LhARA Capture Meeting

4th November 2021

Titus Dascalu

Single particle regime

Motion in the Penning trap

We end up with three types of motion:

- Axial motion
  - » oscillation between the endcaps

$$\omega_z^2 = 4eV / mR^2$$

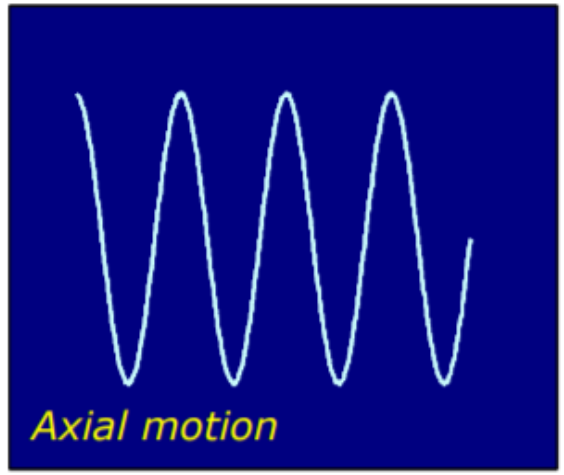
- Modified cyclotron motion
  - » orbit around a magnetic field line

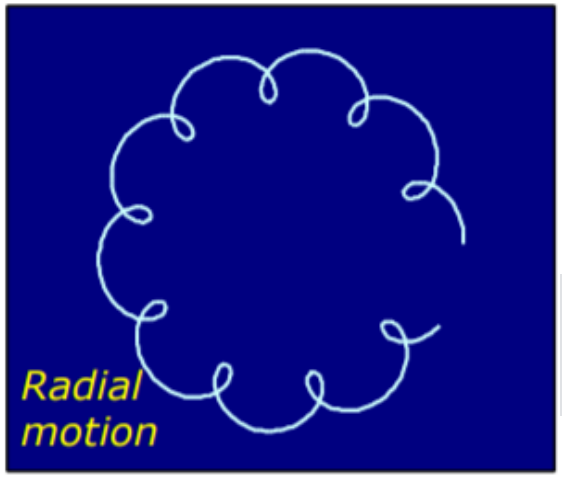
$$\omega'_c = \omega_c / 2 + \sqrt{(\omega_c / 2)^2 - \omega_z^2 / 2}$$

- Magnetron motion (**E×B** drift)
  - » slow orbit around trap centre

$$\omega_m = \omega_c / 2 - \sqrt{(\omega_c / 2)^2 - \omega_z^2 / 2}$$

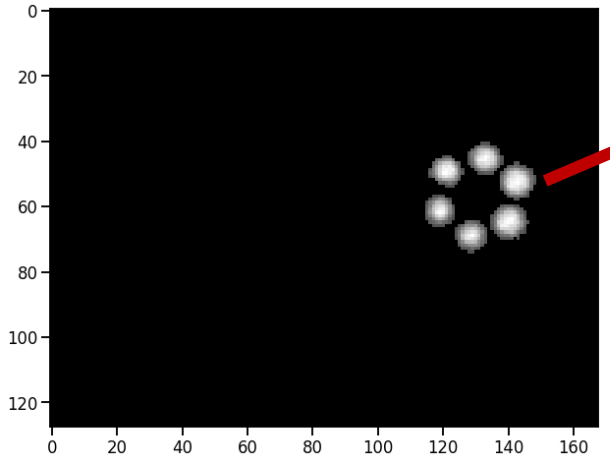
  - » This motion is unstable (negative total energy)



