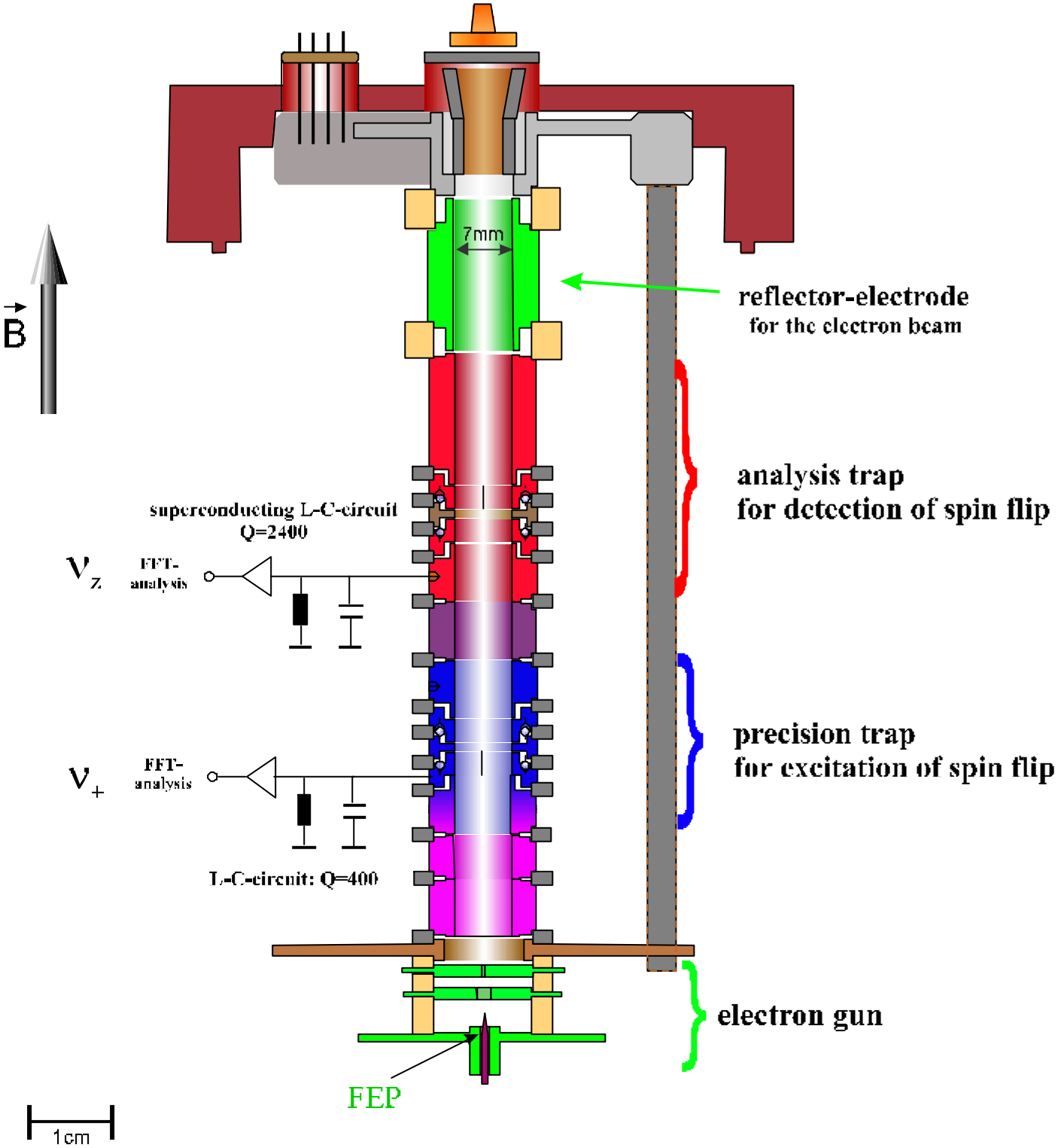
Calculation of cyclotron frequency

$$\nu_- \ll \nu_z \ll \nu_+$$

