

# Electrongun

## 1 Overview

- geometry is unchanged from Artem's version
- all computations use the full beamtube (1.5 m)
- plots of the electrostatic potential and electric field exist as well as convergence studies

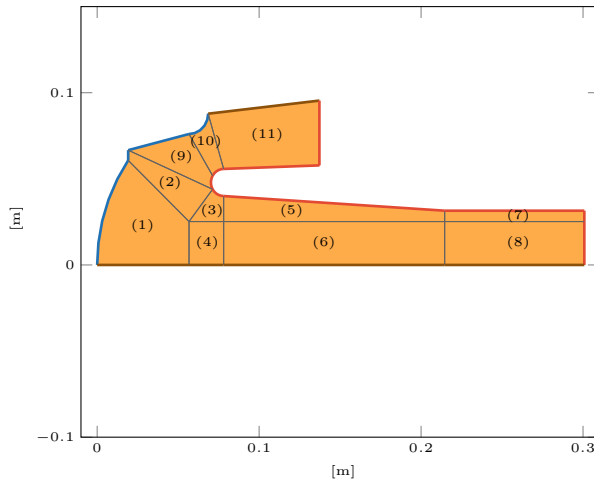


Figure 1: shortened geometry including patches and boundary conditions

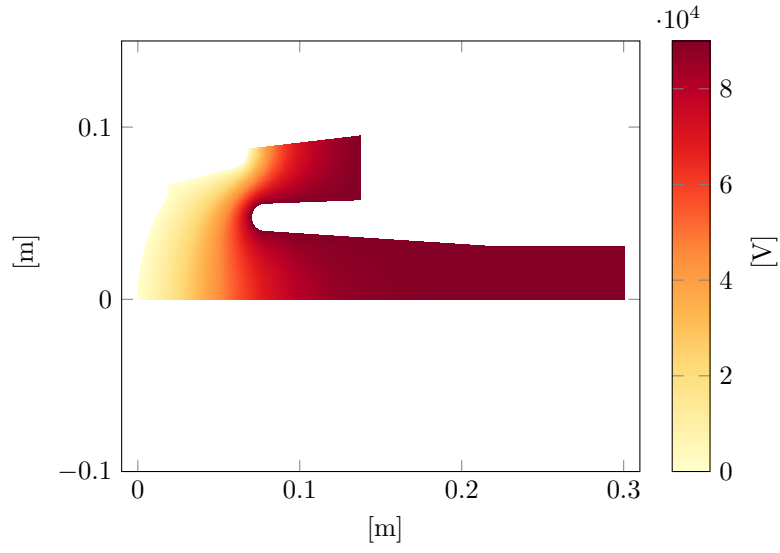


Figure 2: electrostatic potential with degree  $p = 2$  and nsub=8

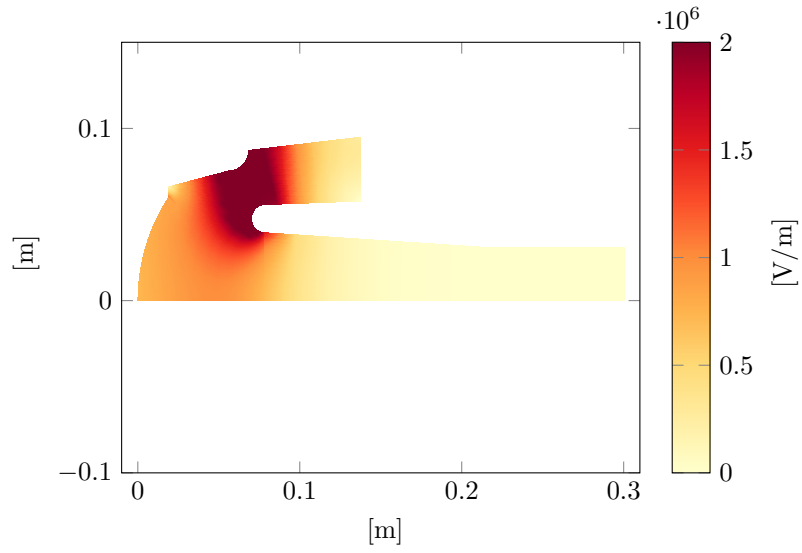


Figure 3: absolute value of electric field with  $p = 2$  and nsub=8

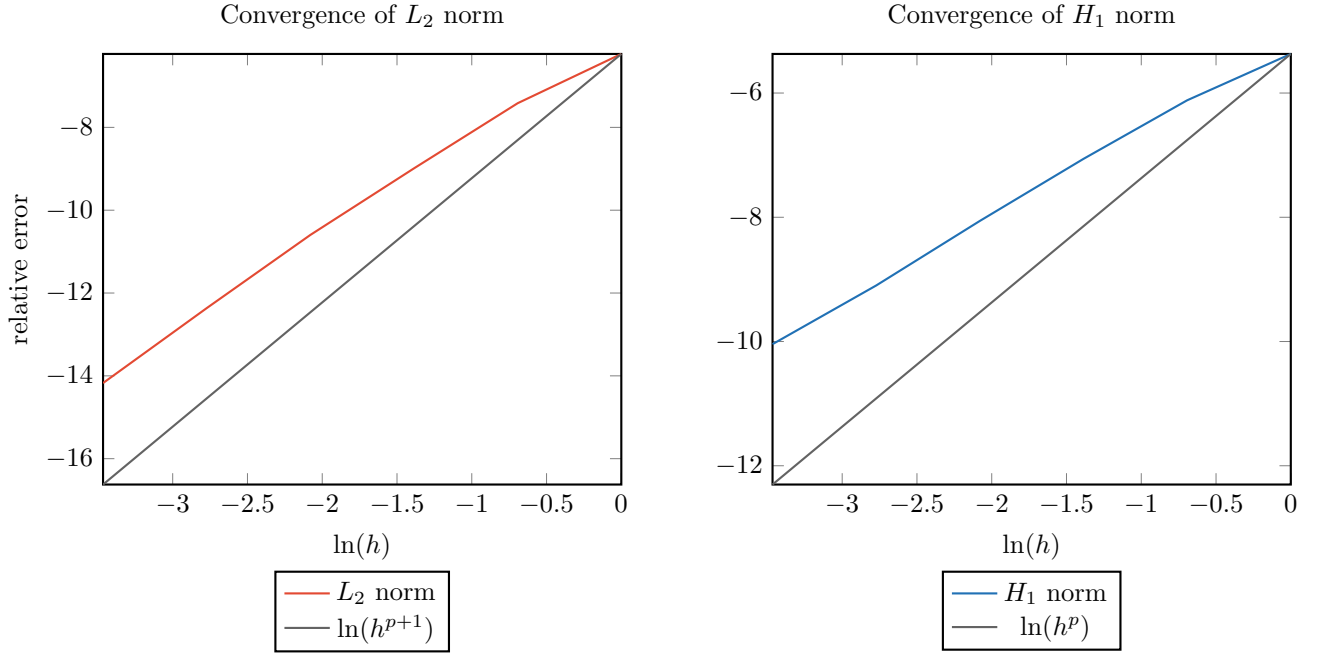


