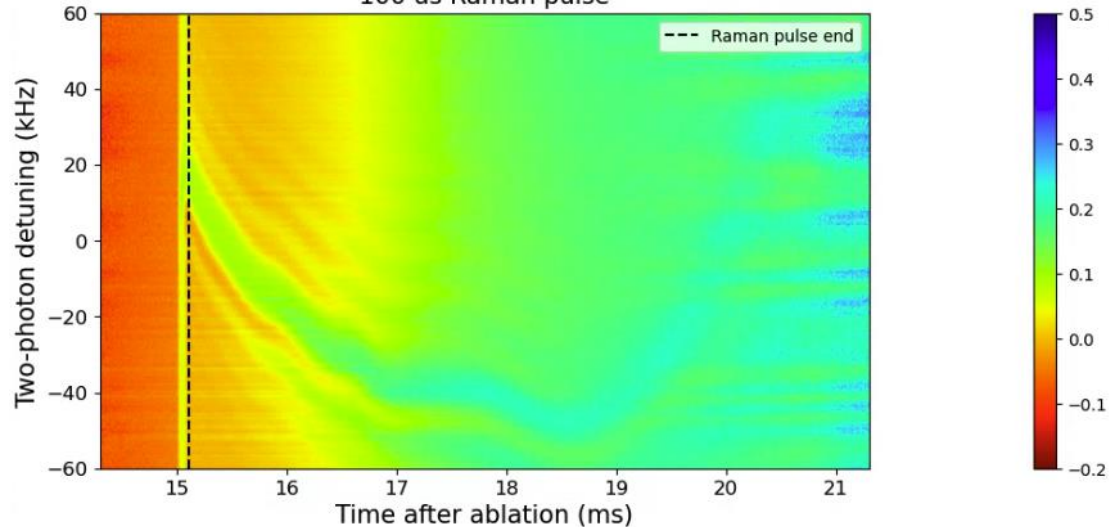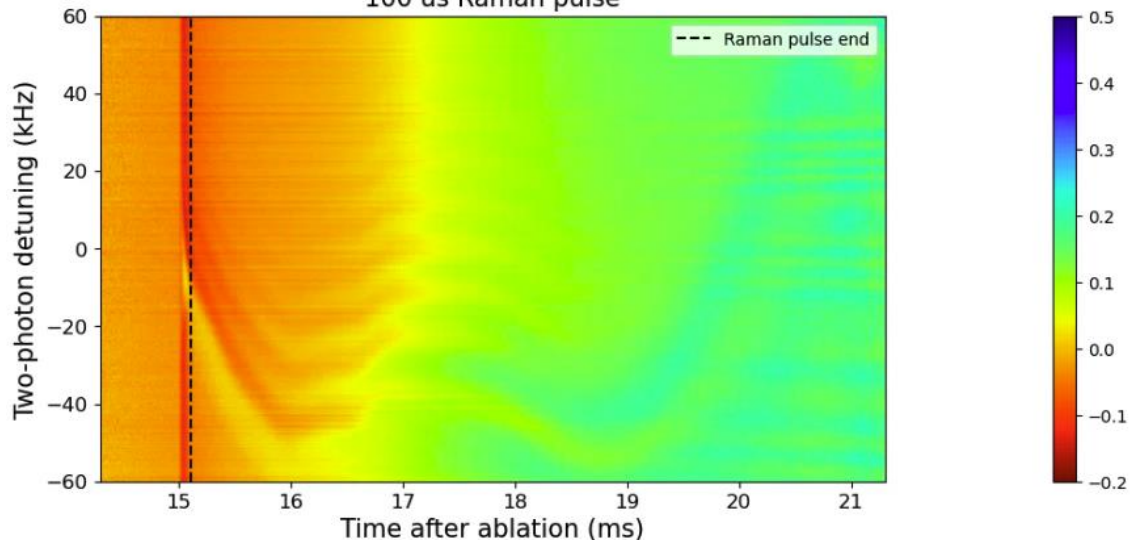But if there's some velocity selection in the transfer to M=+/-1, the one photon detuning may have some E correlation