10 kHz 800 kHz 24 MHz

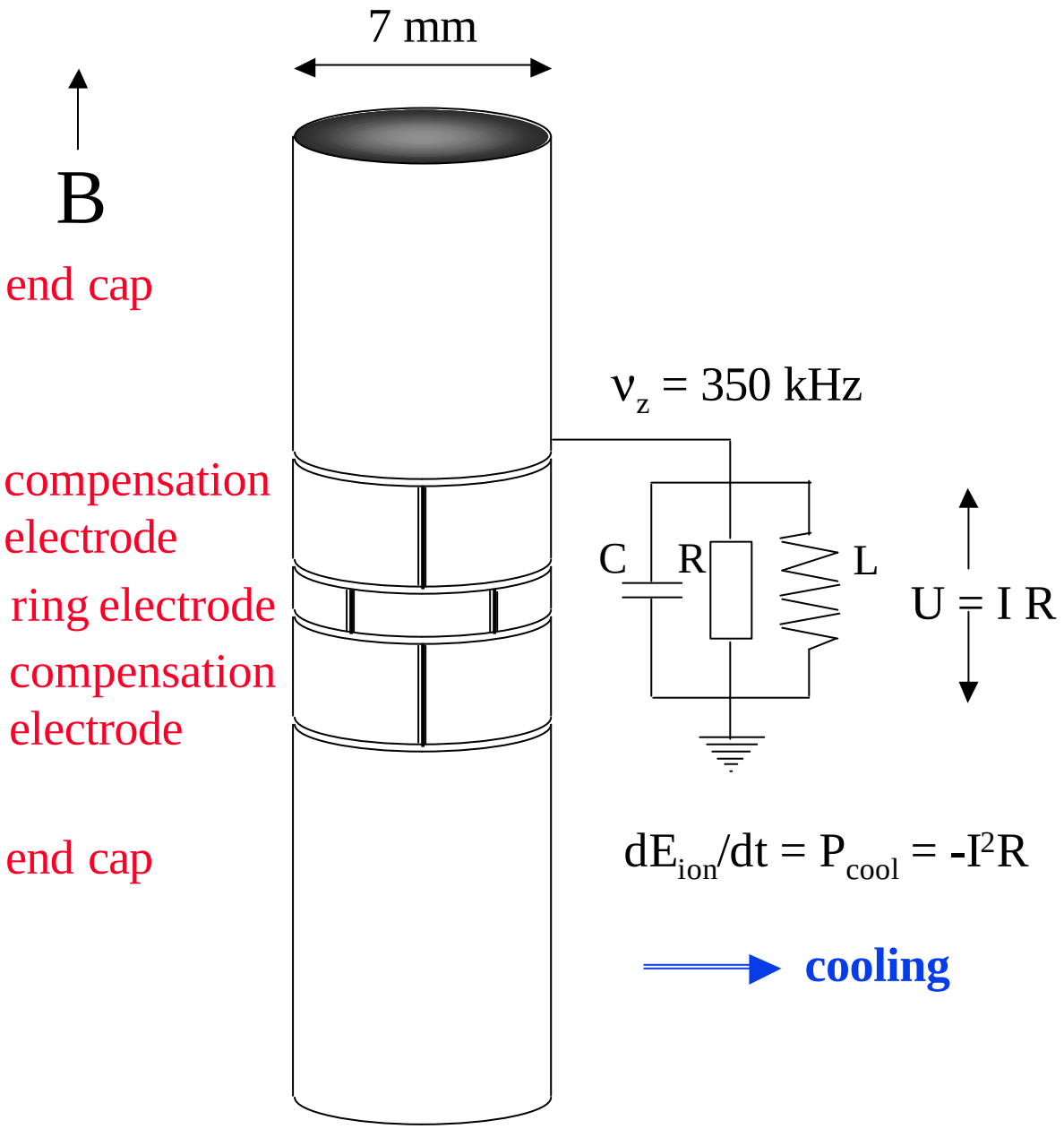
$$\boxed{\nu_c^2 = \nu_-^2 + \nu_z^2 + \nu_+^2}$$

