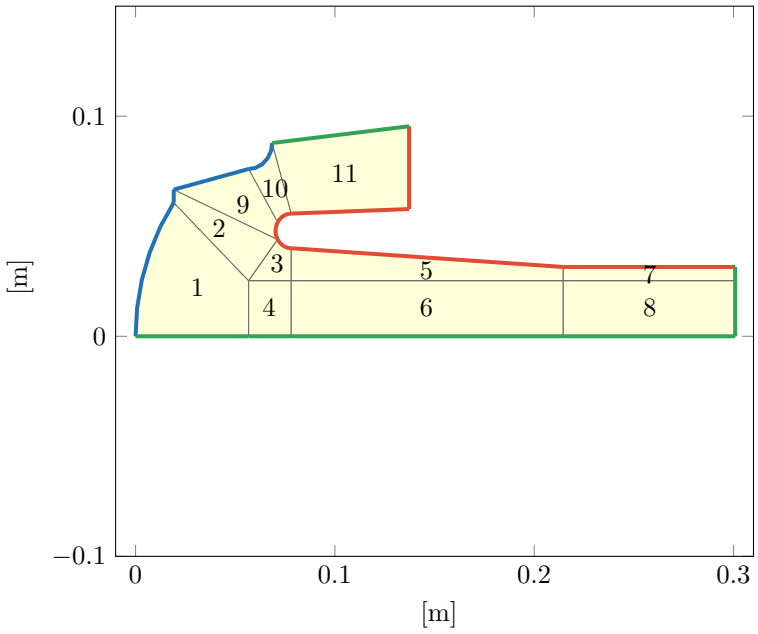
Electrongun

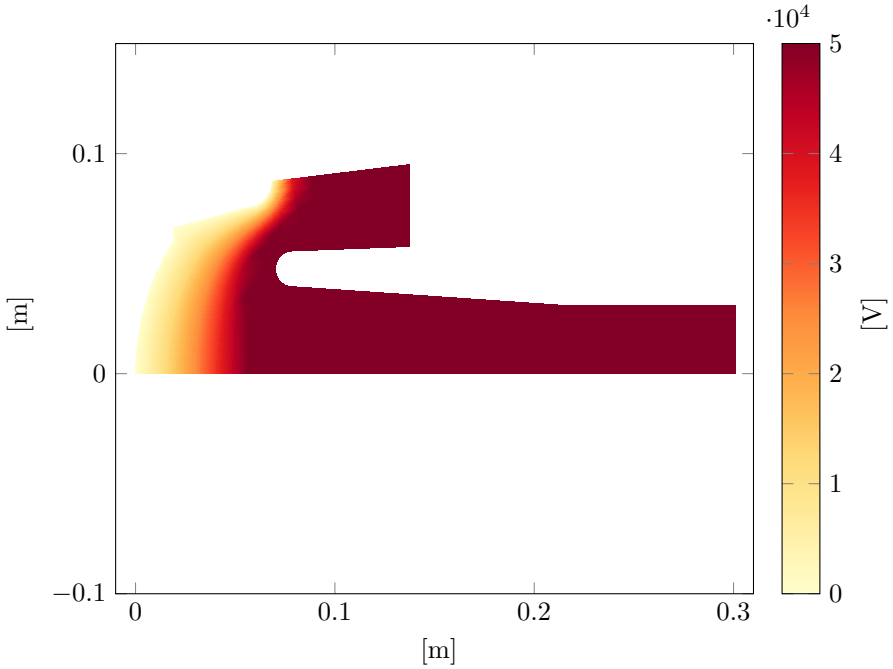
1 Overview

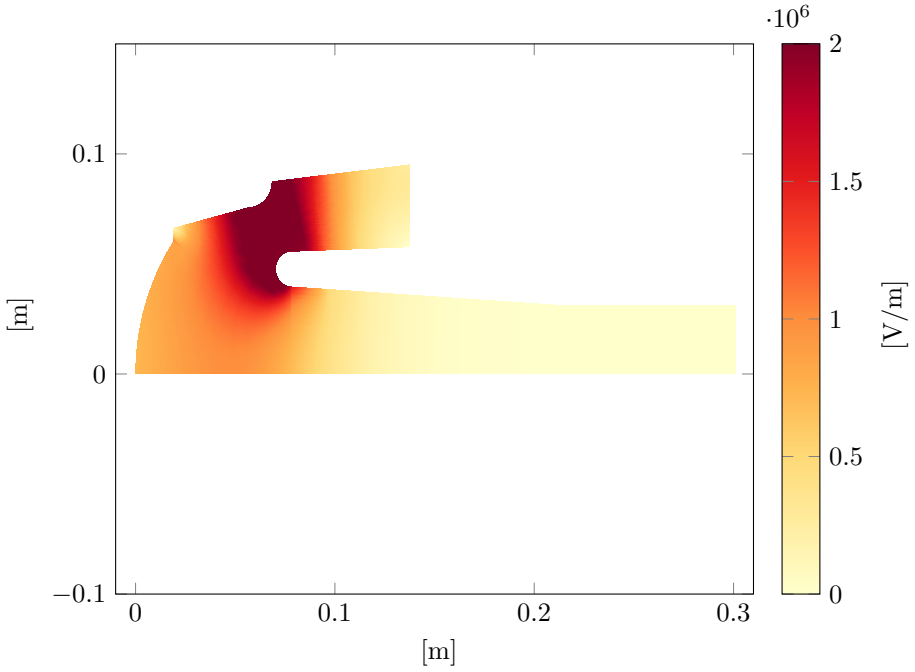
- fieldmap uses equidistant points, may improve if the cathode part has higher resolution, show fieldplots in Astra
- maybe choose the points explicitly to obtain sufficient accuracy
- only 3D field maps with nonzero entries in every coordinate direction allowed, current solution uses two very small steps in x-direction
- fieldmap could be mirrored for 3D (only compute one quadrant and take care of the duplicate entries at the interfaces)

