LhARA Capture Meeting

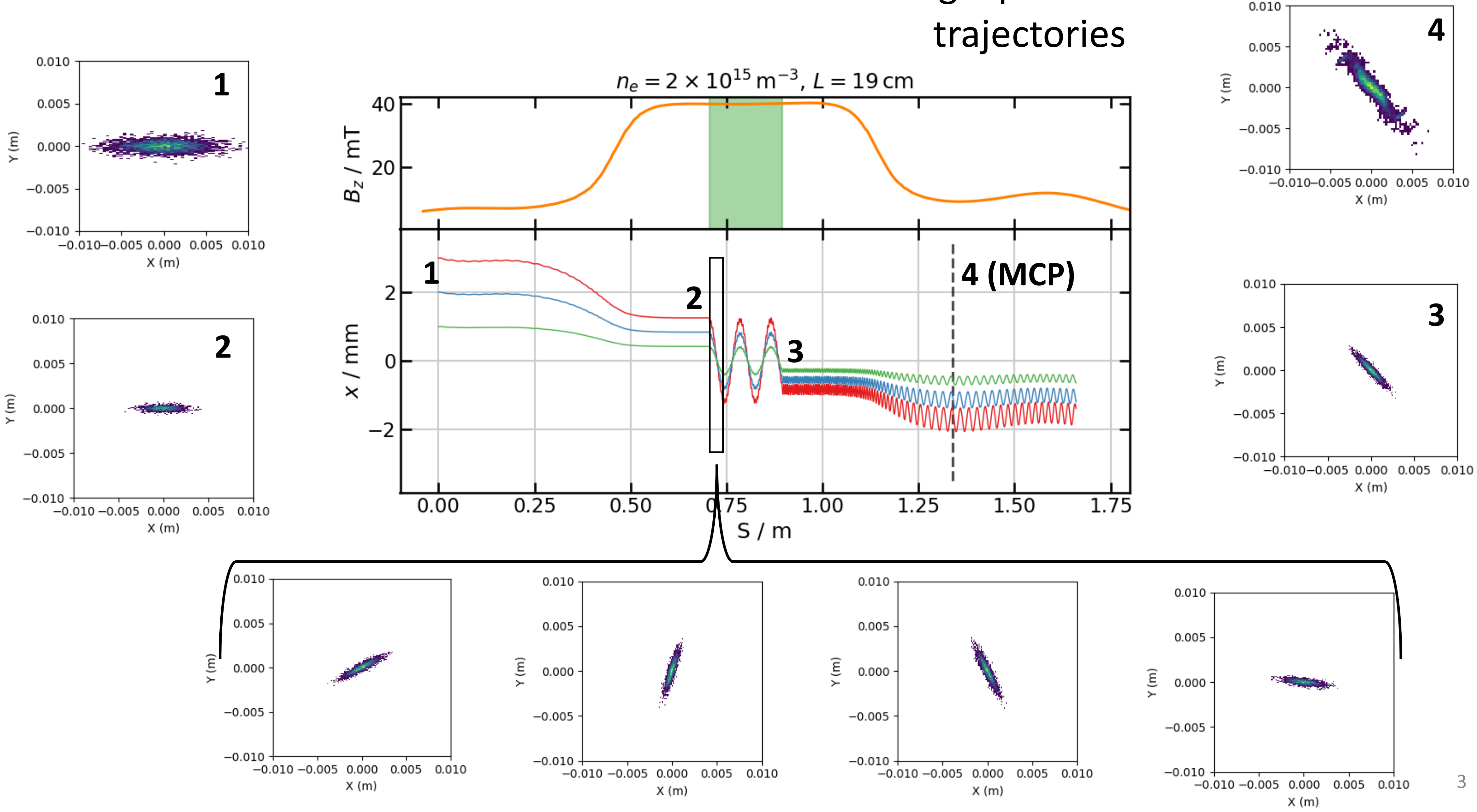
24th June 2021

Titus Dascalu

e^+ beam “focusing”