Universität Mainz / GSI Darmstadt
g-Factor Trap



Electronic Detection and Resistive Cooling

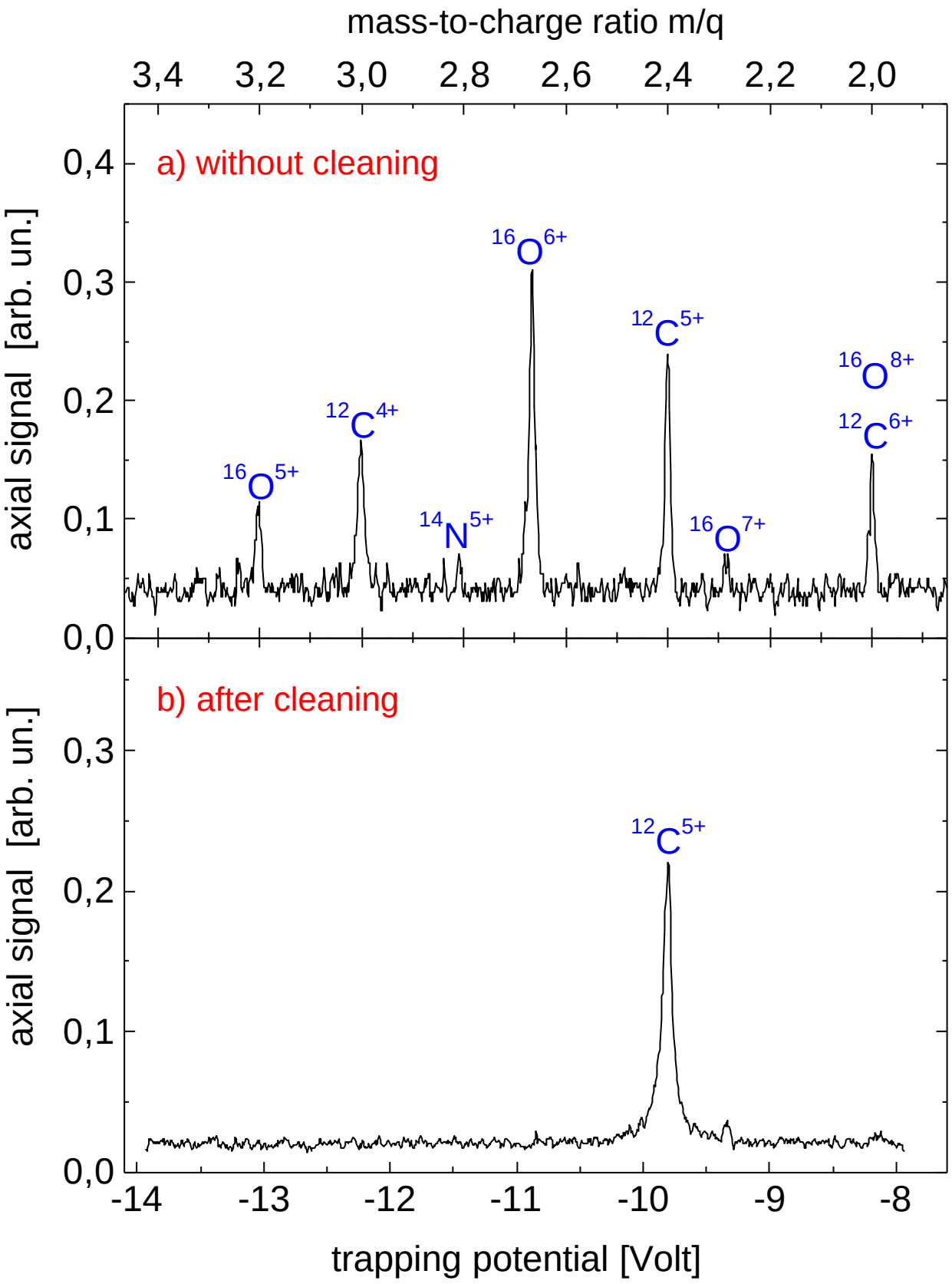
- induced image currents
- kinetic energy of trapped ions is dissipated in resistor R



