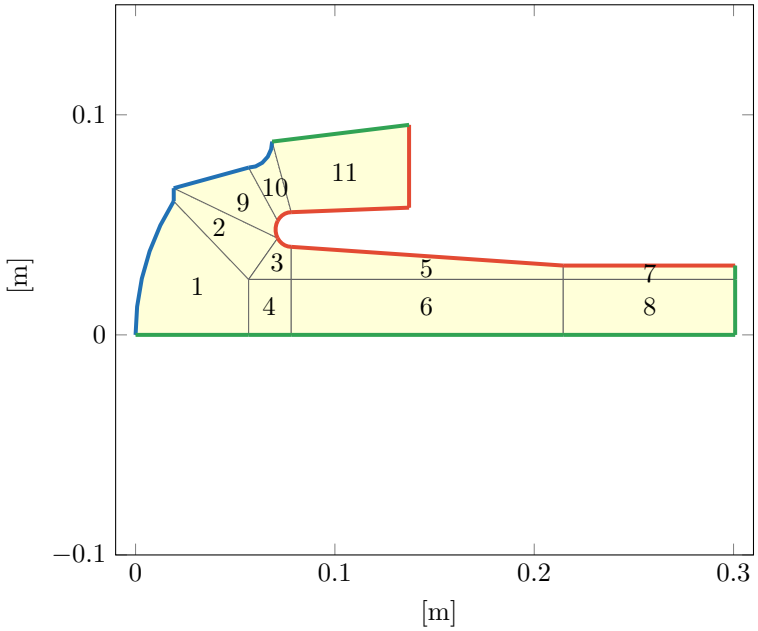
Electrongun

1 Overview

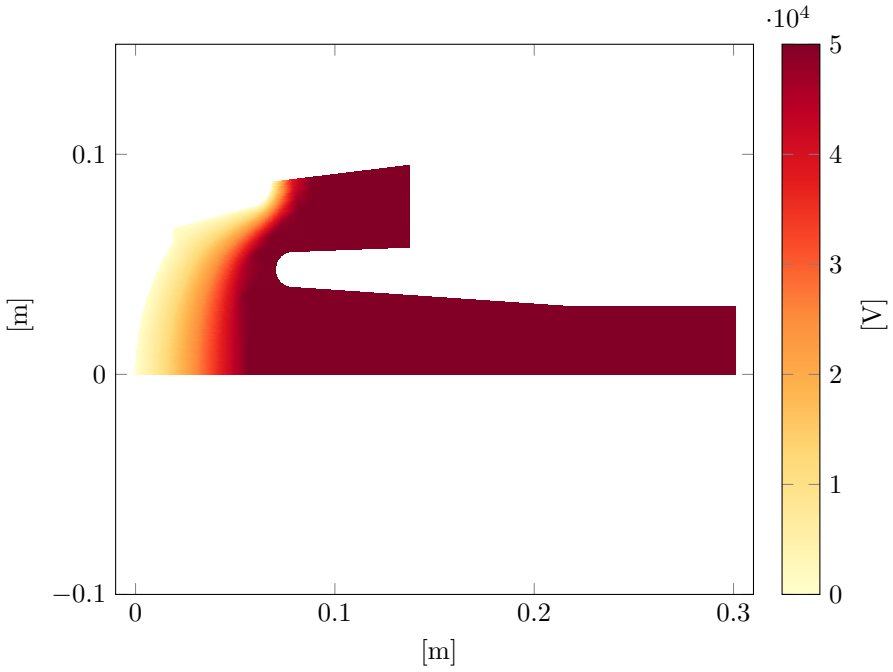
- geometry is unchanged from Artem's version
- all compuations use the full beamtube (1.5 m)



- electrostatic potential using $p = 2$ and $nsub = 8$

- absolute value of the electric field using $p = 2$ and $nsub = 8$

- convergence studies for the electrostatic potential and the electric field
- the reference uses $p = 3$ and $nsub = 64$
- the relative error is computed using the maximum field value



