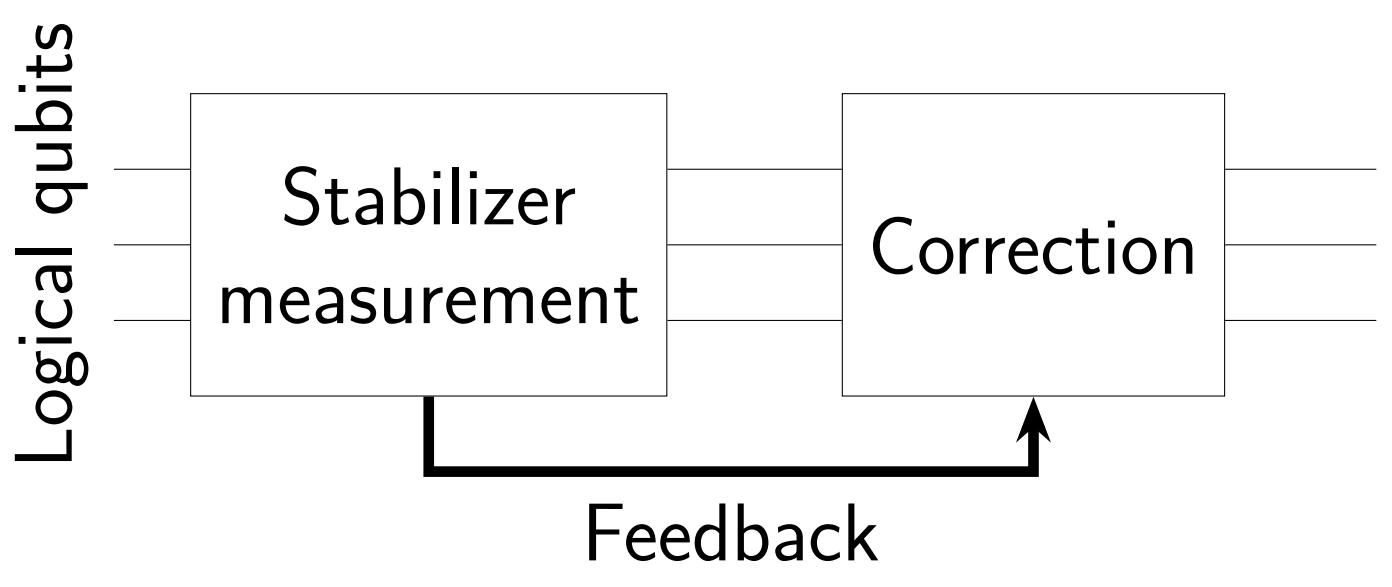


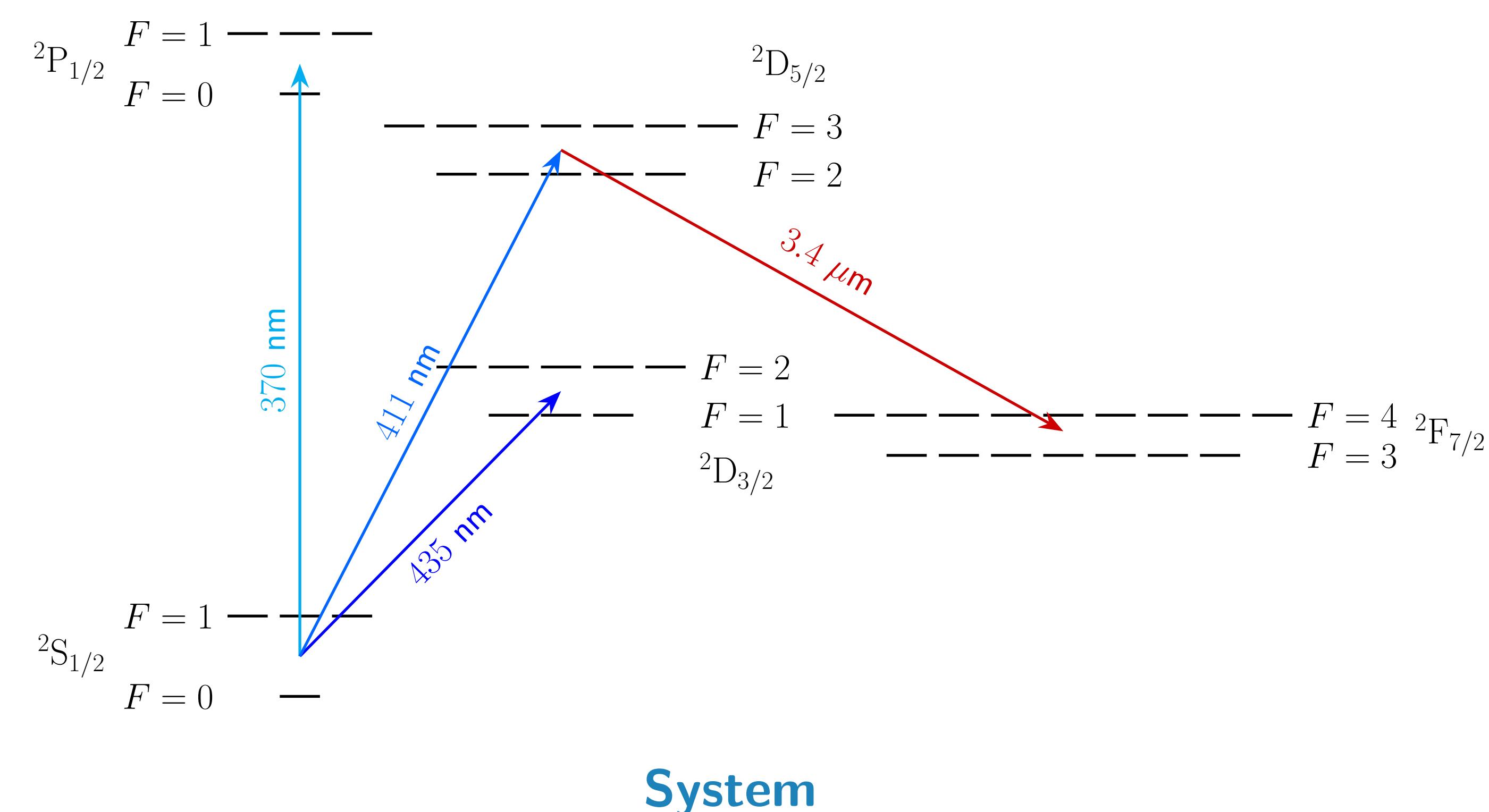
Mid-circuit measurement and the *omg* architecture

Mid-circuit measurement

- Required for multiple rounds of error correction
- Partial readout without perturbing the rest of the system