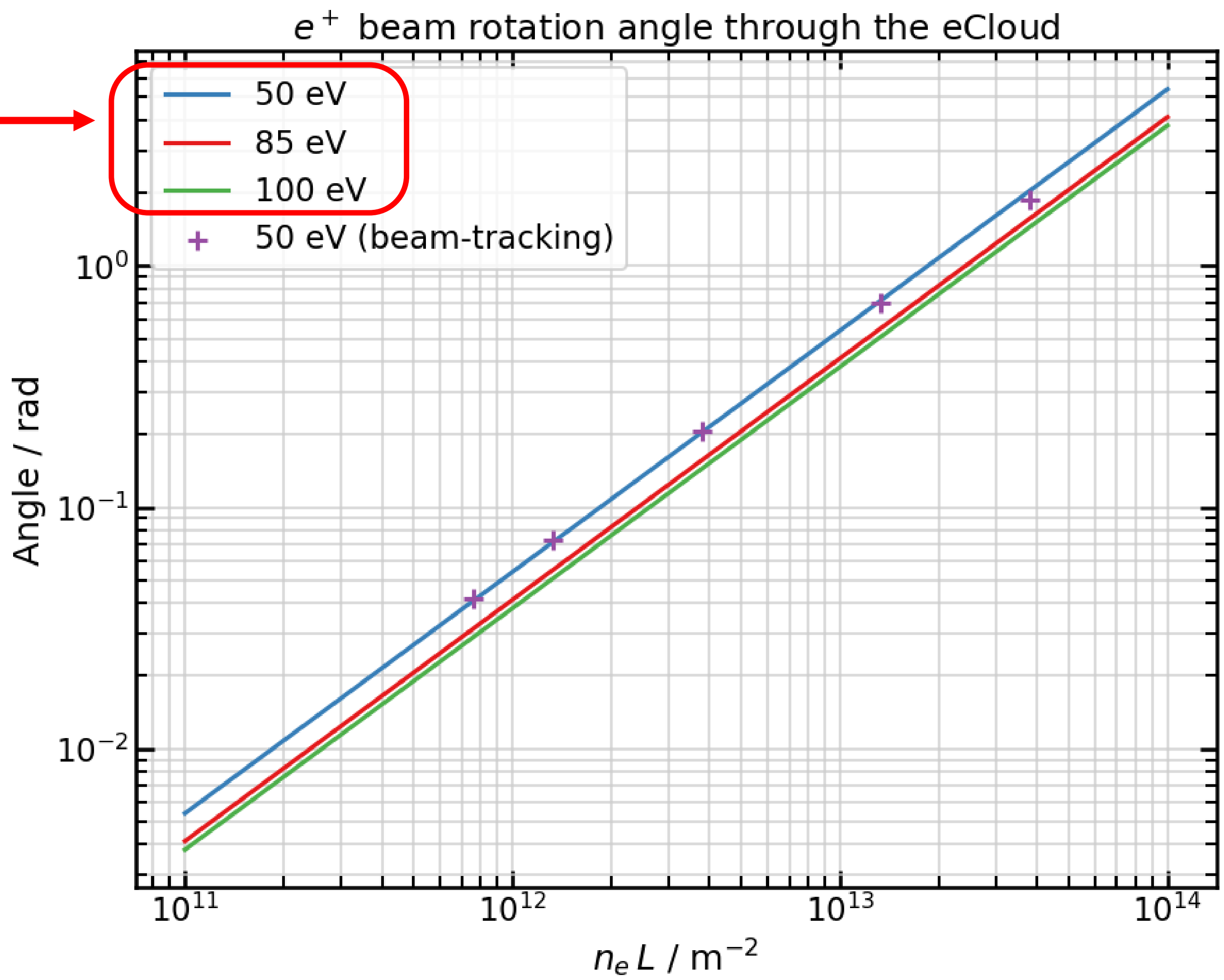
Beam rotation in the e^- cloud

single particle trajectories



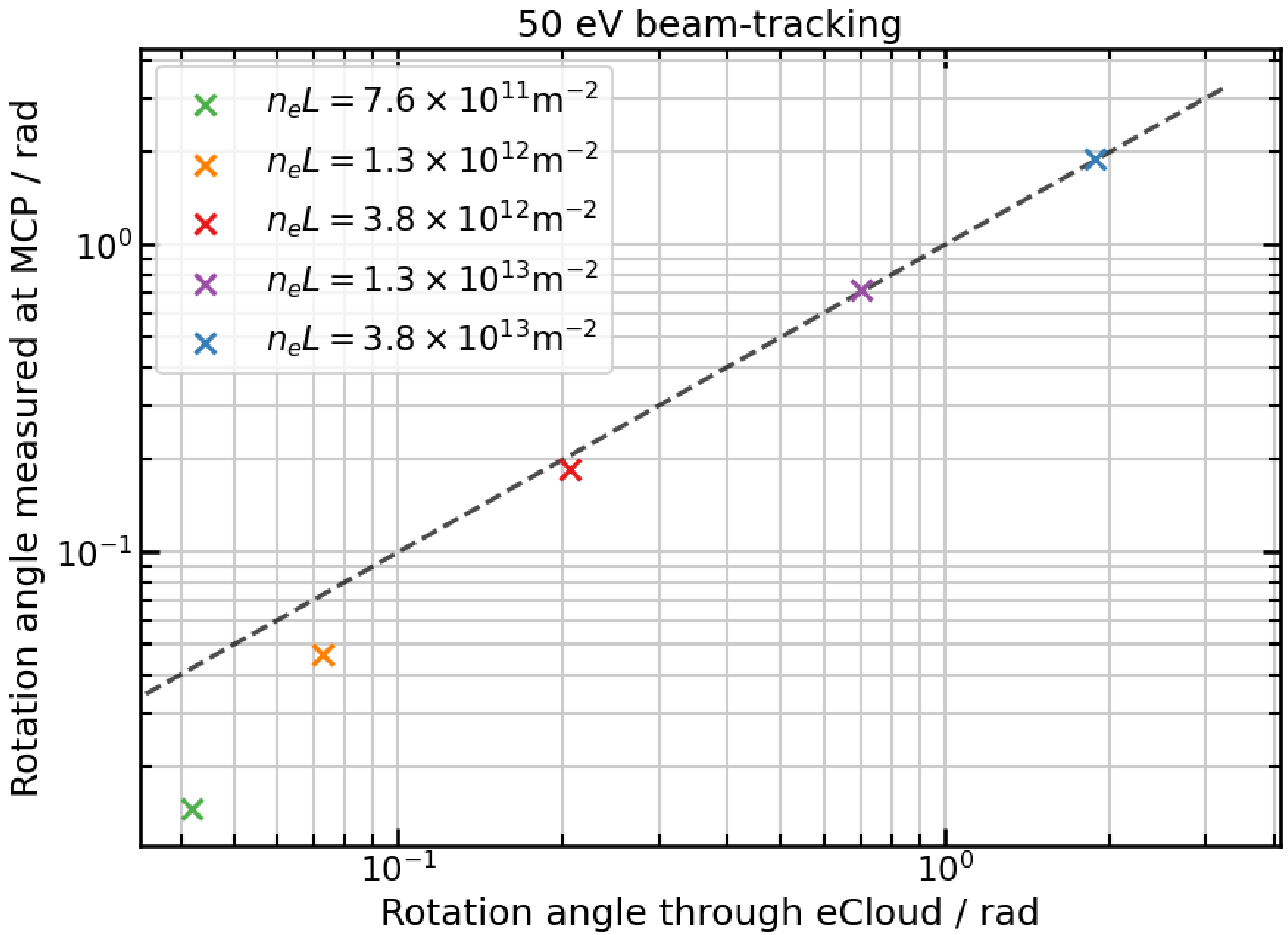
