Electrongun

1 Overview

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

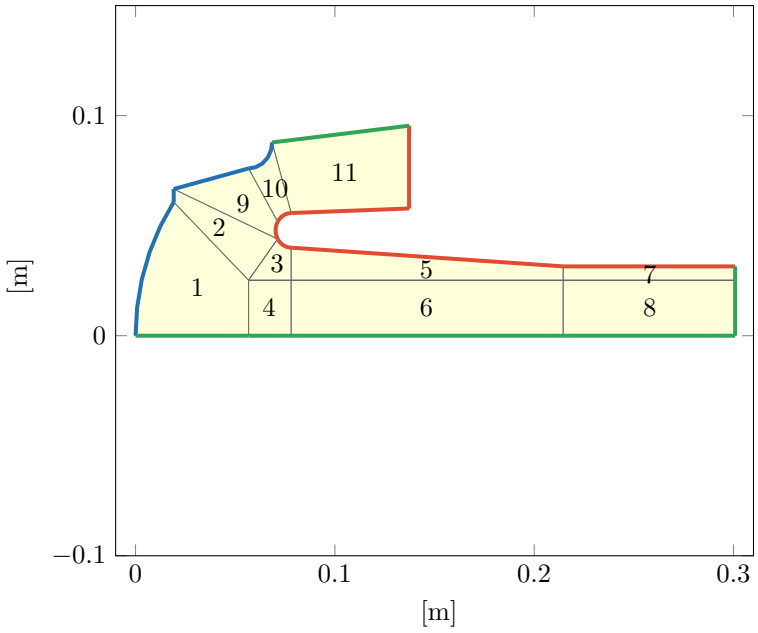

Figure 1: shortened geometry including patches and boundary conditions

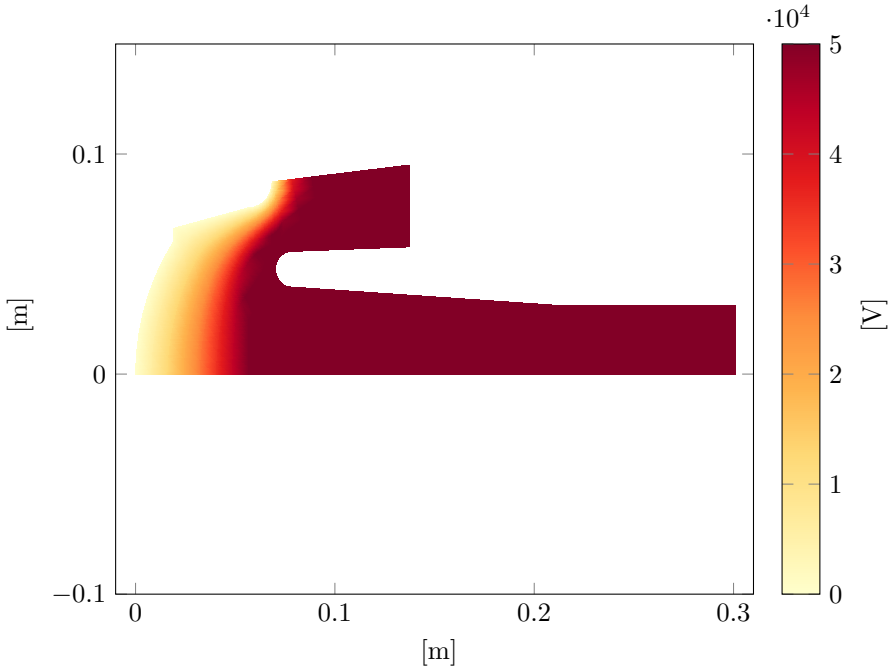

Figure 2: electrostatic potential with degree $p = 2$ and nsub=8

