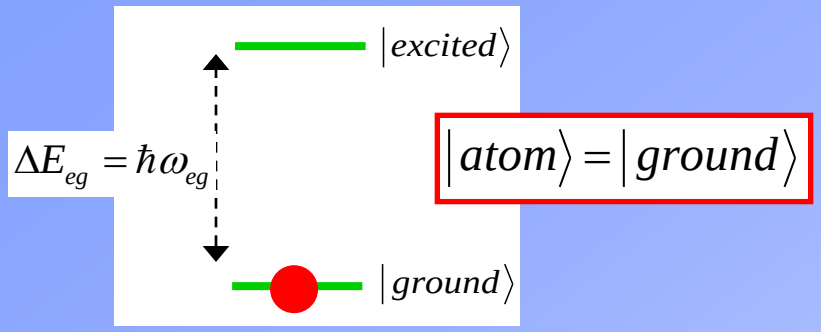
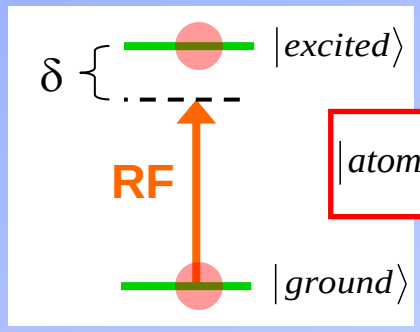
Atomic Clock: basic operation

Step 1: Initialization



$$|atom\rangle = |ground\rangle$$

Step 2: Rabi $\pi/2$ pulse

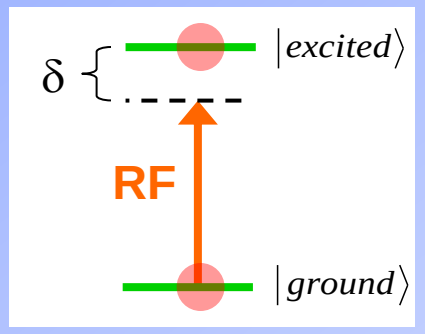


$$|atom\rangle = \frac{1}{\sqrt{2}}\left(|ground\rangle - i|excited\rangle\right)$$

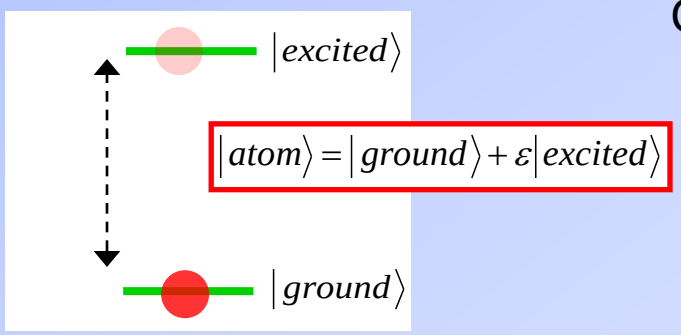
Step 3: wait a time T (determined by electronic clock)

$$|atom(t=T)\rangle = \frac{1}{\sqrt{2}}\left(|ground\rangle - ie^{-i\omega_{eg}T}|excited\rangle\right)$$