If there's some spin-quadrature specific v^E, the measurement scheme no longer works (time of flight isn't consistent measure of distance)
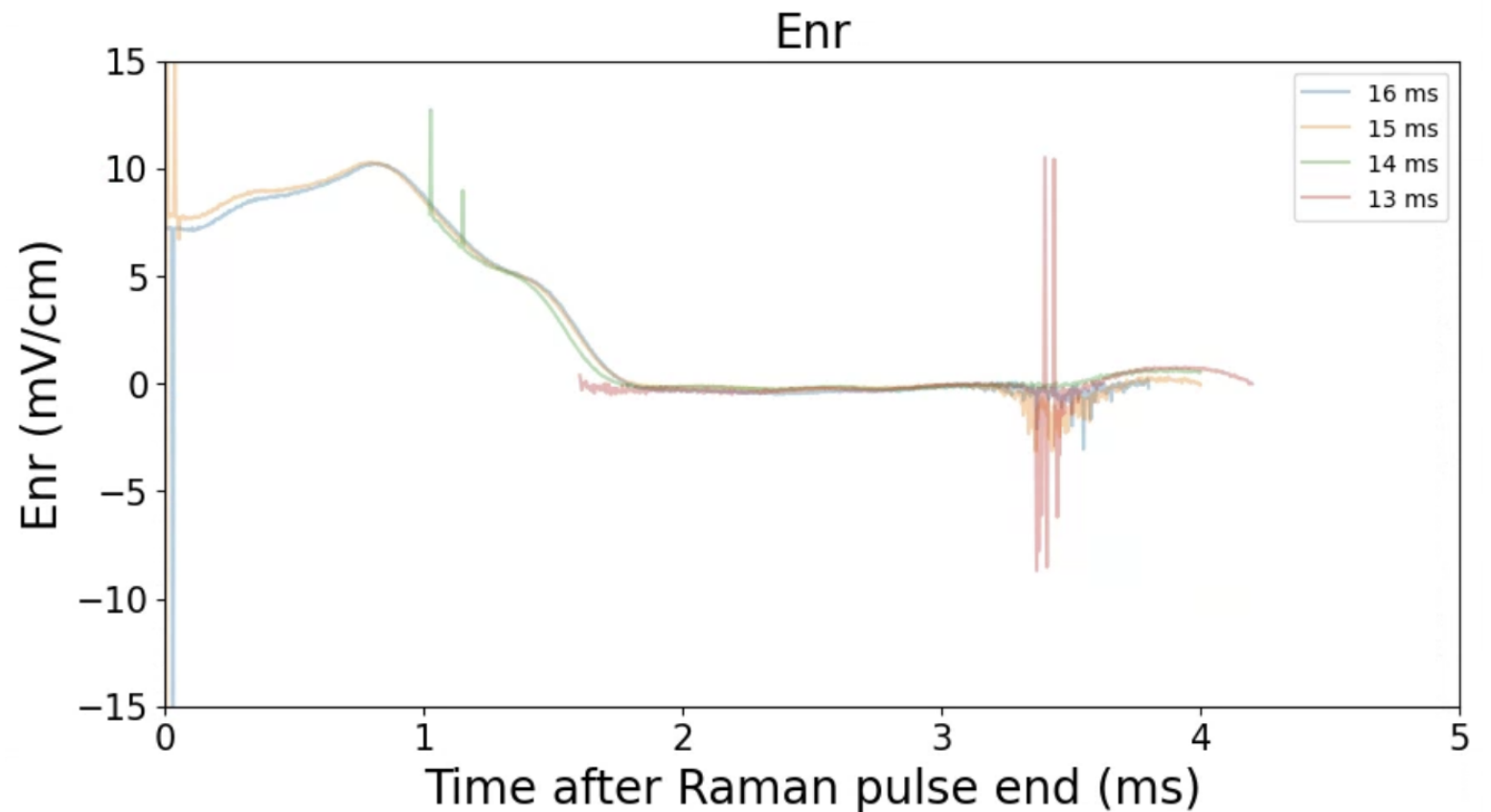
Attempt to improve

