LhARA Capture Meeting

22nd July 2021

Titus Dascalu

Diocotron motion

Electron plasma initial distribution

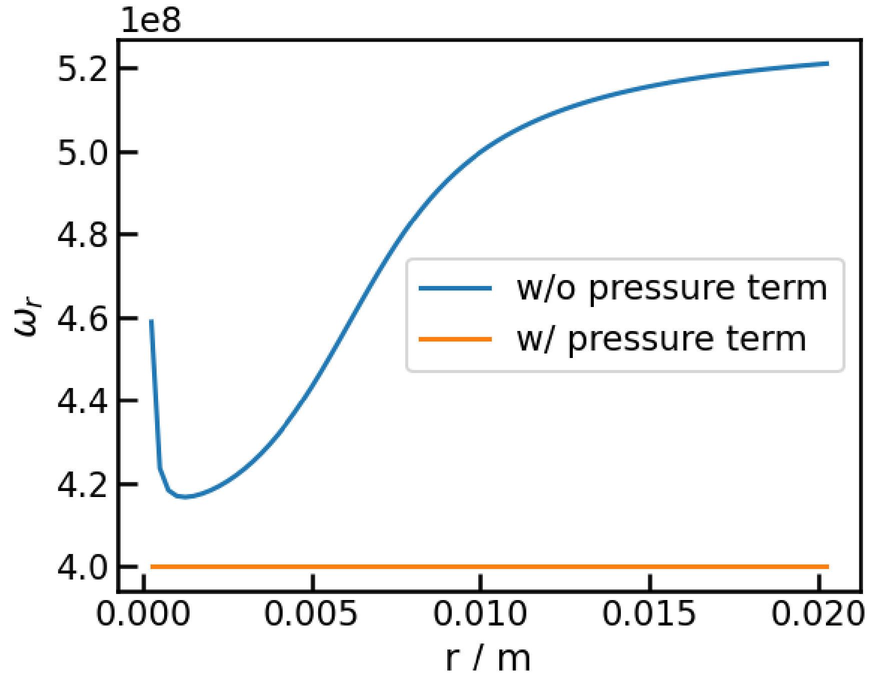
- Input to solving 2D Poisson
  - radius r_p where density falls to half of its central value OR
  - $n_e(r, z = 0)$
- Both result in nonuniform local ω_r

- Added alternative input
  - Uniform local ω_r
  - Use potential that corresponds to rigid rotation

- However…

$$\omega_r = \frac{E_r}{Br} - \frac{k_B T}{qBrn}\frac{\partial n}{\partial r} + \frac{\omega_r^2}{\Omega_c}$$

thermal pressure term

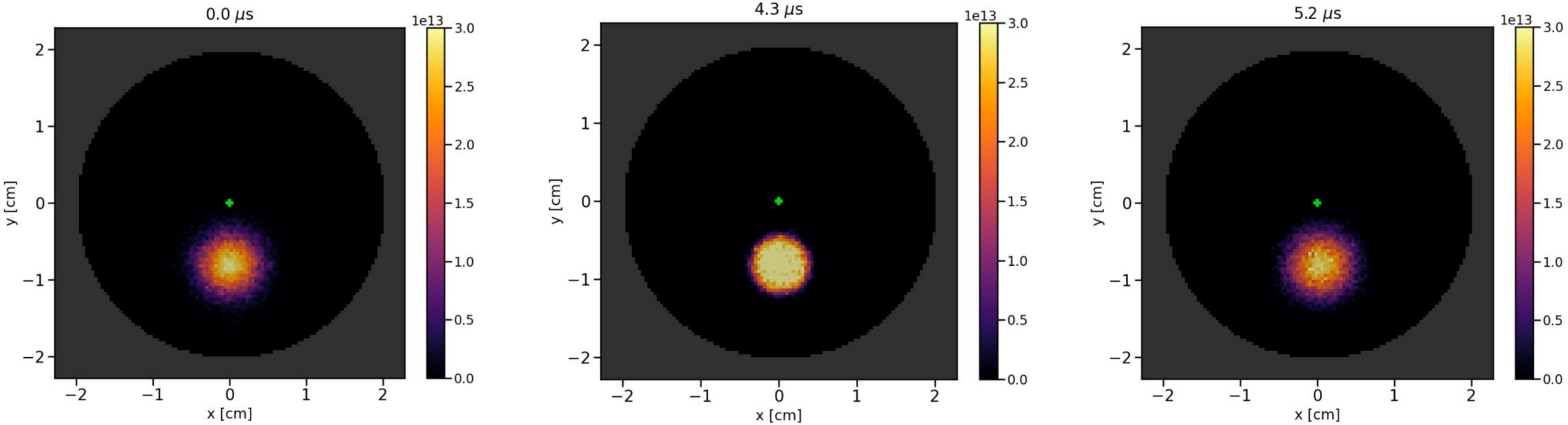


Electron plasma initial distribution

- If initial local ω_r is set taking into account the pressure term, local ω_r will be smaller than the 'equilibrium' ω_r in the absence of pressure

$$\frac{\omega_r^2}{\omega_c} - \omega + \frac{E}{Br} < 0 \qquad \therefore m\omega_r^2 r + \frac{eE}{r} < eB\omega_r r$$

