

# Update on VSim simulation

- Plasma dynamics -

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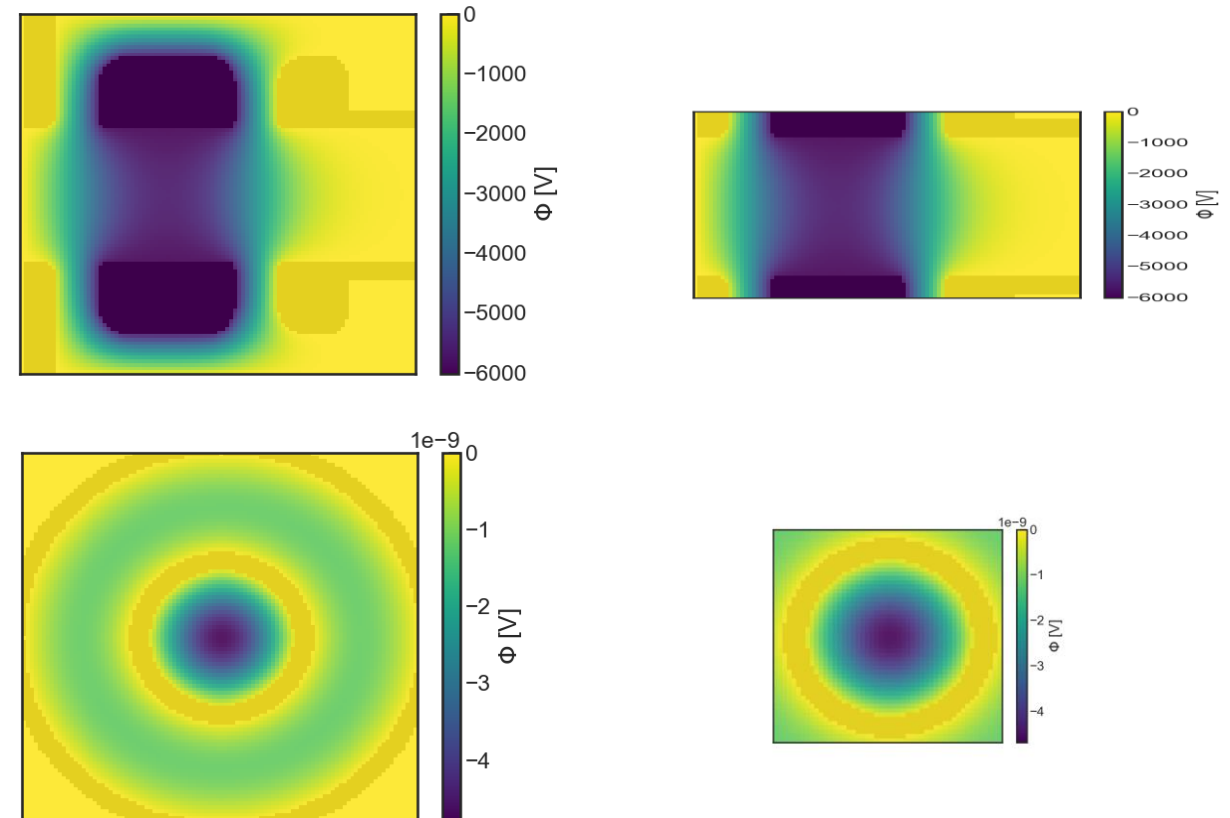
# Grid size reduction

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- Reduce simulation volume by a factor of 4
  - Reduce grid size in x,y by  $\frac{1}{2}$
- Set boundary conditions (BC)
- Assumption: the plasma dynamics does not significantly change the value of the electrostatic potential on the boundary
  - Step 1: simulate the full volume at  $t = 0$  with proper BC
  - Step 2: use the electrostatic potential obtained from Step 1 to set the BC on the surface of the reduced grid

# Grid size reduction

- Verify the method
  1. Without the plasma
    - Max. relative error  $\sim 4.8\%$
    - Located in the middle of the anode where the potential is very close to 0 ( $10^{-6}$ - $10^{-9}$ )
  2. With the plasma
    - Max. relative error  $\sim 0.2\%$