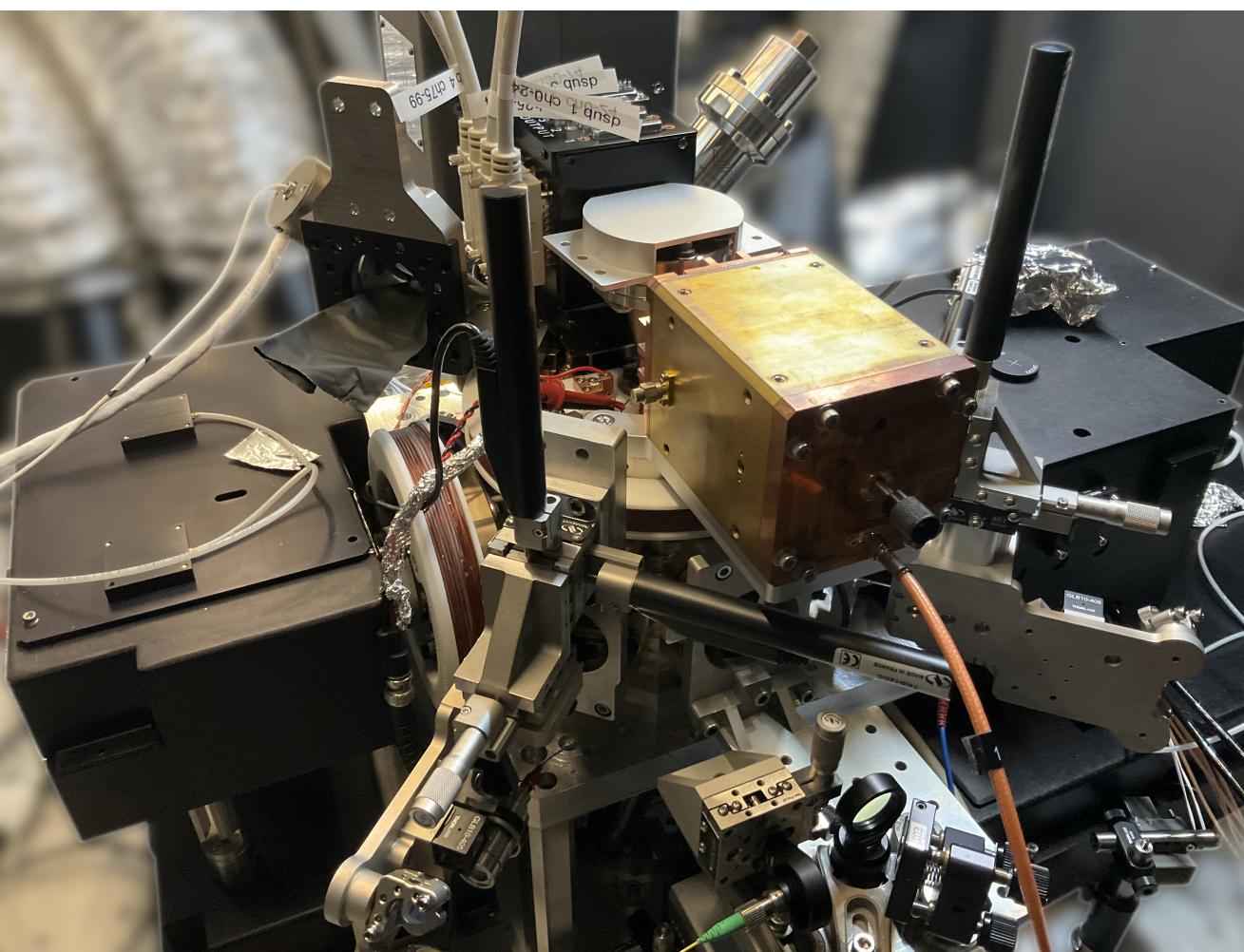
*omg* architecture

- Combining Optical Metastable and Ground state qubits
- Protecting quantum information by converting between qubit types
- Faster than ion-shuttling