Beam rotation in the e^- cloud

Calculation based on drift velocity of guiding centre of single particle



Beam rotation in the e^- cloud

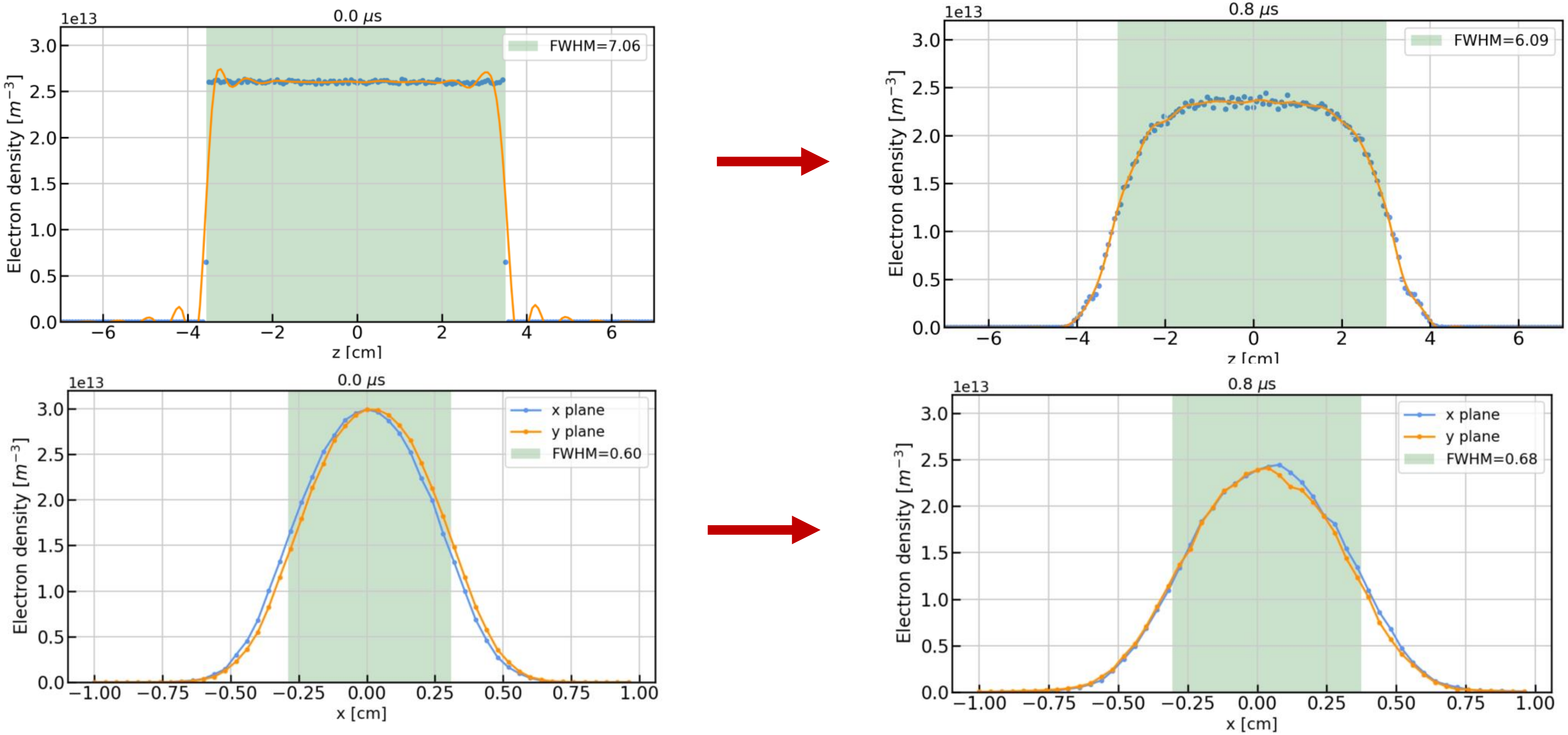
Correlation is 1:1 only at angles above $\approx 10°$



Diocotron motion

Electron plasma initial distribution

(previous simulation)