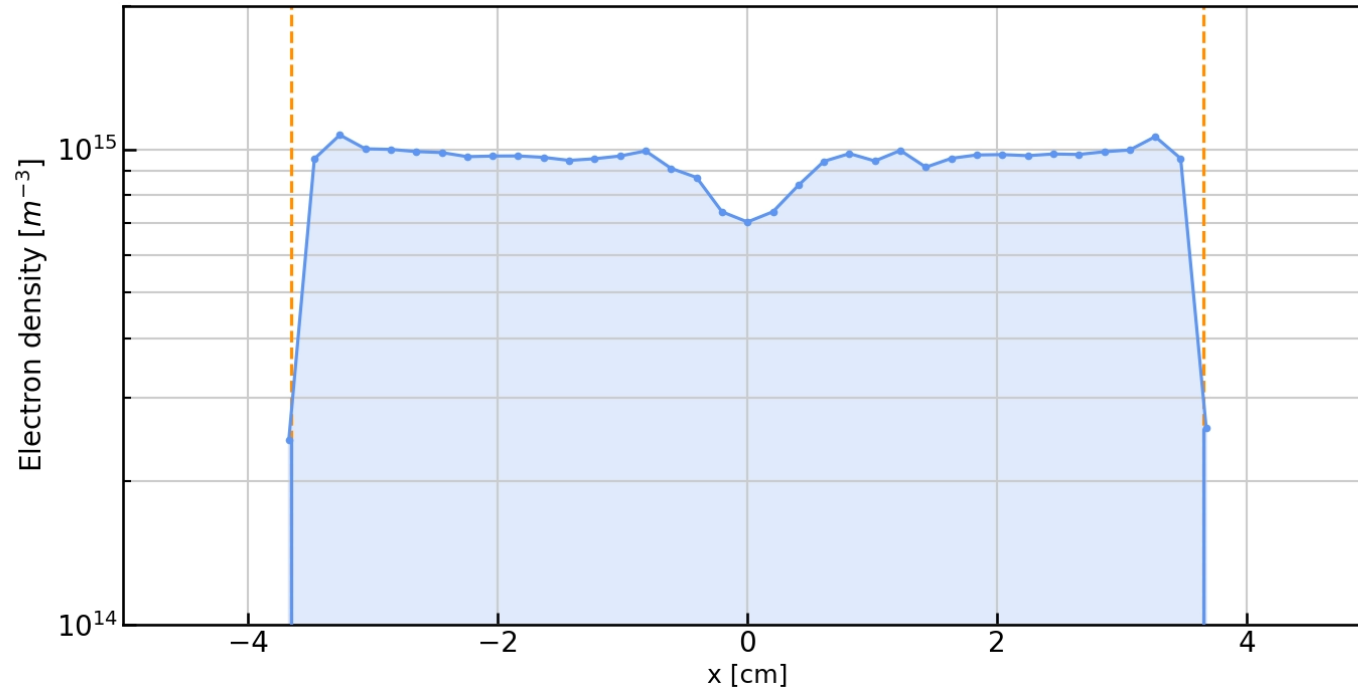
Electrostatic potential obtained with the old (left) and new (right) boundary conditions

# Simulation #4 (parameters)

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- Some of the more important parameters:
  - Electron density  $n_e = 10^{15} \text{ m}^{-3}$
  - External B-field (spatially uniform) – 100 mT
  - Time step  $dt = \text{plasma period} / \text{number of steps per plasma period}$
  - Number of steps per plasma period: 10
  - Number of simulation steps: 5000 (1.75  $\mu\text{s}$ )
    - Grid size: 50 x 50 x 500
    - Macroparticles per cell: 10
  - Cathode voltage - set based on  $n_e$  and the longitudinal confinement condition
- At this stage there is no secondary emission included in the simulation or background gas