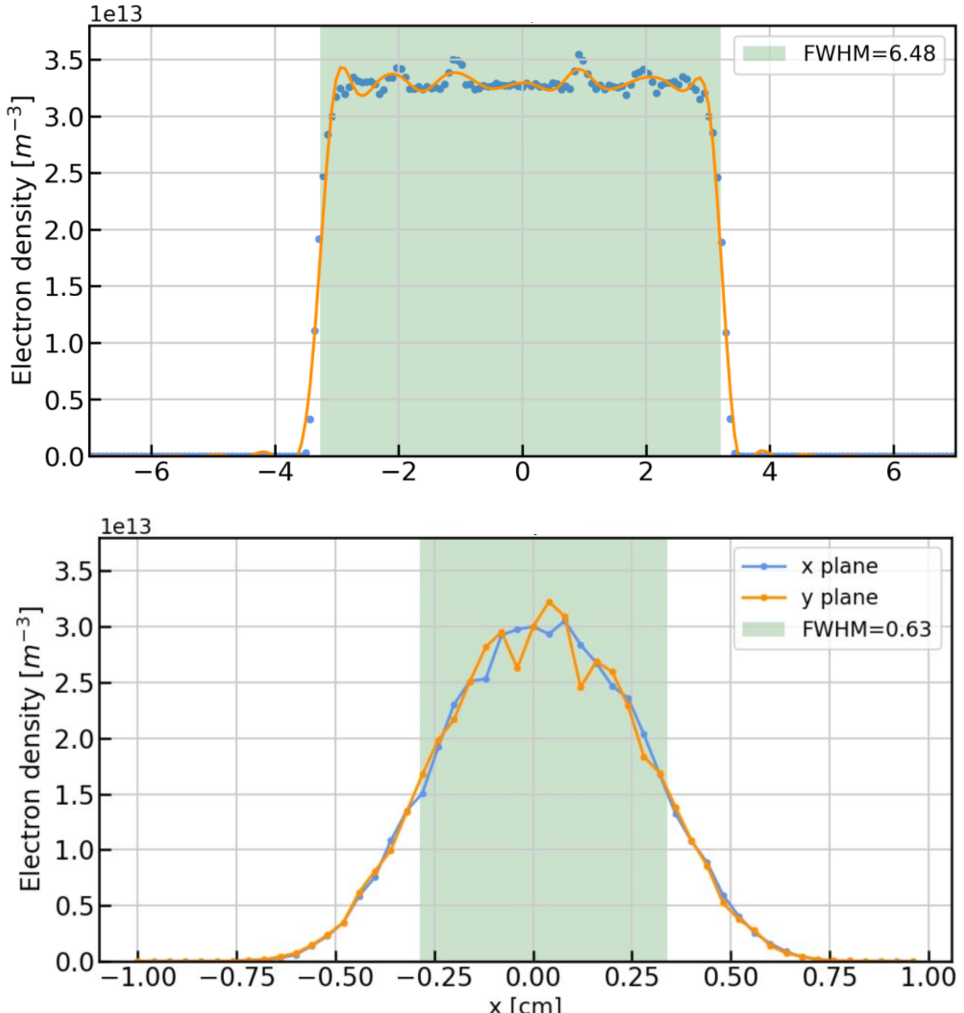
$\therefore$ electrons should move inwards