2 Tracking

- new implementation for fieldmap computation: hand over $\Delta_{x,y,z}$ and compute h as the diagonal of the cuboid
- choose $N_{x,y,z}$ such that the desired domain is fully enclosed
- repeat convergence study by simultaneously decreasing Δ by 2^{-n}
- do this for full 3D fieldmap right away (only compute one quadrant and take care of the duplicate entries at the interfaces)
- 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
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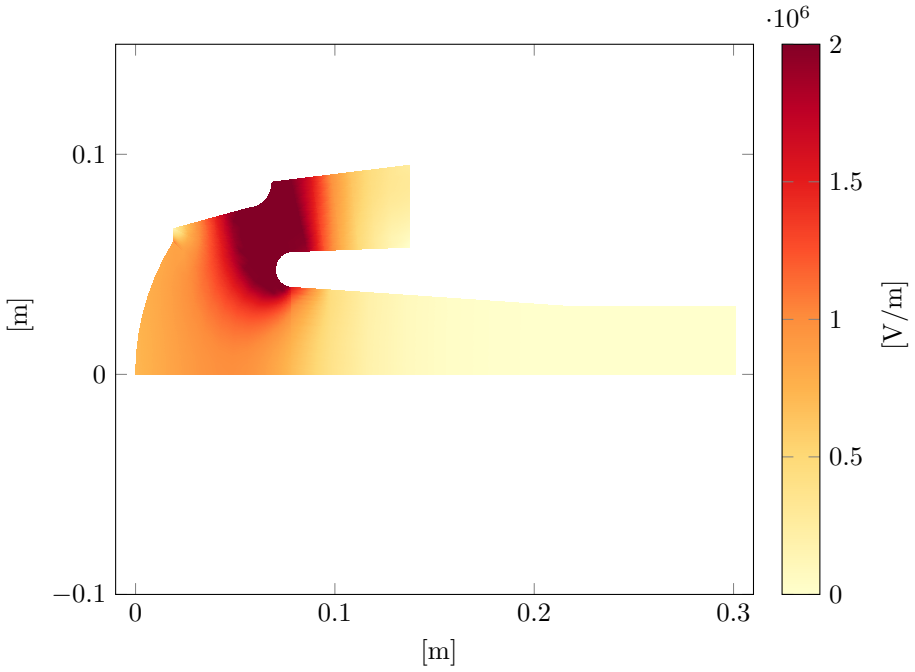
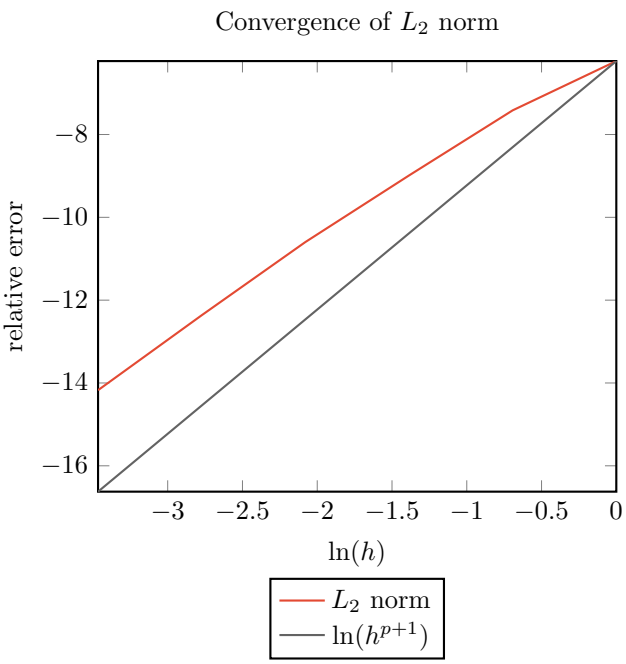
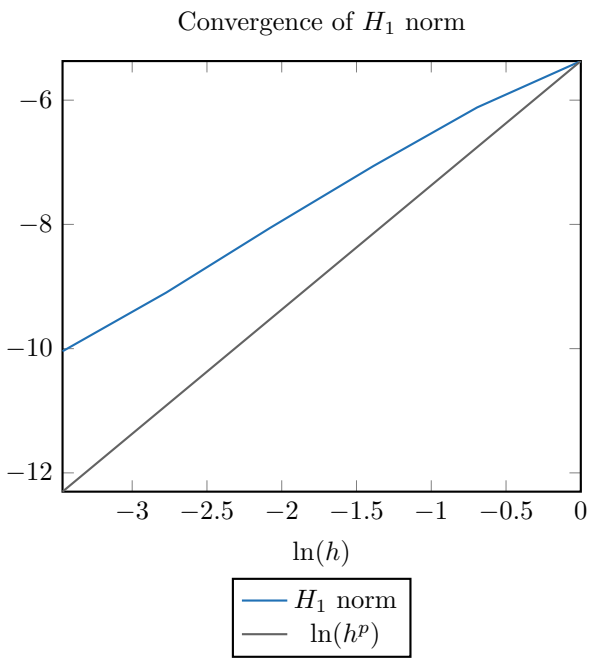
3 Optimization

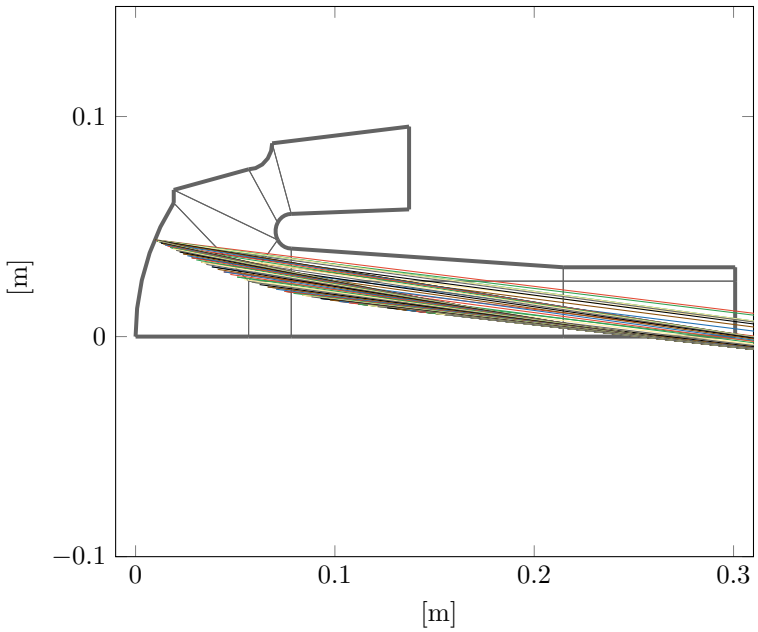
- cost function uses outermost beam minimum, distance of beam minima and radial derivatives of minima
- extra constraint to force continuity at (0,0)



- start with straight cathode
- only load the geometry once and manipulate control points (increase number of control points with each optimization cycle)


Convergence of L_2 norm
relative error
−8
−10
−12
−14
−16
−3
−2.5
−2
−1.5
−1
−0.5
0
ln(h)
L_2 norm
ln(h^{p+1})


Convergence of H_1 norm
−6
−8
−10
−12
−3
−2.5
−2
−1.5
−1
−0.5
0
ln(h)
H_1 norm
ln(h^p)


0.1
0
−0.1
[m]
0
0.1
0.2
0.3
[m]