- Prepare Q, M=+/-2 at first lens STIRAP
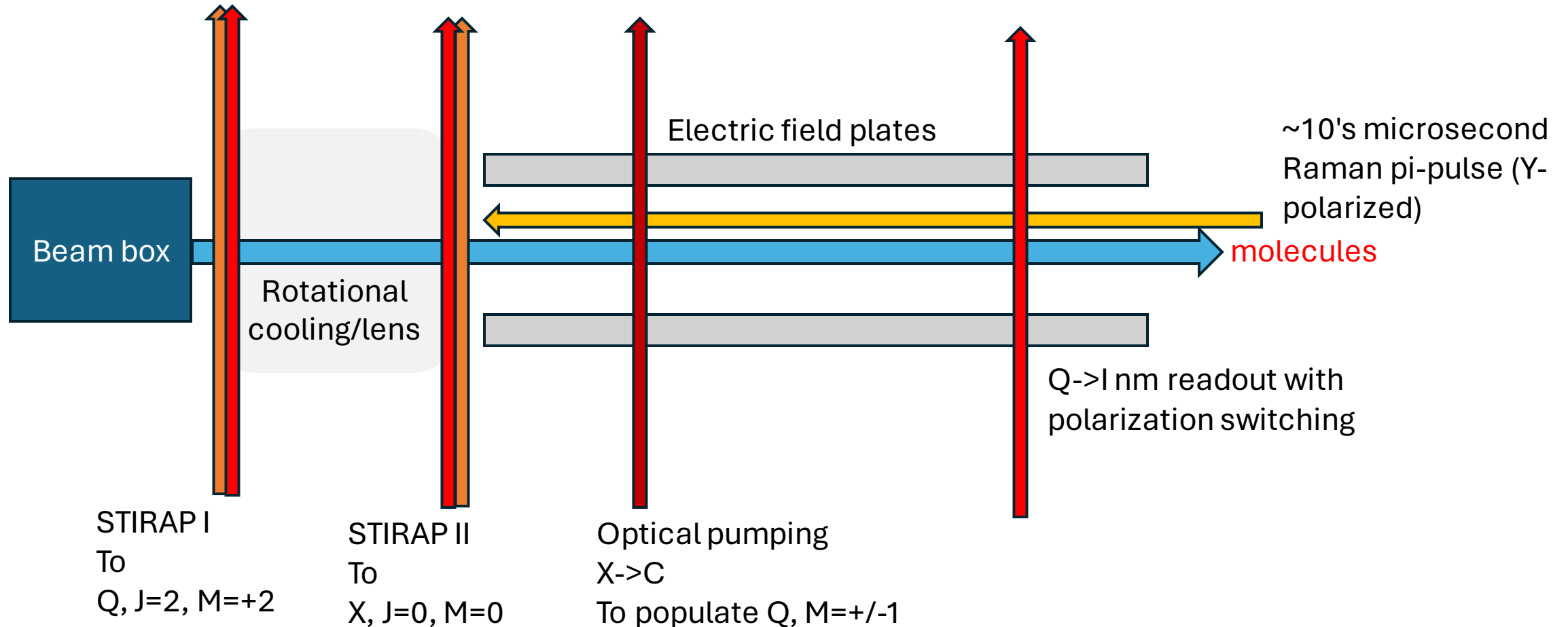- Provide greater symmetry in reaching M=+/- 1
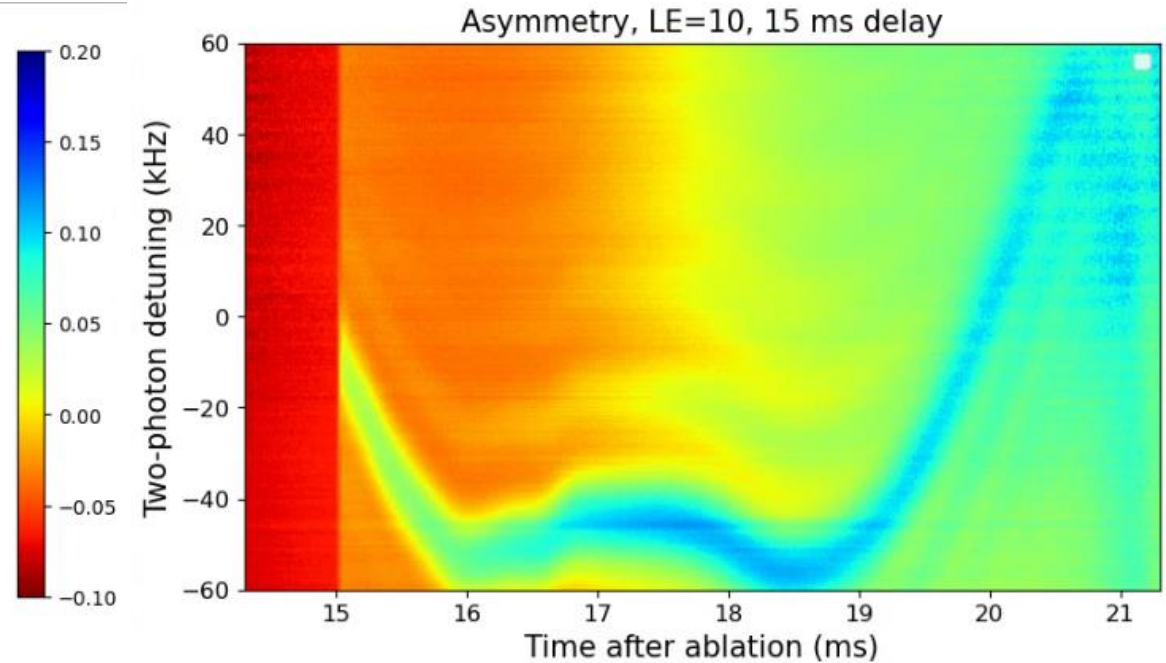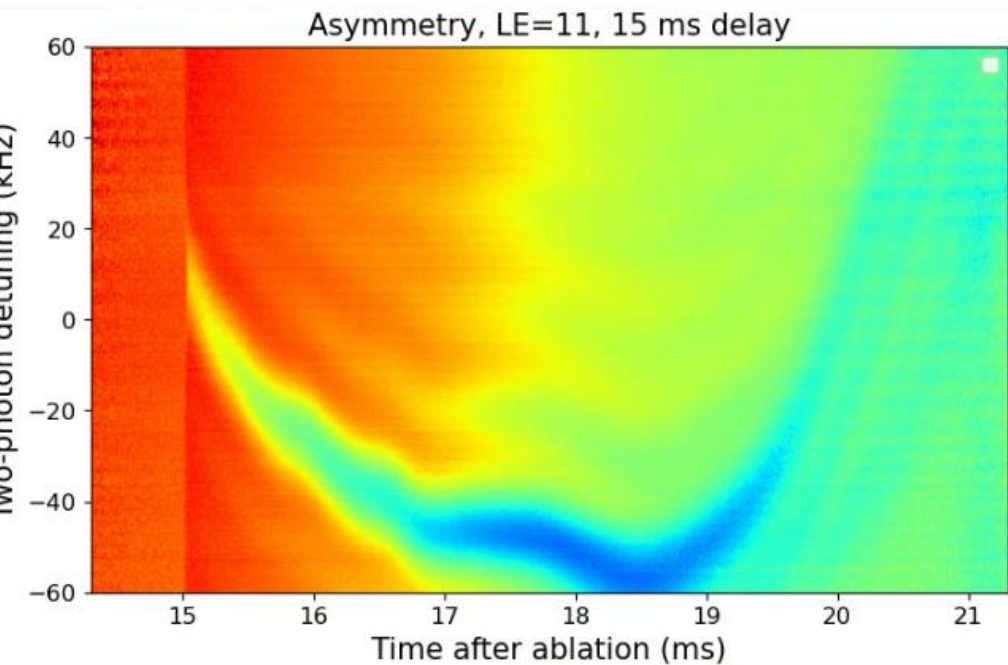
Enr estimate after changing STIRAP

- Much smaller discrepancy (<1 mV/cm)
  that can mostly be explained by varying
  velocity within the beam

Better way to prep for comag/Enr

Prepare initial state by transferring back to X, J=0, M=0 and then optically pumping into Q, J=2, M=+/-2 with vertical STIRAP

Electric field plates

~10's microsecond Raman pi-pulse (Y-polarized)

Beam box

molecules

Rotational cooling/lens

Q->I nm readout with polarization switching

STIRAP I
To
Q, J=2, M=+2

STIRAP II
To
X, J=0, M=0

Optical pumping
X->C
To populate Q, M=+/-1

Plan for next few weeks

- Try with current setup to get idea of Enr near prep

- Setup 2nd lens STIRAP and vertical STIRAP to get population in H state

- Repeat Enr measurements with improved Raman scheme, and double check with microwave measurement in H

- Explicitly measure systematic slope $\dfrac{\partial \omega^{\mathcal{NE}}}{\partial E^{nr}}$