Figure 4: reference uses  $p = 3$  and nsub=64, relative error uses maximum potential/field value

## 2 Tracking

- new implementation for fieldmap computation: hand over  $\Delta_{x,y,z}$  and compute  $h$  as the diagonal of the cuboid
- implementation creates entire 3D fieldmap
- convergence study for time integrator uses same fieldmap throughout
- integrator uses different number of steps in each simulation, thus only approximation of error possible

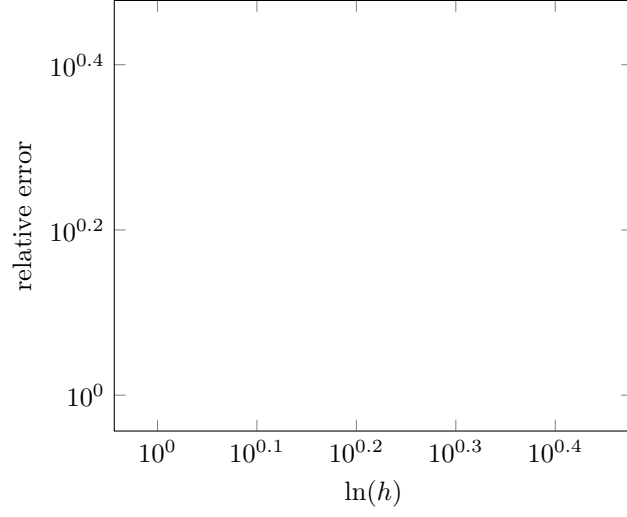


Figure 5: convergence of particle trajectory while refining the grid

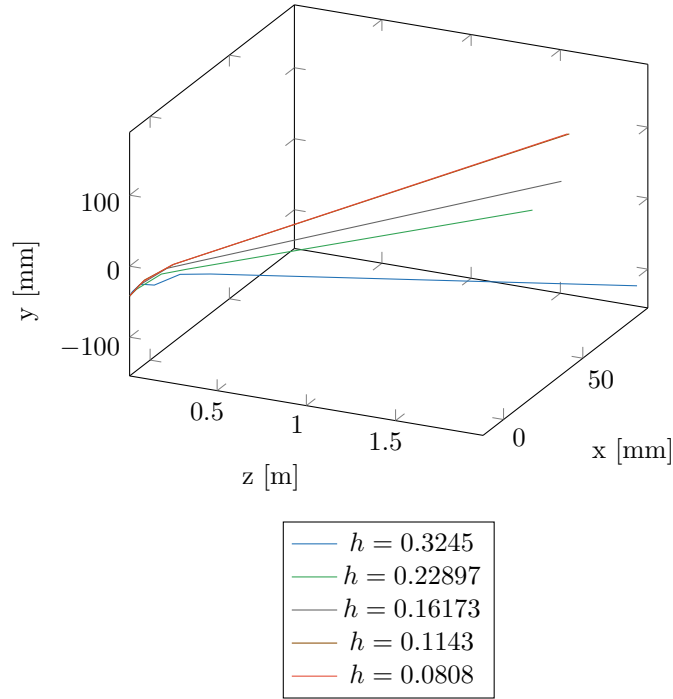


Figure 6: particle trajectories during grid refinement,  $h$  in [m]