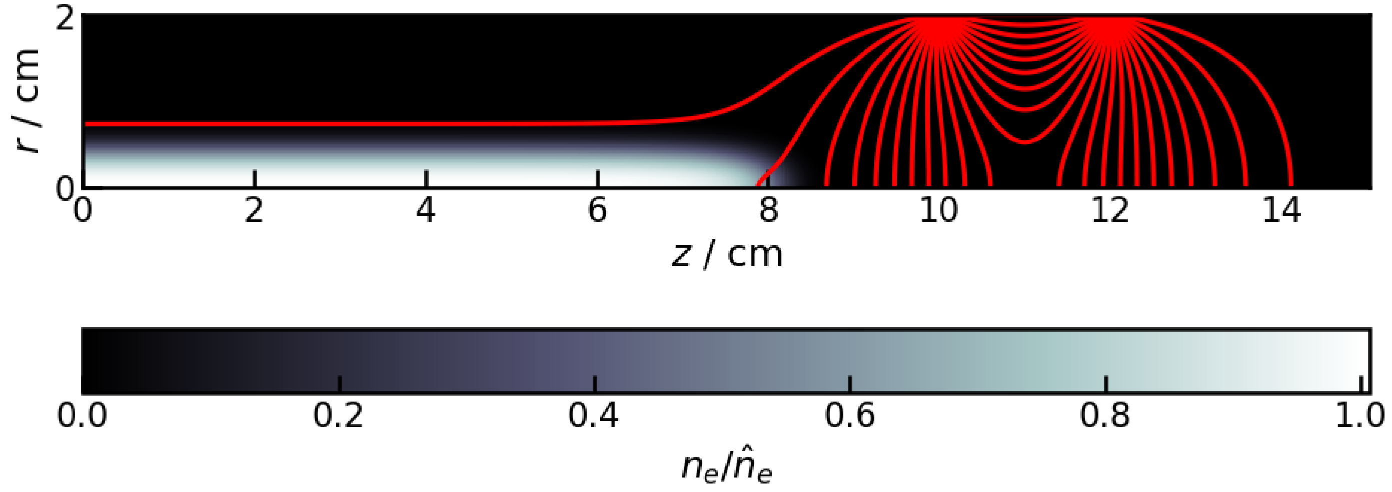
Electron plasma initial distribution

- Solve cylindrically symmetric Poisson equation
- Uniform B field, plasma on-axis
- Newton SOR method on a 2D grid
- Solution fully determined by radius r_p where density falls to half of its central value

$$\nabla^2\phi = -\frac{q}{\epsilon_0} n(r,z) = f(r,\phi)$$

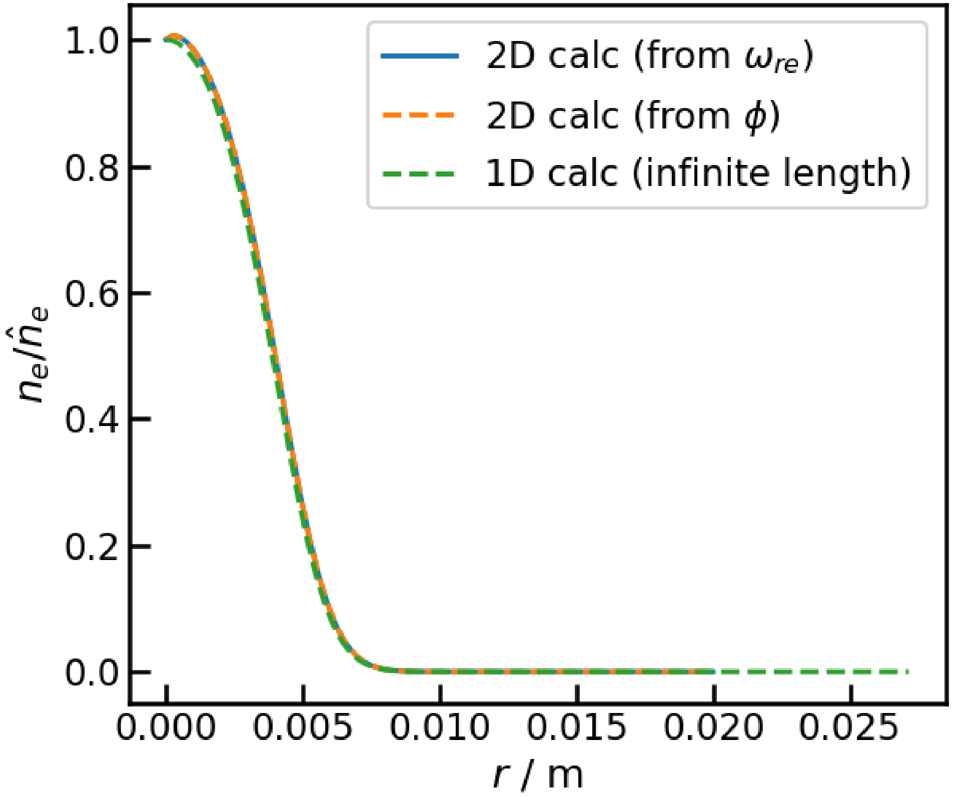
$$f(r,\phi) = -\frac{q n_0}{\epsilon_0} \exp\left(-\frac{q}{kT}(\phi - \phi_{00}) - \alpha r^2\right)$$