$dE_{ion}/dt = P_{cool} = -I^2R$

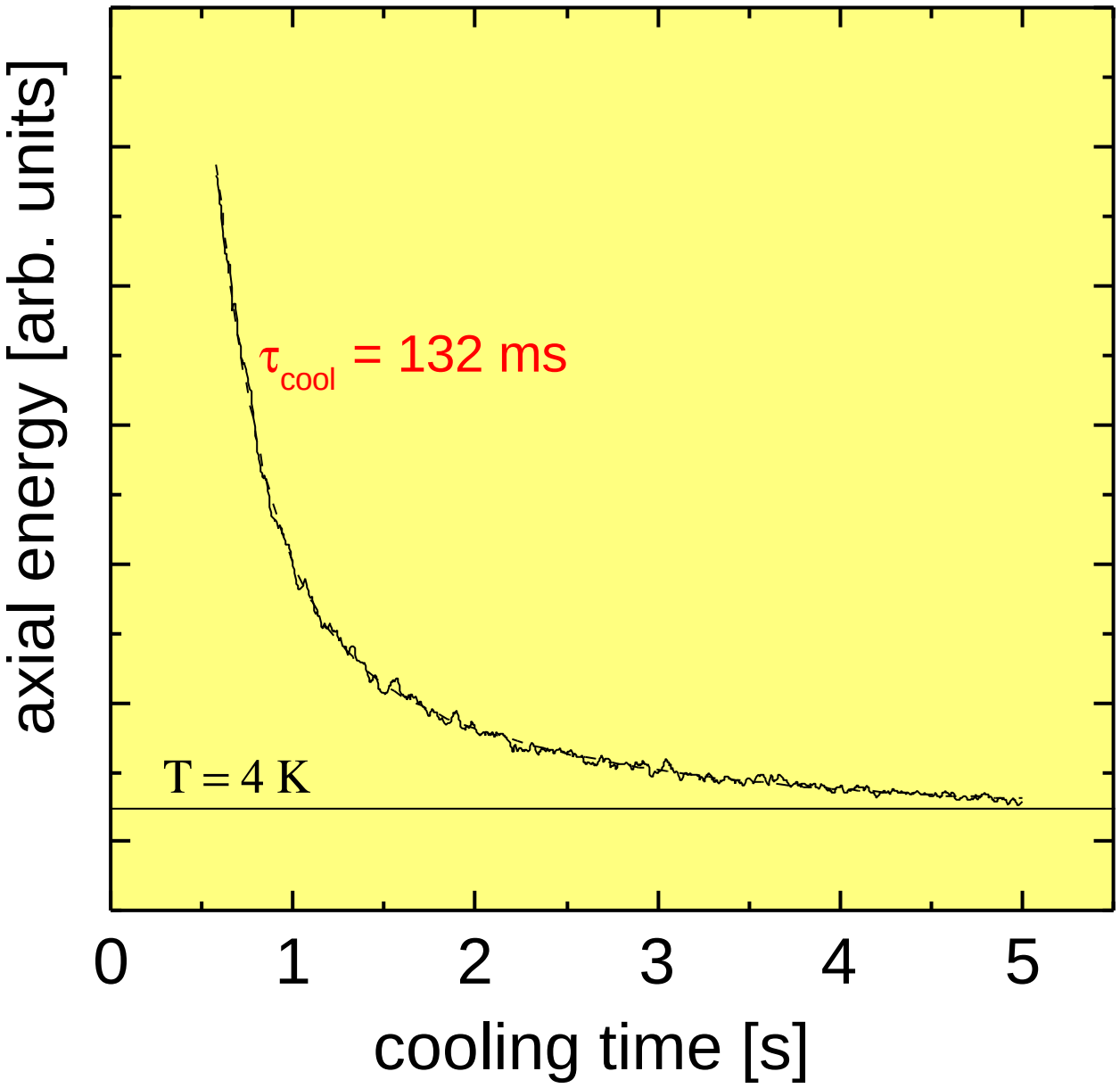
cooling

Mass Spectrum of Trapped Ions