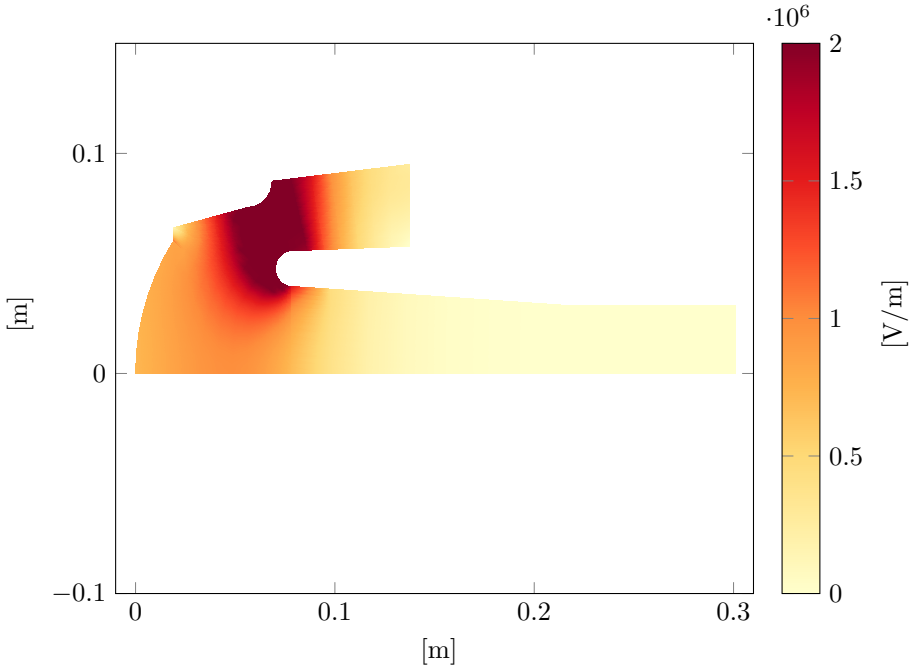

Figure 3: absolute value of electric field with $p = 2$ and nsub=8

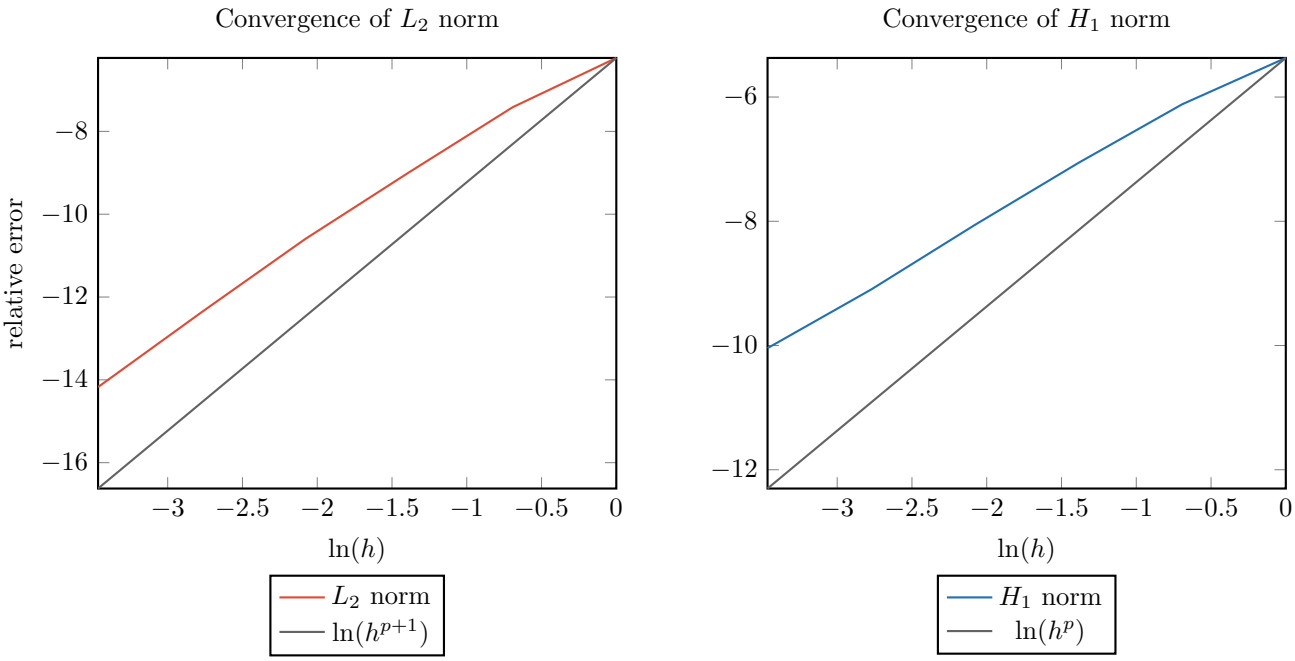

Figure 4: reference uses $p = 3$ and nsub=64, relative error uses maximum potential/field value