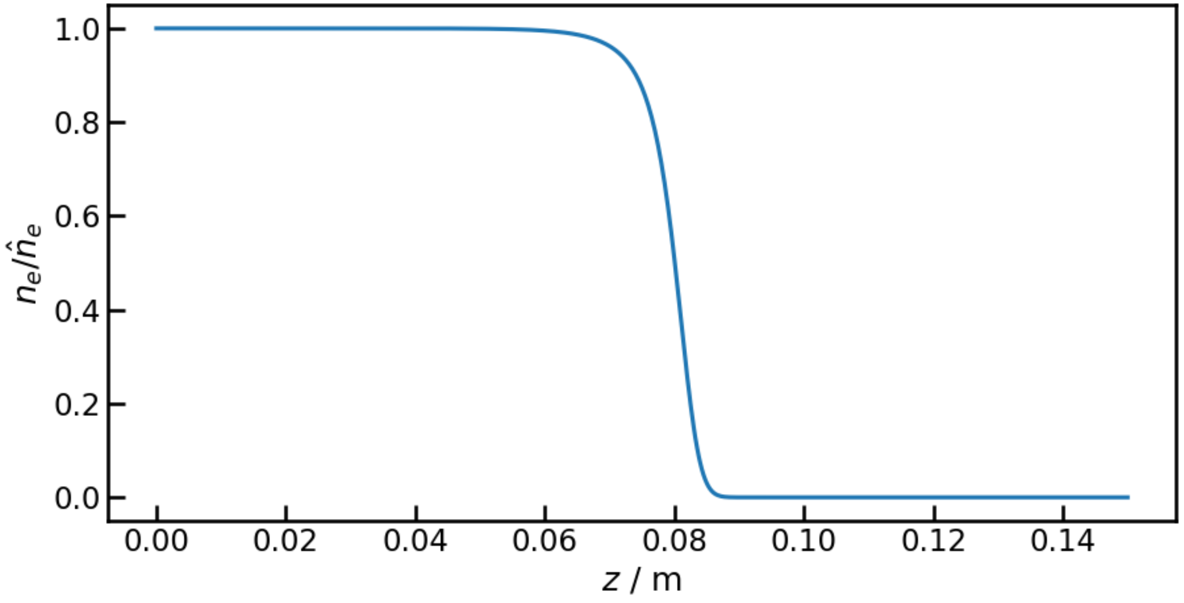
$$\alpha = -\frac{q}{kT r_p^2}(\phi(r_p,0) - \phi(0,0)) + \frac{\ln 2}{r_p^2}$$