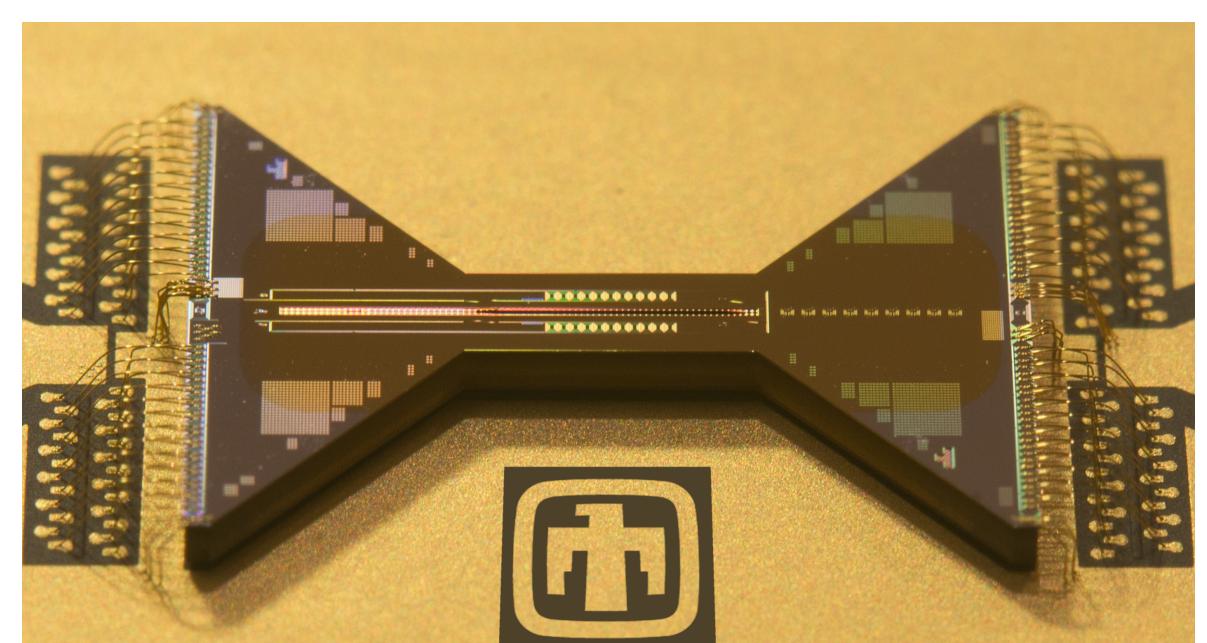


Optical control

- Global state preparation and detection with 370 nm
- Individually addressable Raman with 355 nm
- Global 435 nm for exciting to $D_{3/2}$ states
- (Planned) Global 411 nm and 3.4 μm for accessing $D_{5/2}$ and $F_{7/2}$ states