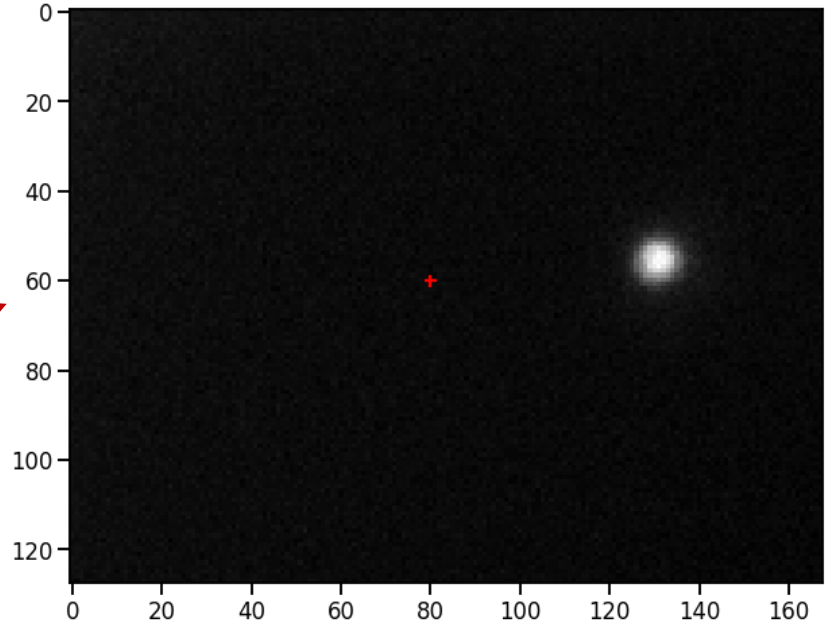


Richard Thompson
Les Houches 2018

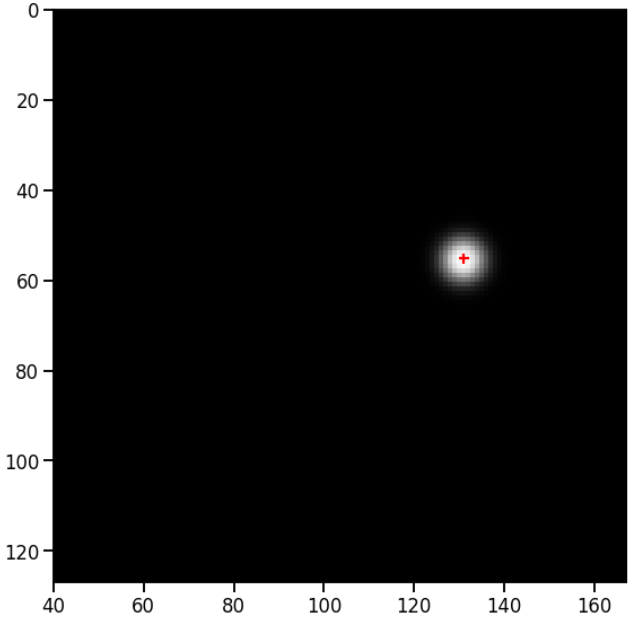
Analysis steps