*time scale is 1000 times smaller

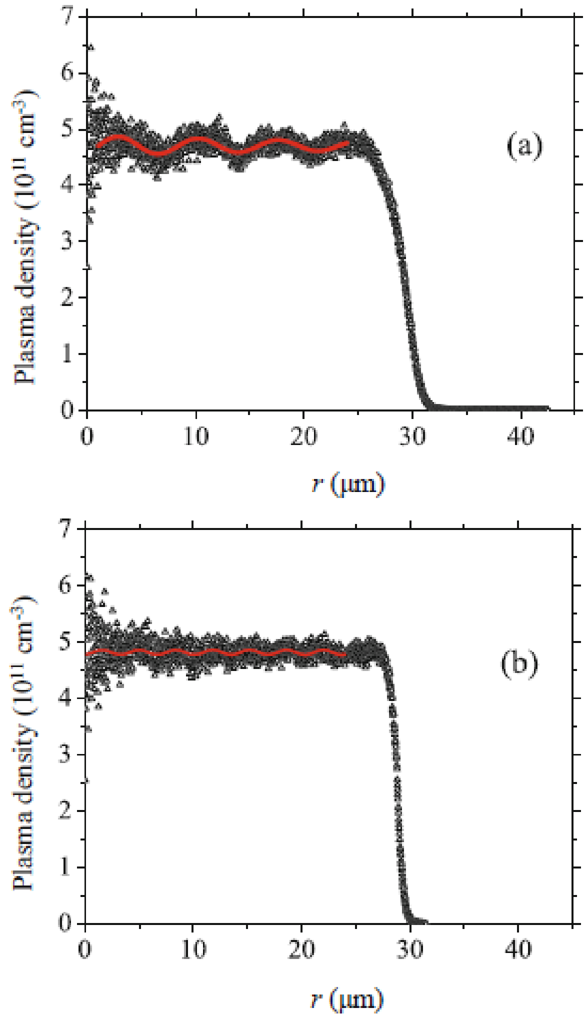
Plasma fluctuations

- Possible source: numerical instabilities
  - If a number of fast particles violate the CFL condition

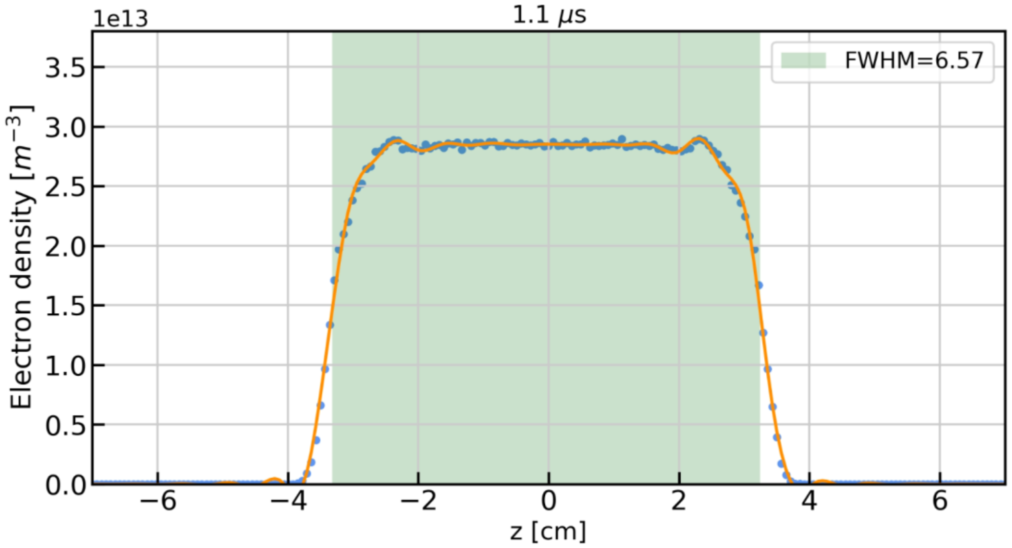


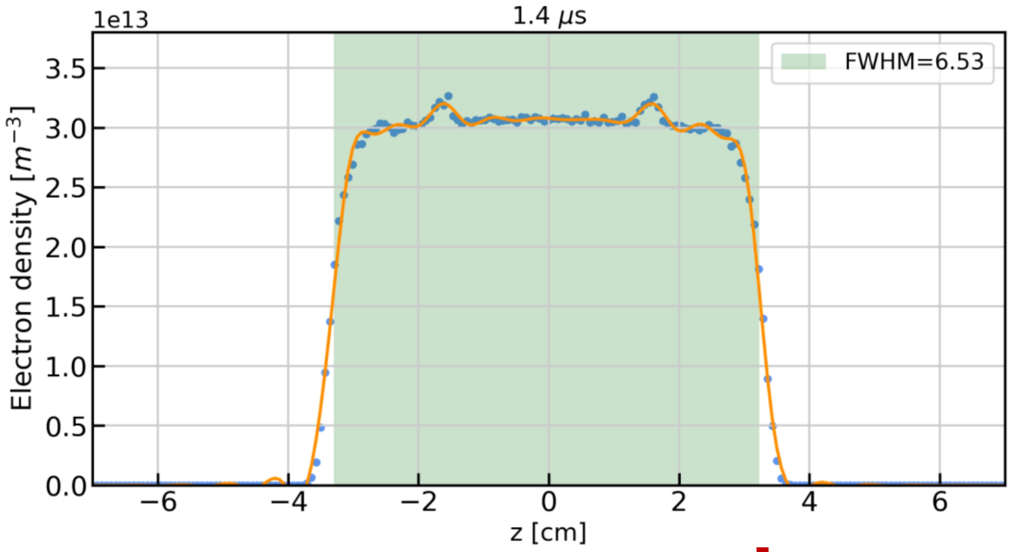
Simulation studies of the behavior of positrons in a microtrap with long aspect ratio