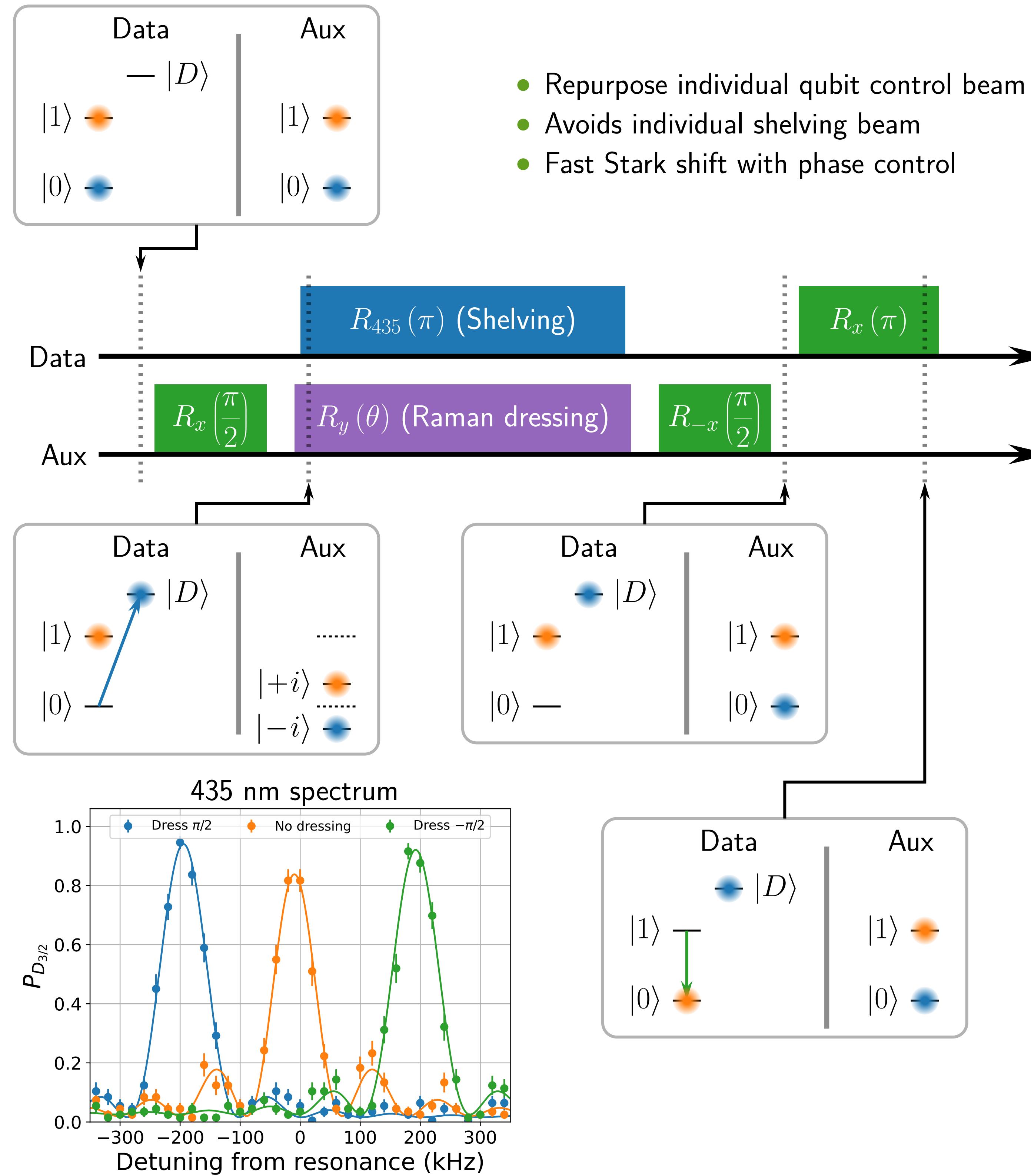


Phoenix surface trap

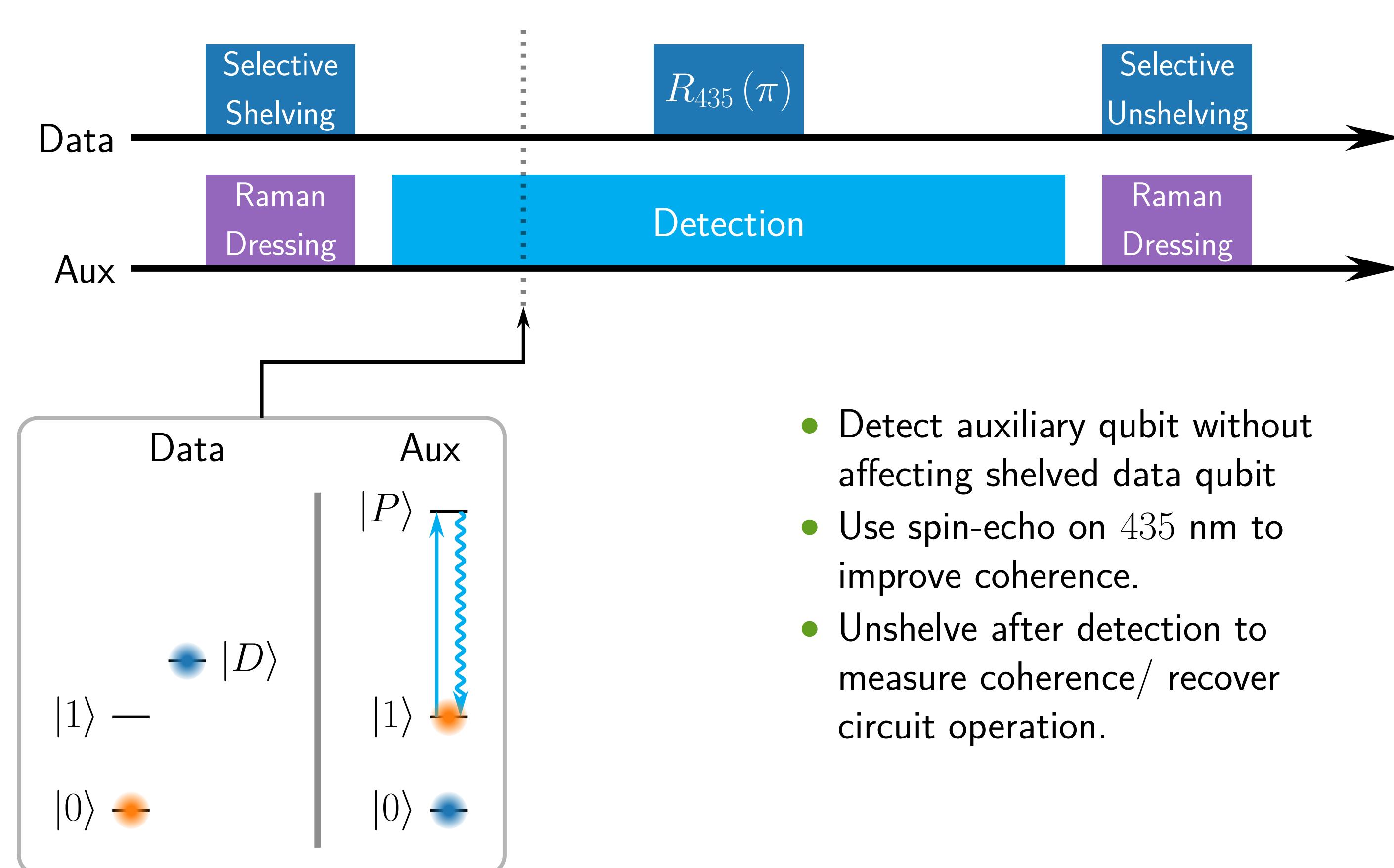


- Separate loading and quantum region
- Fine control of ion position
- Low heating rate