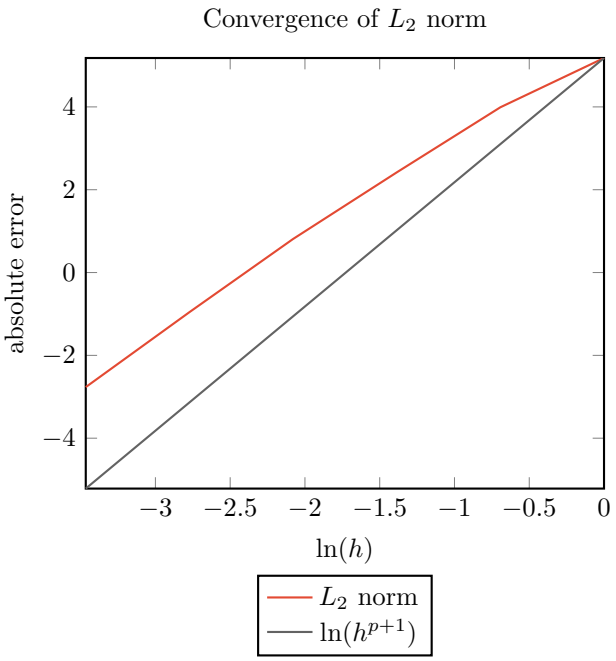
2 Tracking

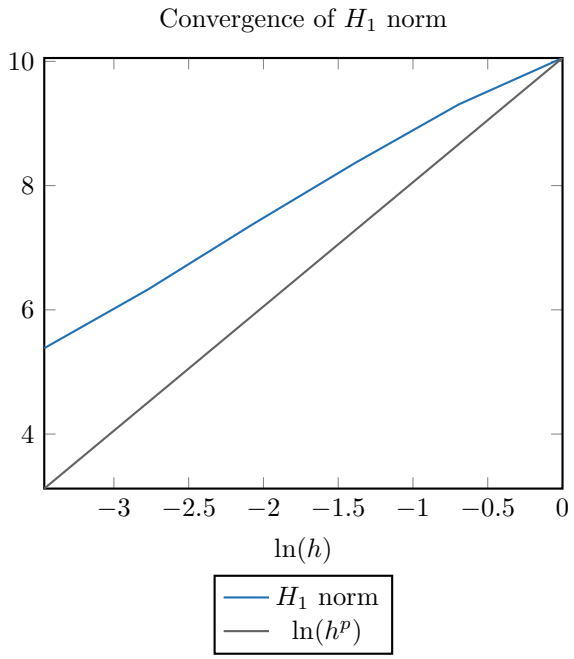
- emission is handled on my side, either uniformly or normally distributed particles
- both types depend on multiple parameters: total charge Q, number of particles N_{prt}, position of probe particles and also bounds for uniform or μ, σ for normal distribution
- none of the parameter combinations have produced ideal results yet, show tracks
- I tried emission over time span, sharply increases computation time and did not yield different results (maybe try almost constant emission over a very short time span 0.1ns or even shorter)
- space charge is included with planar mirror plane (may be improved by approximating our cathode geometry and using the referenced paper, only works for 2D!)
- inclusion of solenoid and 3D tracking should be possible (don't know the computational cost yet)
- start with straight cathode, show tracks also for this case!

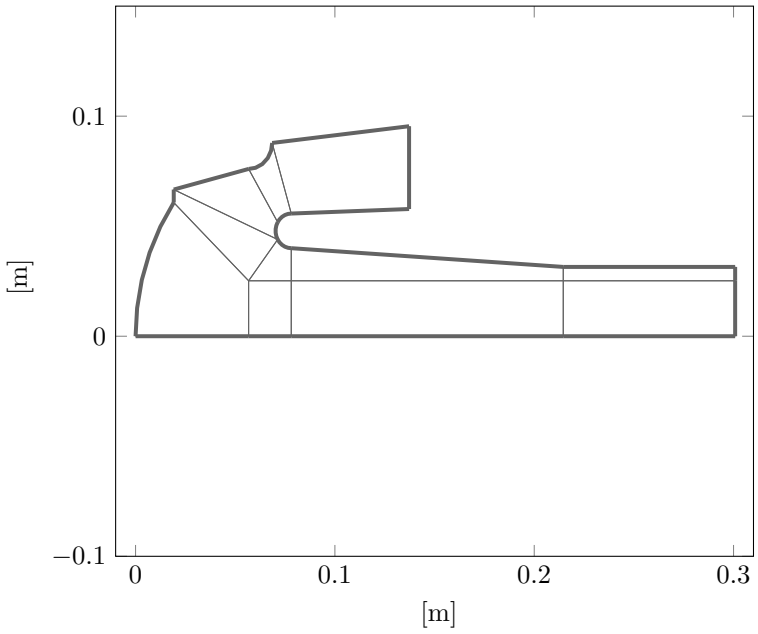

0.1
0
−0.1
[m]
0
0.1
0.2
0.3
[m]
1
2
3
4
5
6
7
8
9
10
11


·10^4
5
4
3
2
1
0
[V]
0.1
0
−0.1
[m]
0
0.1
0.2
0.3
[m]


·10^6
2
1.5
1
0.5
0
[V/m]
0.1
0
−0.1
[m]
0
0.1
0.2
0.3
[m]


Convergence of L_2 norm
absolute error
4
2
0
−2
−4
−3
−2.5
−2
−1.5
−1
−0.5
0
ln(h)
L_2 norm
ln(h^{p+1})


Convergence of H_1 norm
10
8
6
4
−3
−2.5
−2
−1.5
−1
−0.5
0
ln(h)
H_1 norm
ln(h^p)



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
- how to correctly manipulate control points to only load the geometry once (increase number of control points with each optimization cycle)