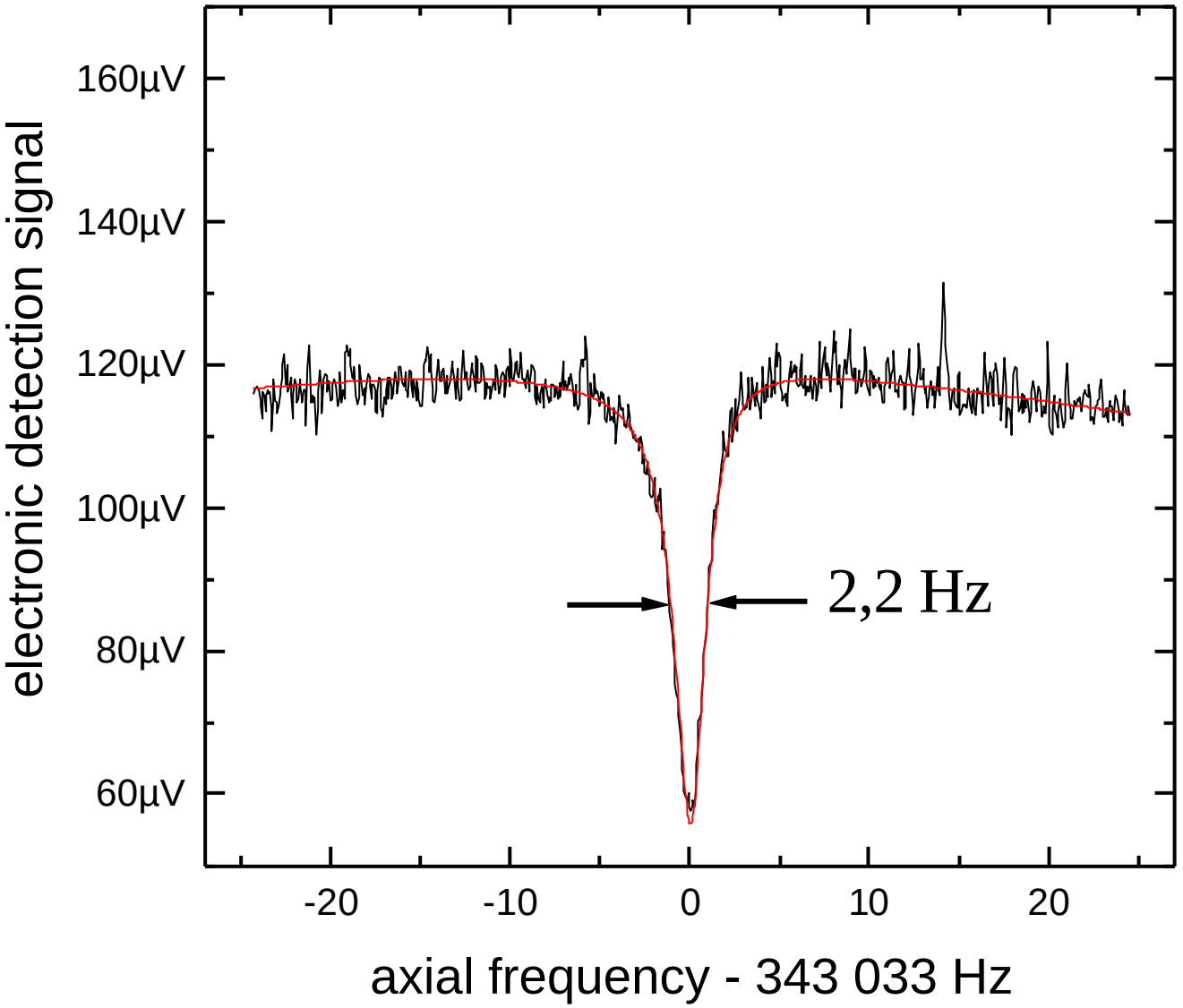
Resistive Cooling of C^{5+}-ions in a Penning Trap