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

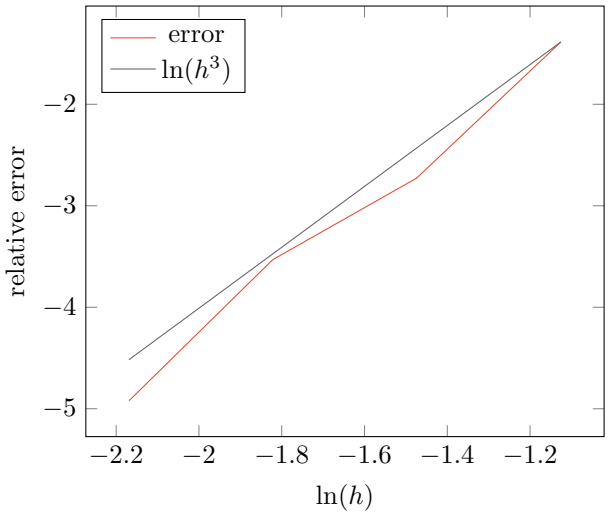

Figure 5: convergence of particle trajectory while refining the grid

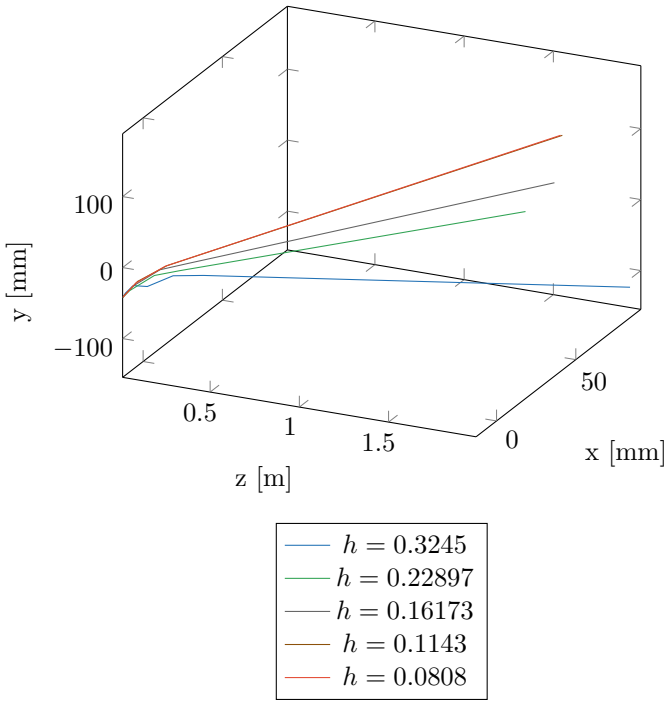

Figure 6: particle trajectories during grid refinement, h in [m]