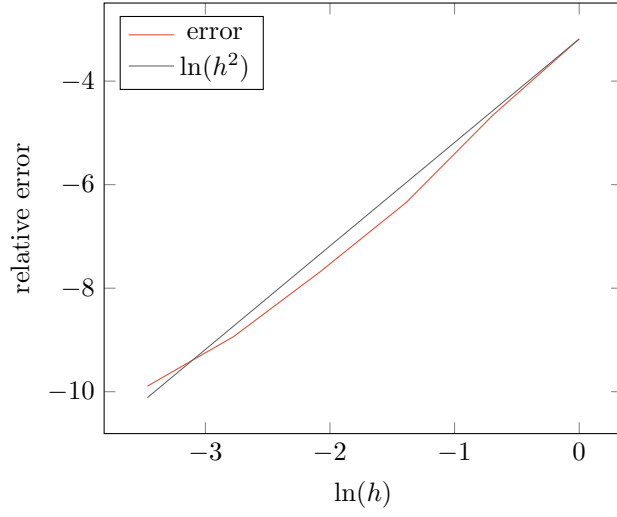


Figure 7: convergence of particle trajectory while decreasing the time step size

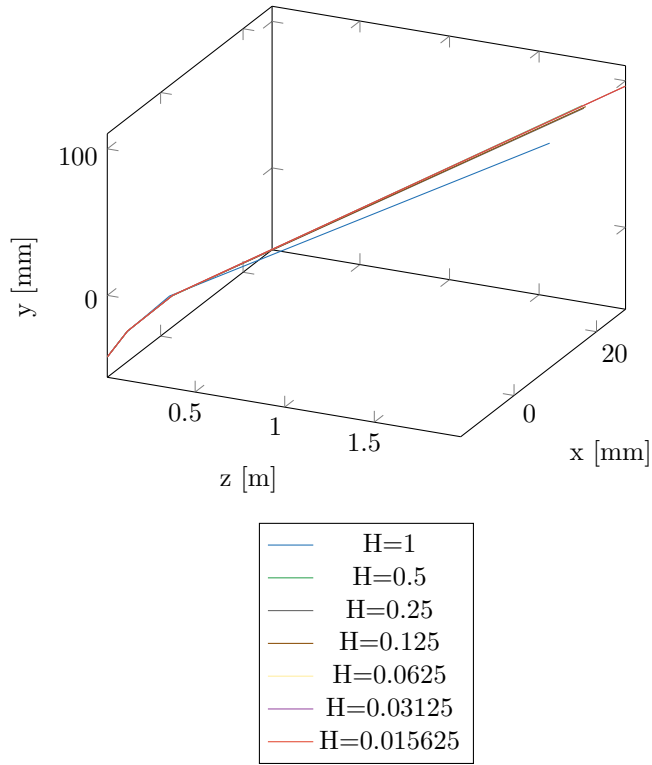


Figure 8: particle trajectories during integrator study,  $H$  in [ns]

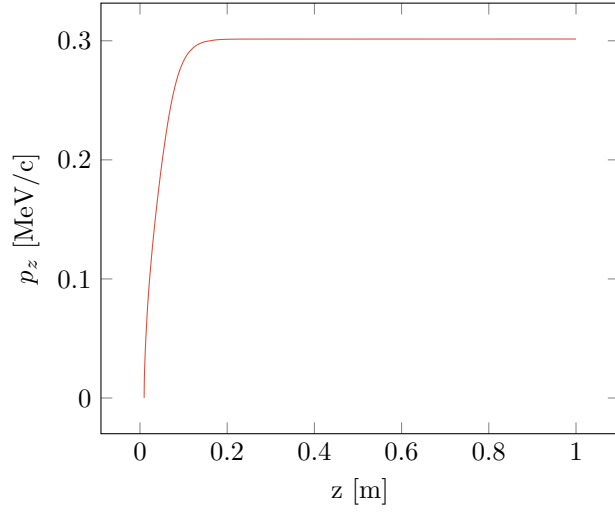


Figure 9: longitudinal momentum of particle during simulation

- emission is handled on my side, either uniformly or normally distributed particles
- both types depend on multiple parameters: total charge  $Q$ , number of particles  $N_{prt}$ , position of probe particles and also bounds for uniform or  $\mu, \sigma$  for normal distribution
- emission is performed based on the rotated 2D cathode

### 3 Optimization

- cost function uses outermost beam minimum, distance of beam minima and radial derivatives of minima
- extra constraint to force continuity at (0,0)
- start with straight cathode
- only load the geometry once and manipulate control points (increase number of control points with each optimization cycle)