https://doi.org/10.1063/1.860594
https://doi.org/10.1063/1.5092136

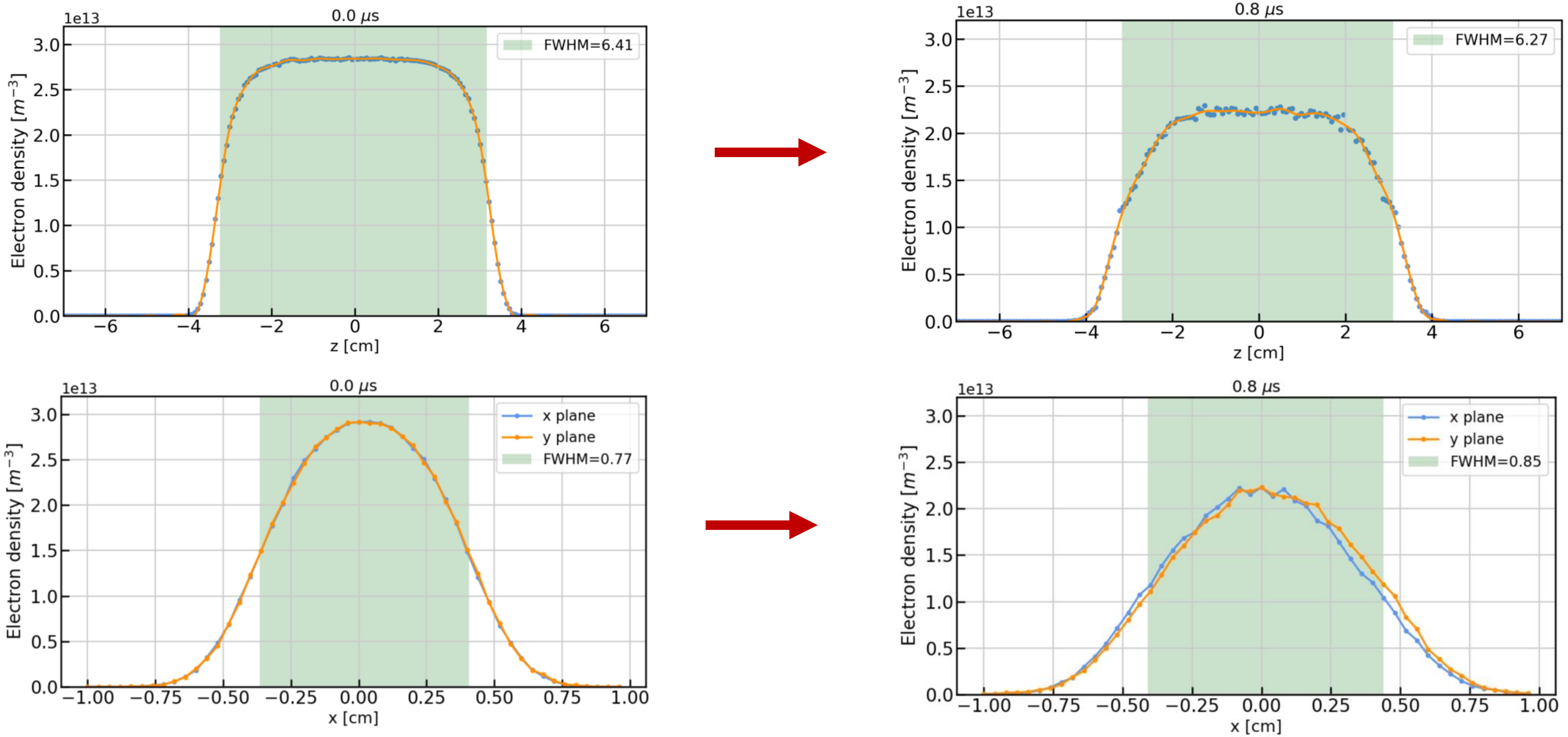
Electron plasma initial distribution





Electron plasma initial distribution

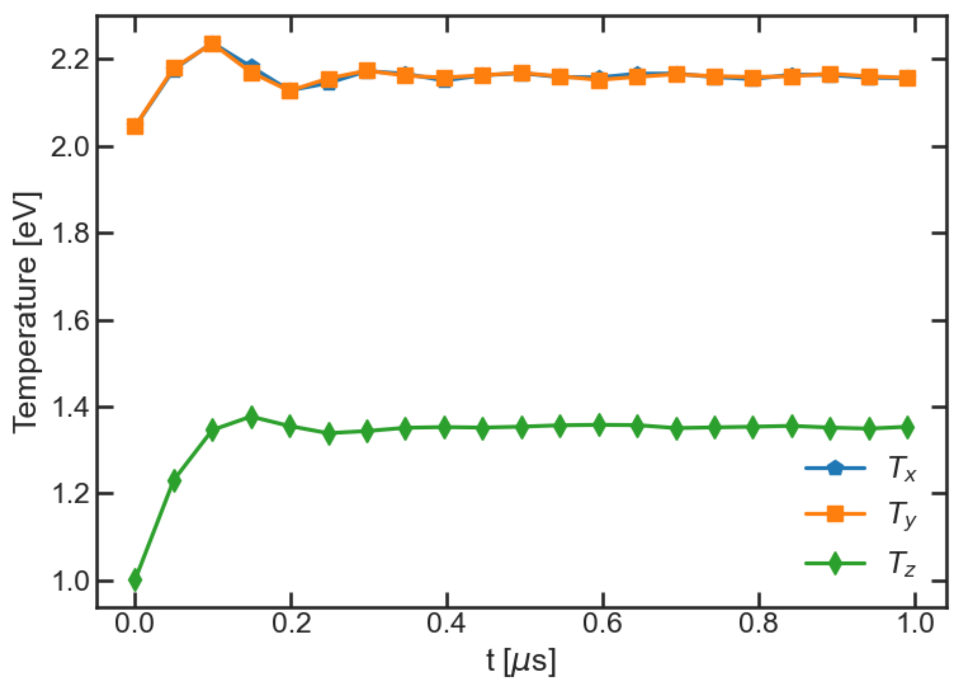
(improved initial distribution)