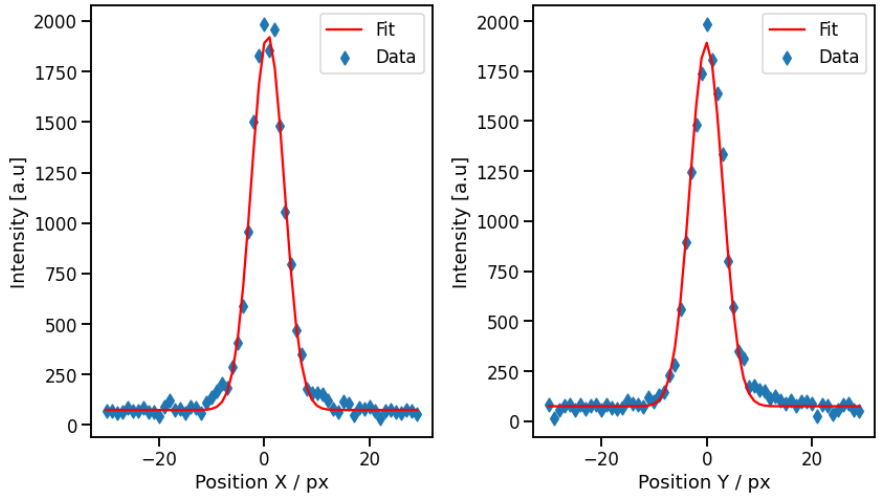
Magnetron rotation

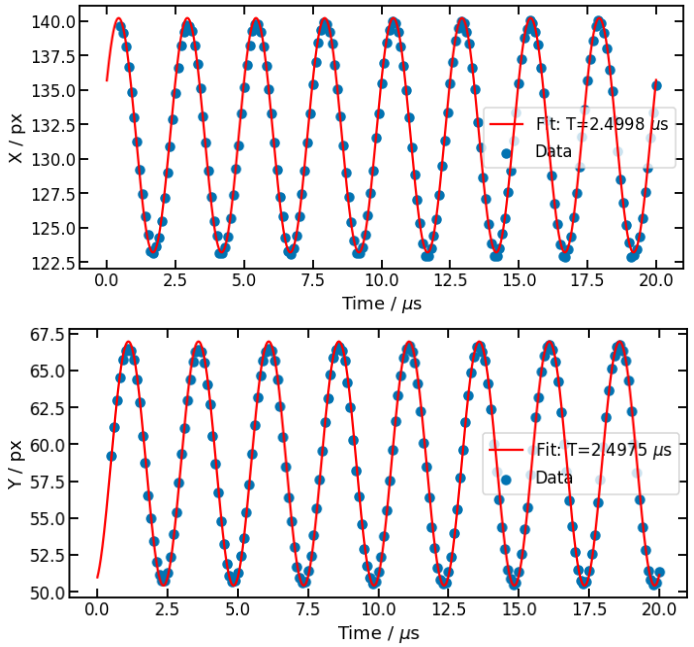


Single camera image



2D Gaussian Fit