- final temperature: T = 4 Kelvin



Measurement of the axial frequency of a single C^{5+}-ion

° non-destructive detection at T = 4 Kelvin



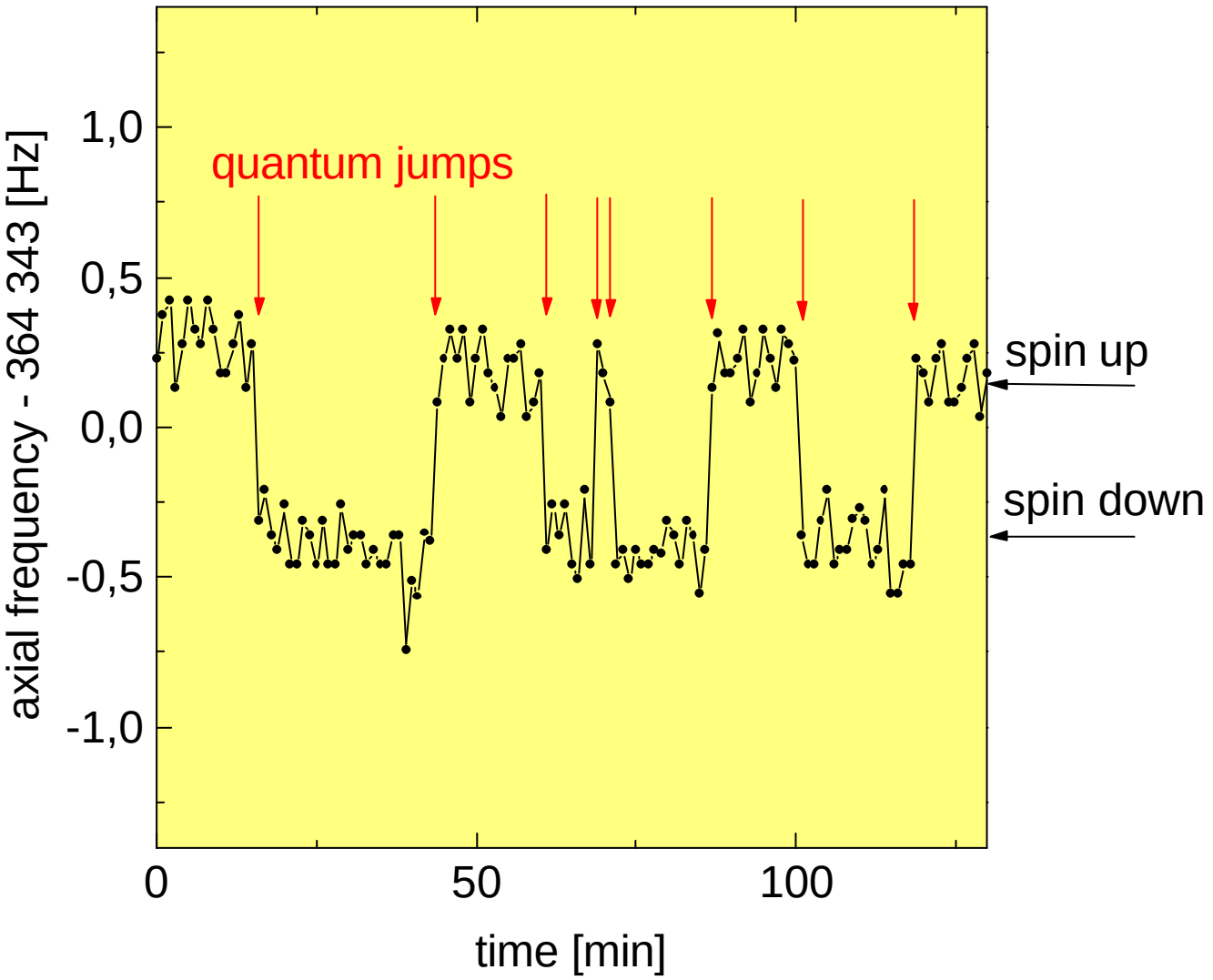
Spin-Flip Transitions of a Single C^{5+}-Ion