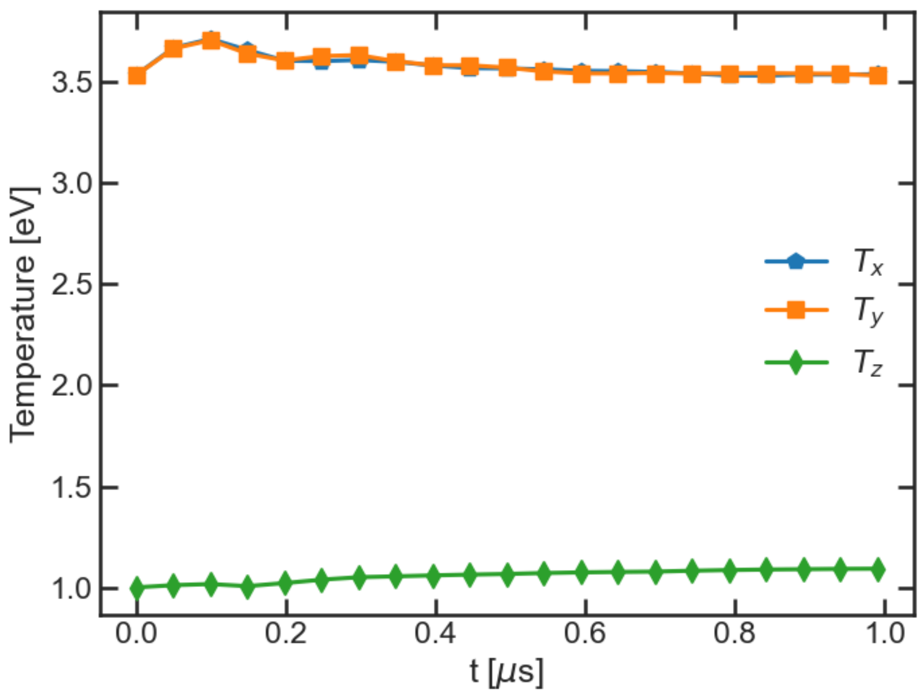


Long. vs Transv. temperatures

- Added elastic collisions between the electrons
  - Cross-section based on Rutherford scattering

(improved initial distrib.)





Collision frequency much smaller than the diocotron frequency