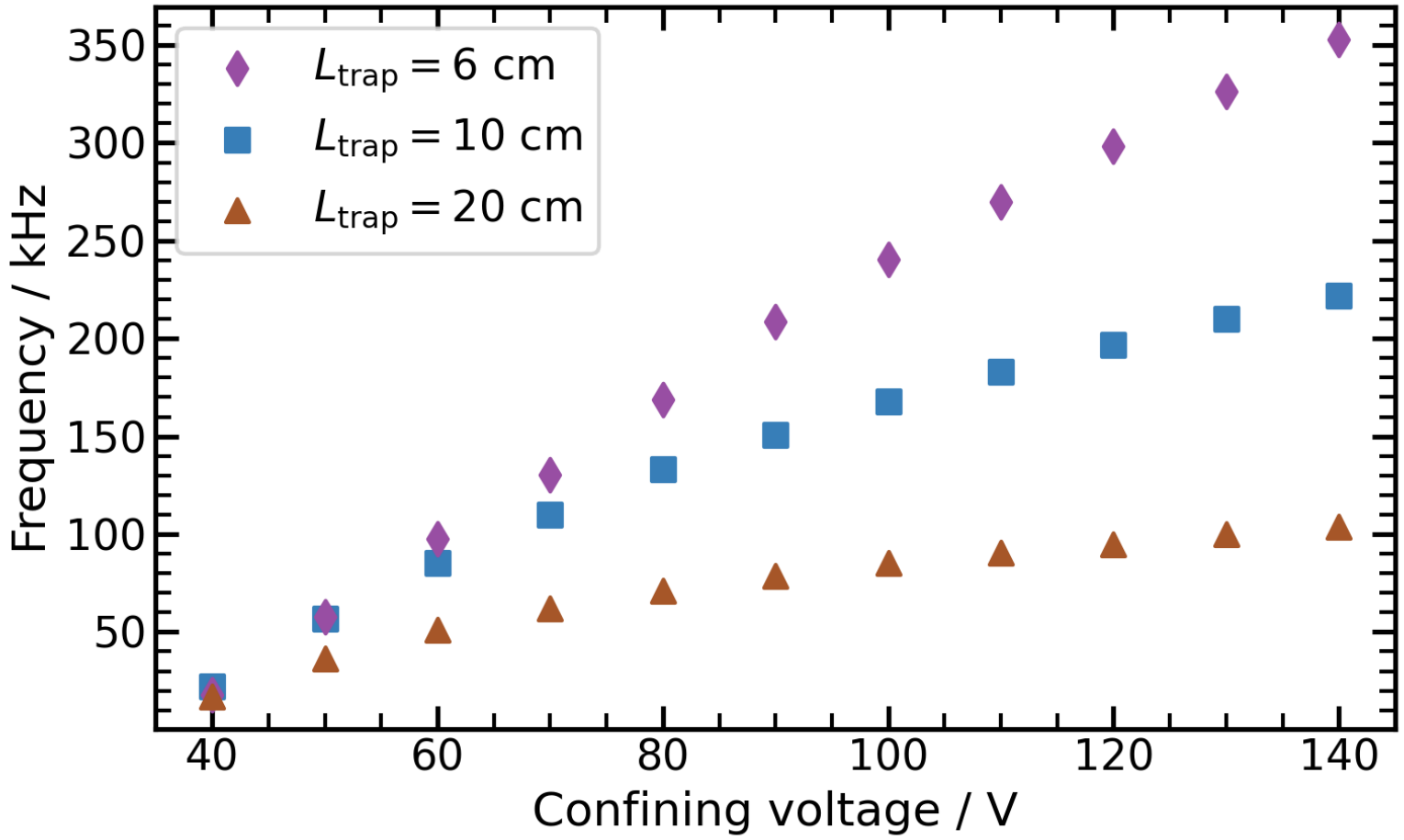




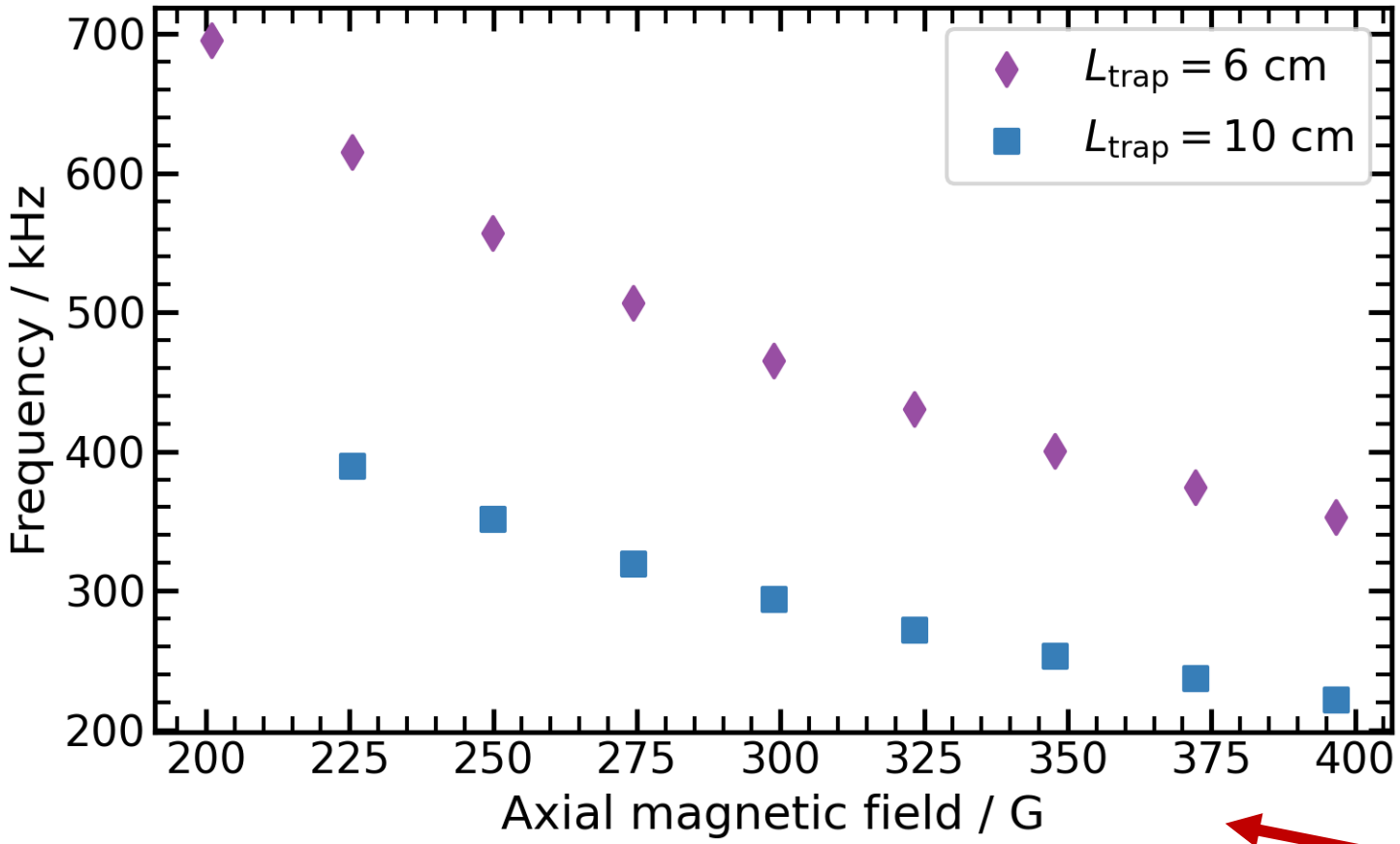
Rotation frequency + amplitude

Position vs. time