Selective shelving with Raman dressing

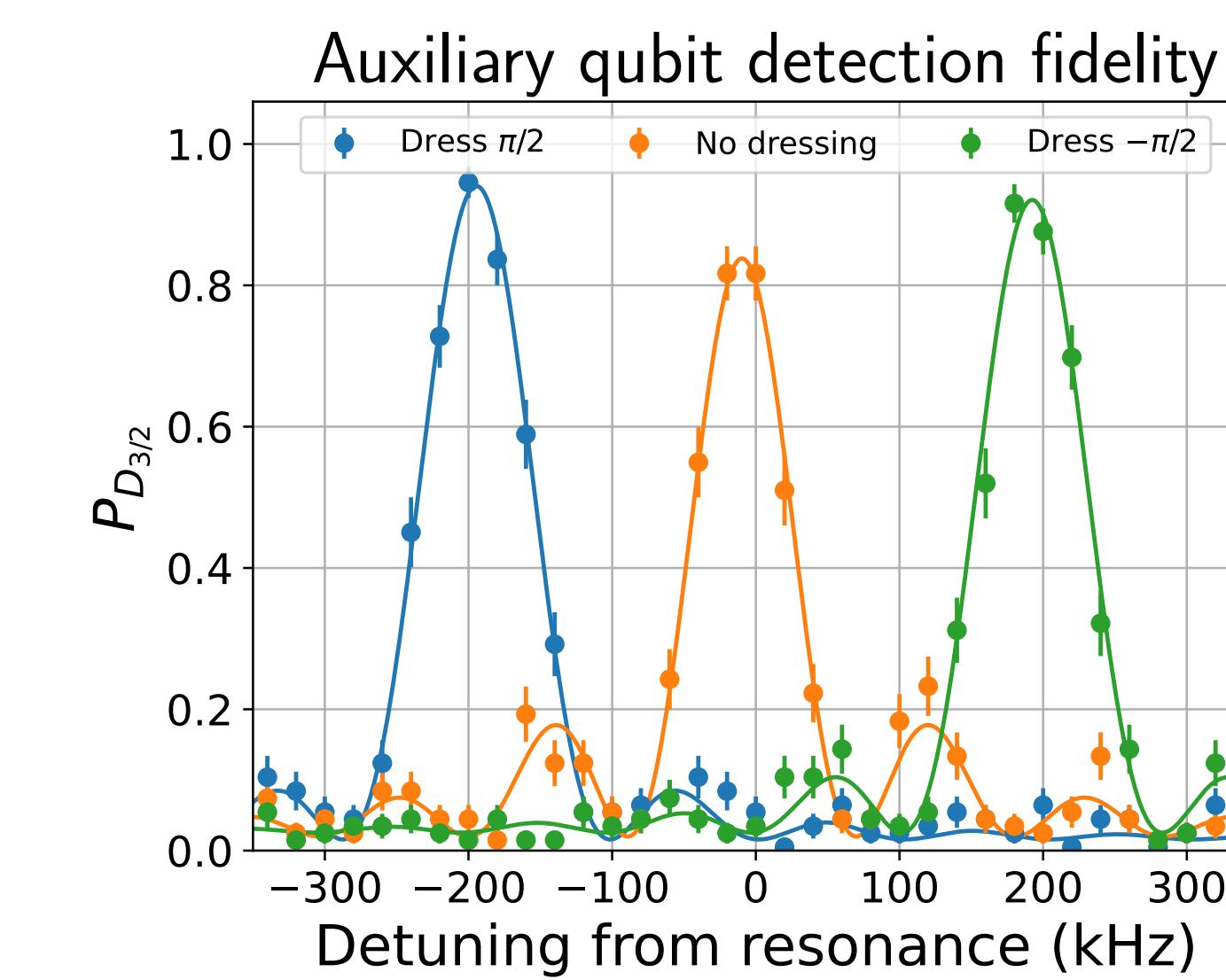


Mid circuit measurement with selective shelving



Preliminary results

Mid circuit measurement



Data qubit coherence



- Data qubit coherence 100%
- Limited by single qubit control
- Optical qubit coherence time
- Effect of re-scattering

Future works

- Improve dressing and shelving fidelity
- Shelf to longer lived $F_{7/2}$ state for better protection (Nature Physics vol. 18, 1058-1061 (2022))