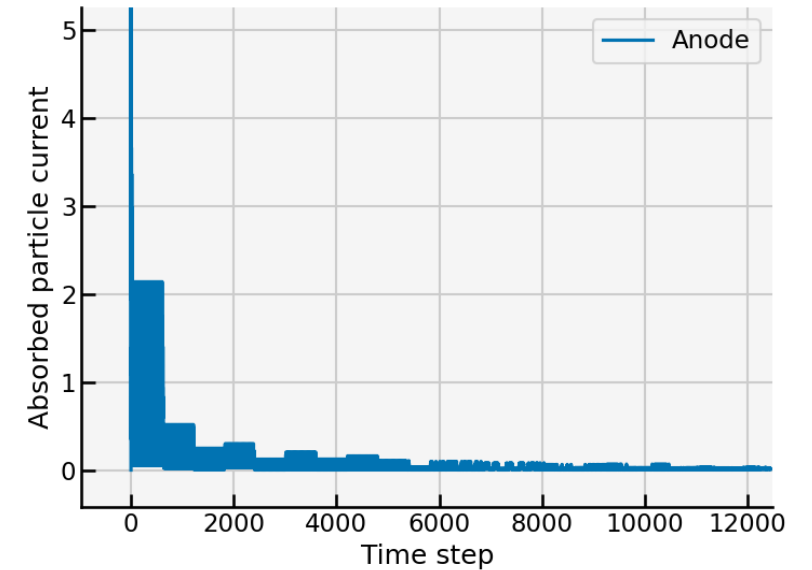
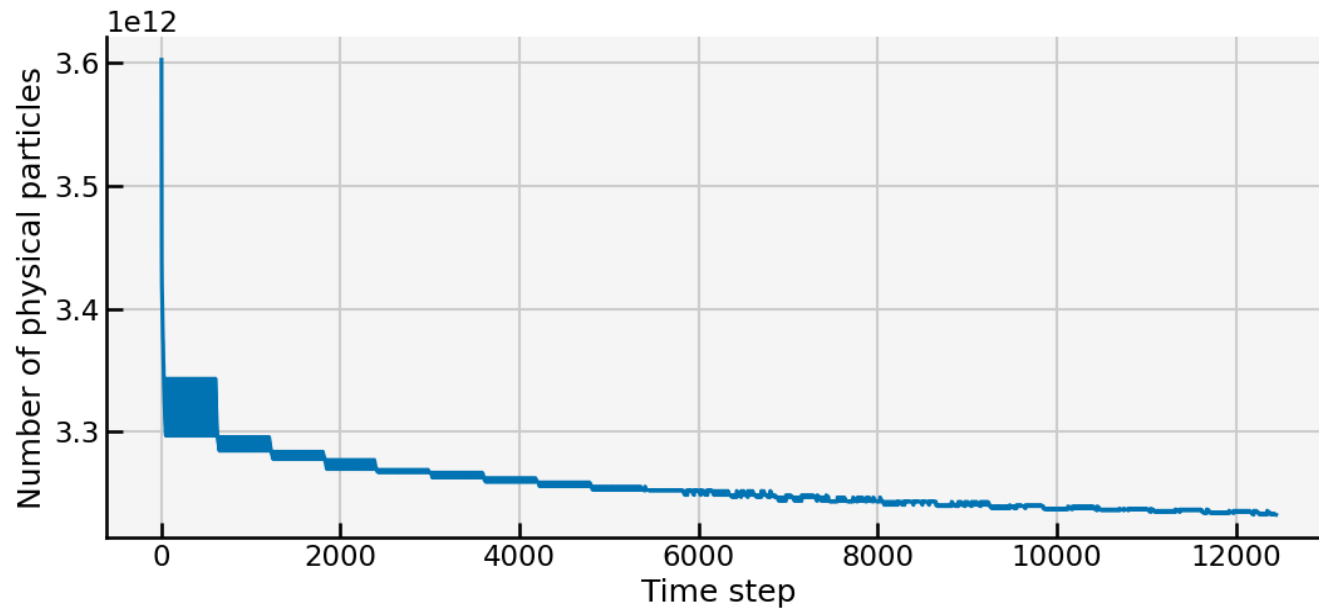
# Electron cloud dynamics



- Simulation stopped after ~ 210 ns
- VSim license on SCARF must be renewed
- Similar density depression observed at the centre as before at final time step (figure above)

# Particle loss

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- The error with dumping particle number and absorbed currents is now fixed
- Step-like structure due to each value being separately dumped by each core used in the simulation (24 cores here)