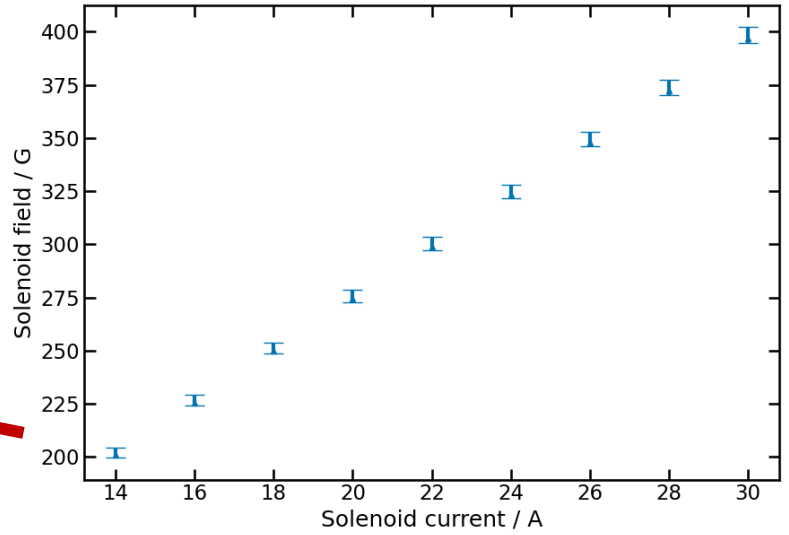
Magnetron motion – results (1)



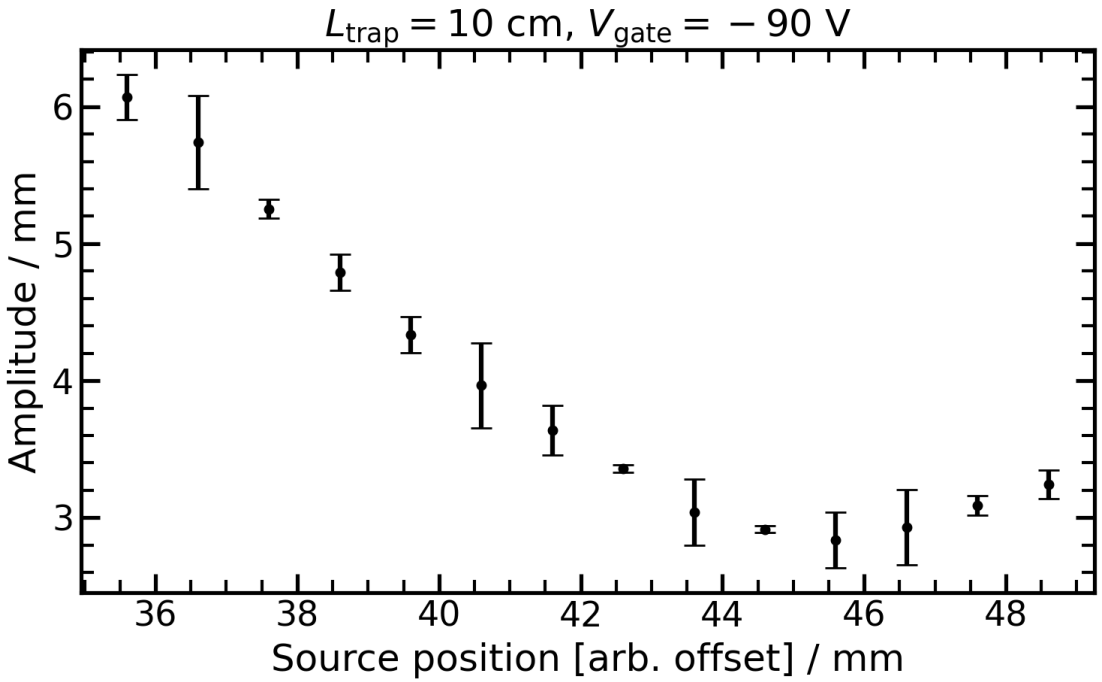
Magnetron motion – results (2)