- excitation at Larmor precession frequency

  ν_L = 104 GHz

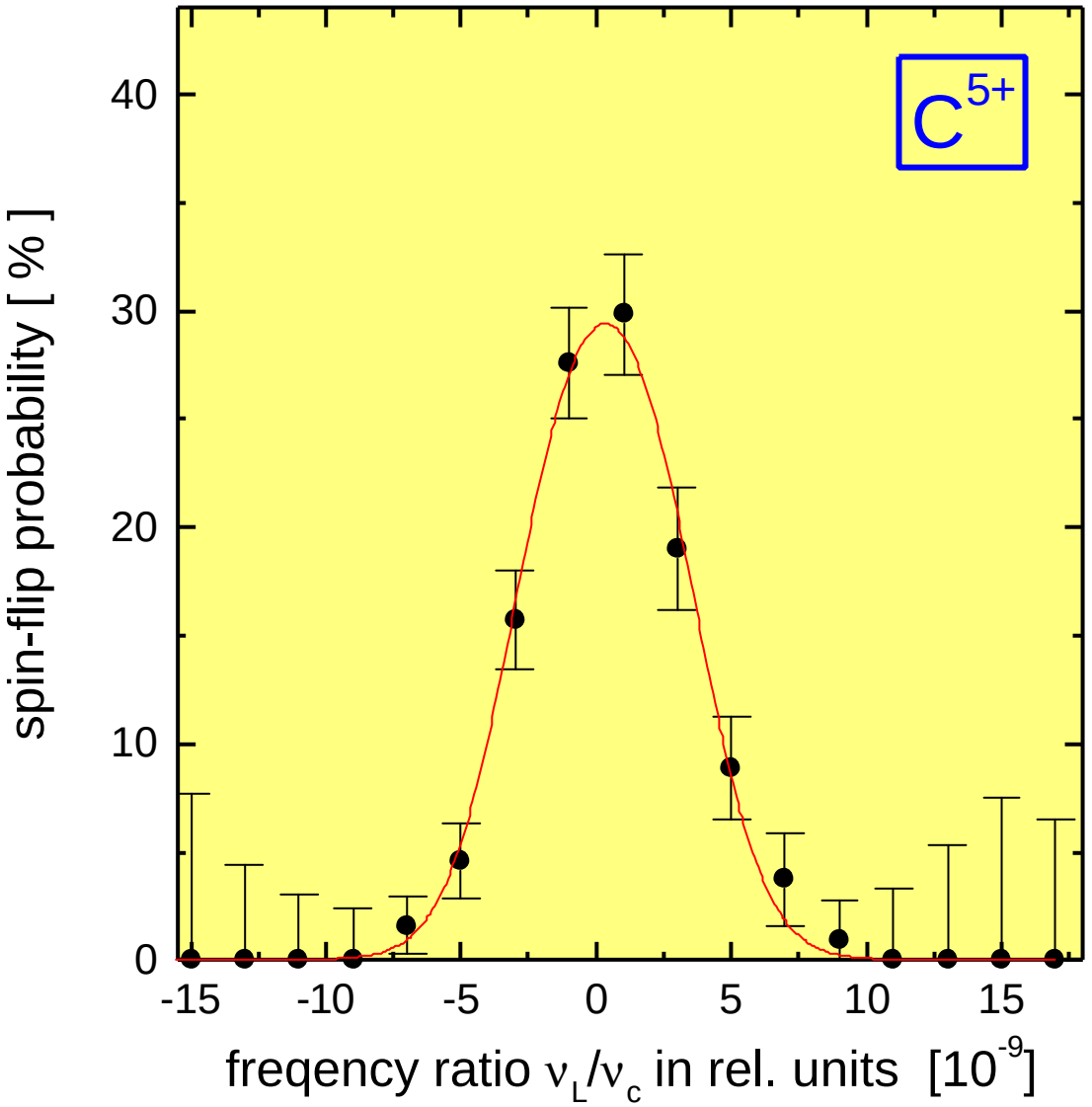
- detection by continuous Stern-Gerlach effect

  $B(z) = B_0 + B_2 z^2$



Larmor Resonance of the Bound Electron in Hydrogen-like Carbon

- novel double-trap technique
- linewidth = 7 ppb



Cyclotron Frequency Spectrum of a Single C^{5+}-Ion in a Penning Trap

- single ion at T = 4 Kelvin
- linewidth: $\Delta\nu_c/\nu_c = 9 \cdot 10^{-10}$