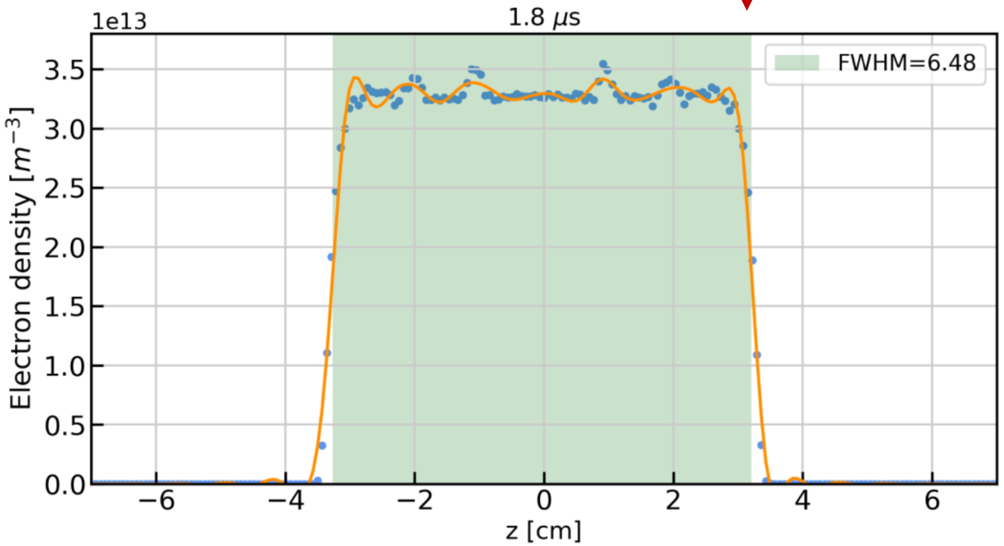
Alireza Narimannezhad[a], Christopher J. Baker, Marc H. Weber, Joshah Jennings, and Kelvin G. Lynn[b]



Plasma fluctuations





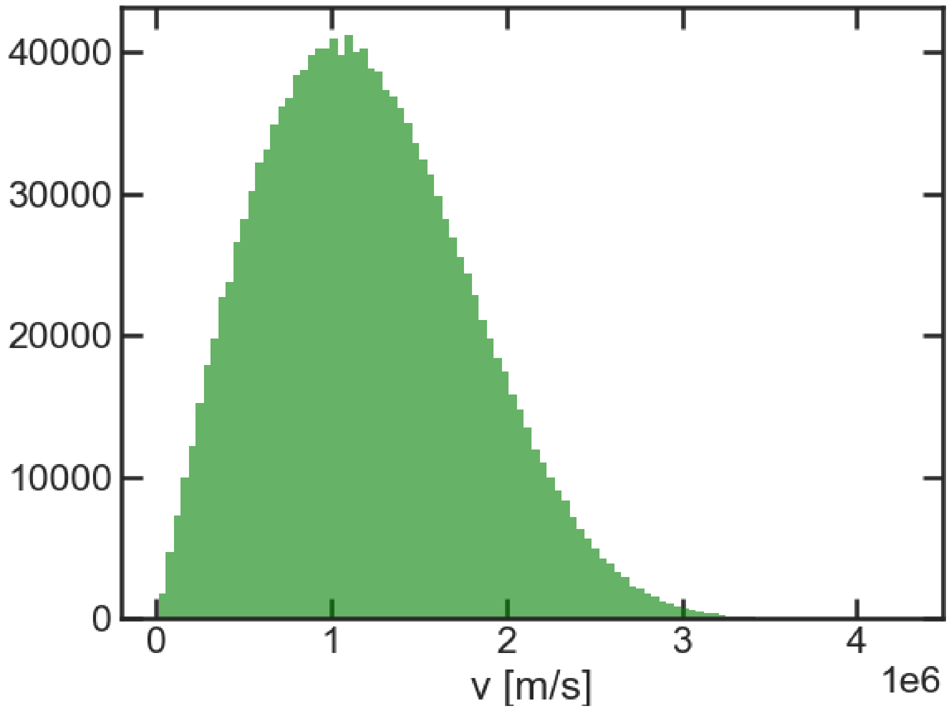


*time scale is 1000 times smaller

Plasma fluctuations – CFL condition

- Possible source: numerical instabilities
  - If a number of fast particles violate the CFL condition

$$\frac{\min(dx, dz)}{dt} = \frac{0.4 \times 10^{-3}\ m}{4 \times 10^{-11}\ s} = 10^{7}\ m/s$$



Plasma temperature

- Calculating temperature from RMS speed and from Gaussian fit give same results
- Rigid rotation widens the distribution from the rotating frame