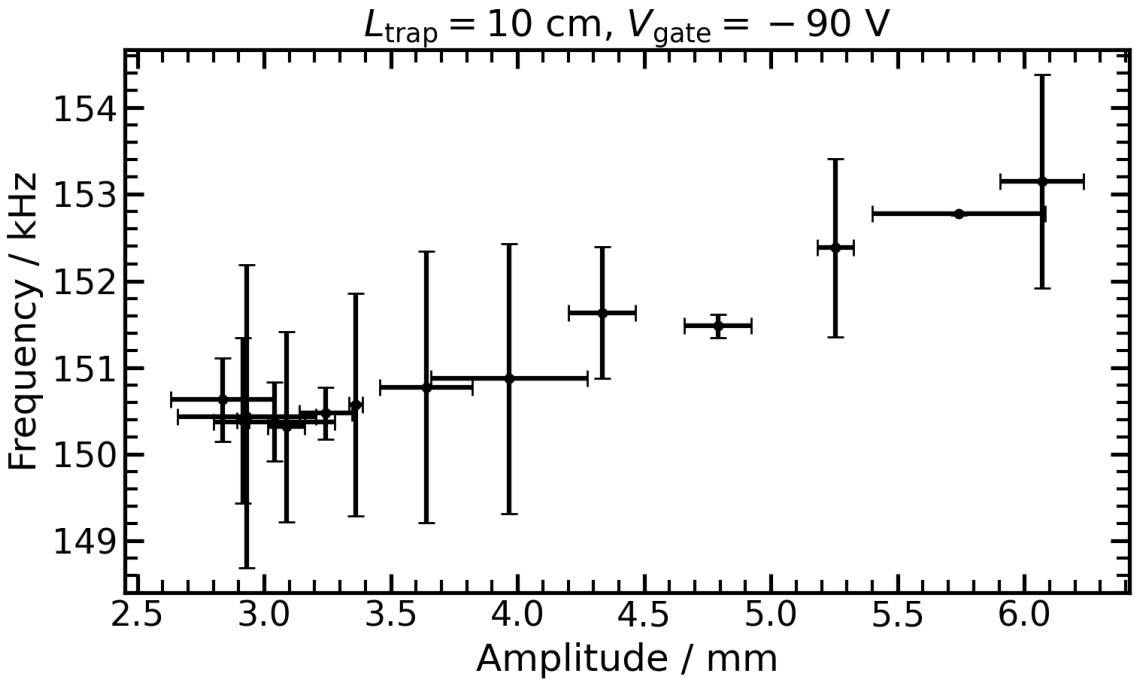


Magnetic field strength in the centre of the solenoid obtained from model of the solenoid + coils

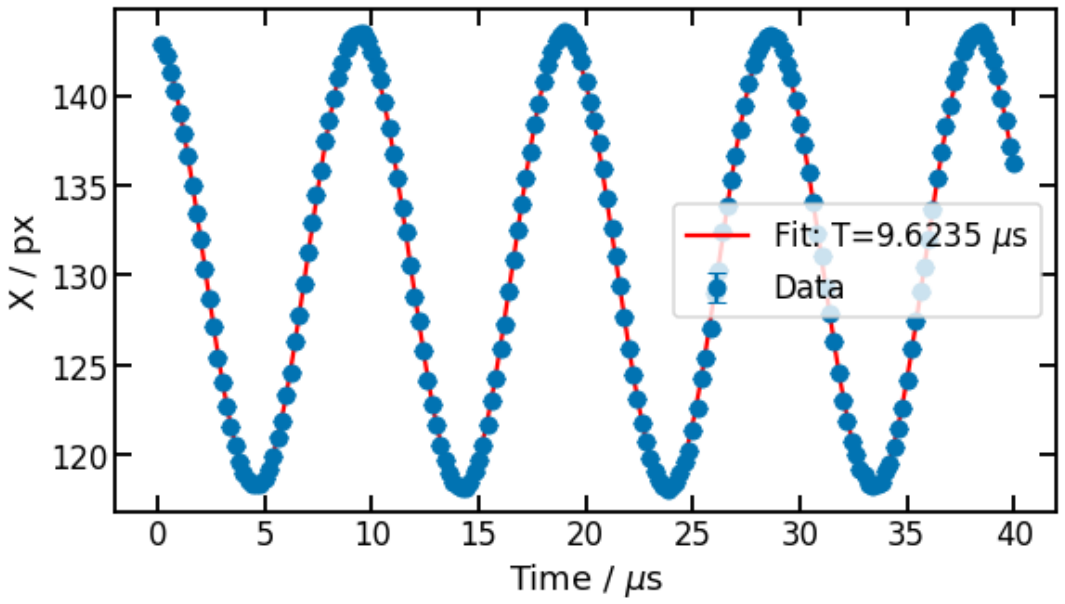


Magnetron motion – results (3)





Magnetron motion – charge variation



200 frames

Charged picked-up by the P-screen