Step 4: Rabi $\pi/2$ pulse again



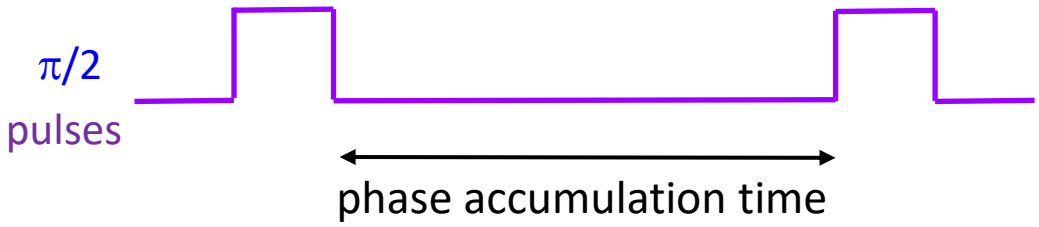
Step 5: Readout

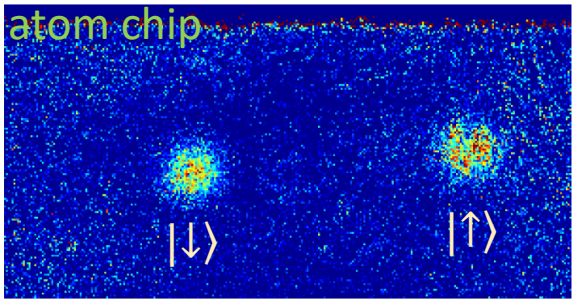


Step 6:
Correct electronic clock

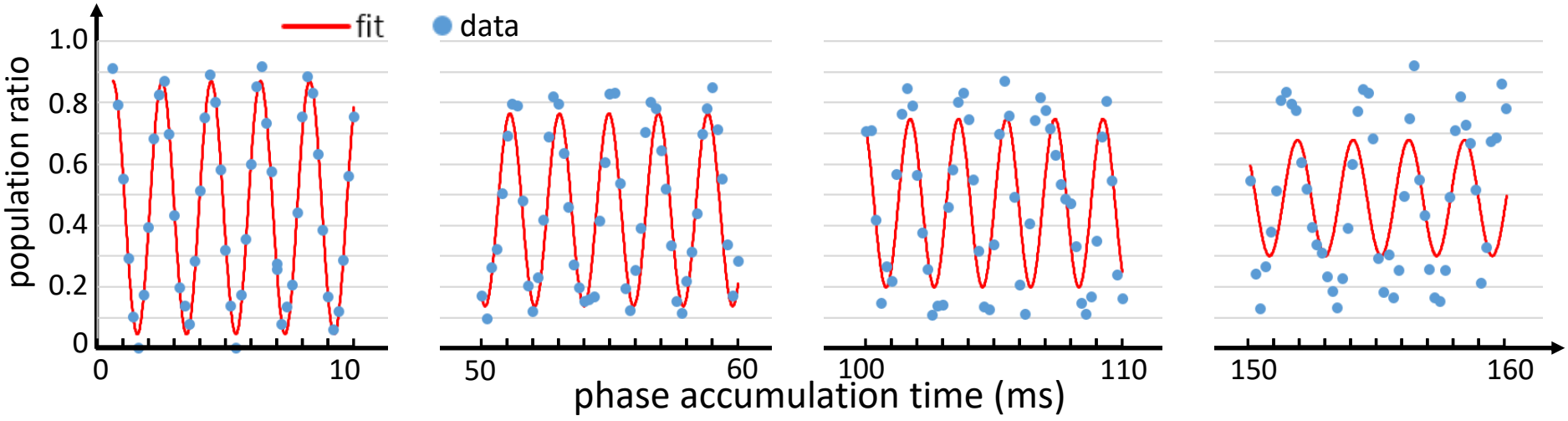
$$\delta \to 0$$

Ramsey Interferometer



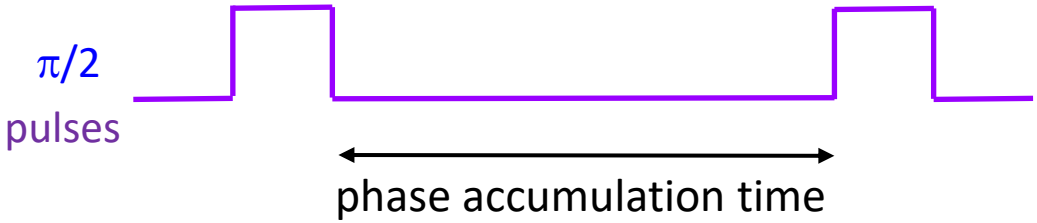


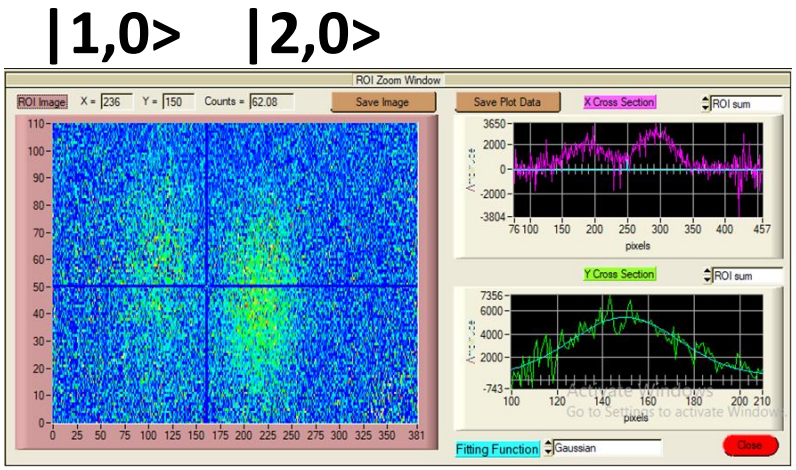
Ramsey signal with trapped ^{87}Rb atoms



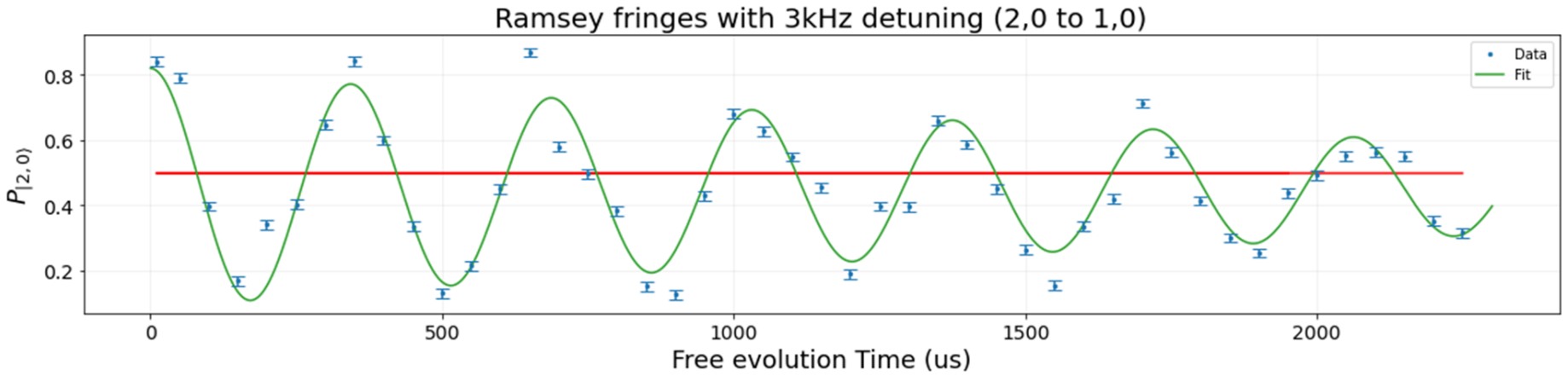
[data from S. Du, PhD thesis, 2021]

Ramsey Interferometer





Ramsey signal with free fall ^{87}Rb atoms



[data from Y. Ding, summer 2025]