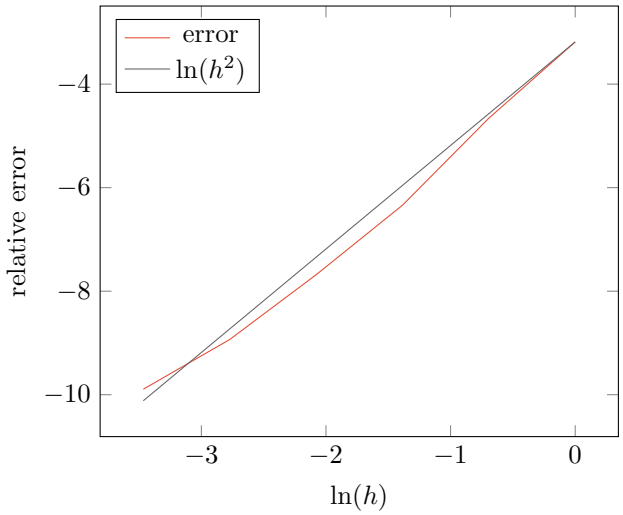

Figure 7: convergence of particle trajectory while decreasing the time step size

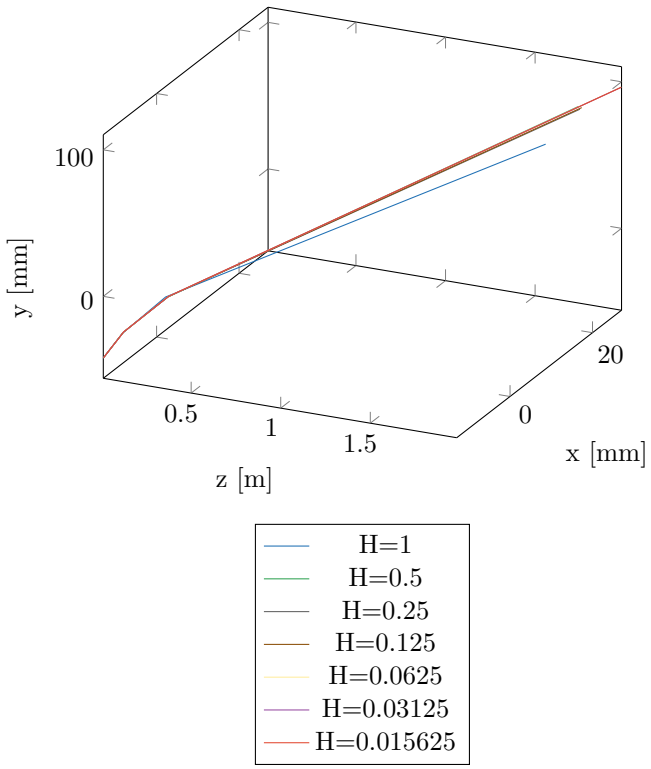

Figure 8: particle trajectories during integrator study, H in [ns]

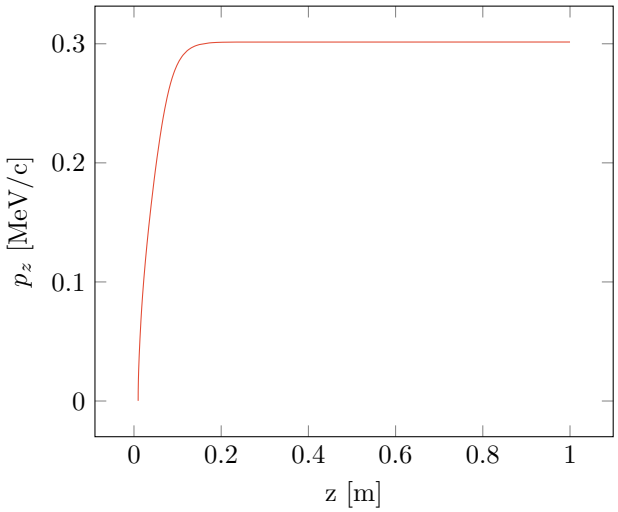

Figure 9: longitudinal momentum of particle during simulation

- 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 μ, σ 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)