

An App for Calculating the Electric Field outside Electrical Installations

Nils Lavesson

ABB Corporate Research, Power Devices, Forskargränd 7, 72178 Västerås, Sweden

Introduction: Requirements on electric fields near electrical installations, in areas where people are allowed access, are becoming more common. Here the low frequency case is considered, where the verification is done mainly through simulation. An app is constructed to allow easy integration into the design process.



Figure 1. An ABB shunt capacitor bank.

Methods: Low frequency electric fields can be simulated using the electrostatic module. A parametric 2D axisymmetric geometry with one tower and two fences is constructed and implemented in an app. The geometry covers the most common cases and is a good approximation to the full 3D geometry.

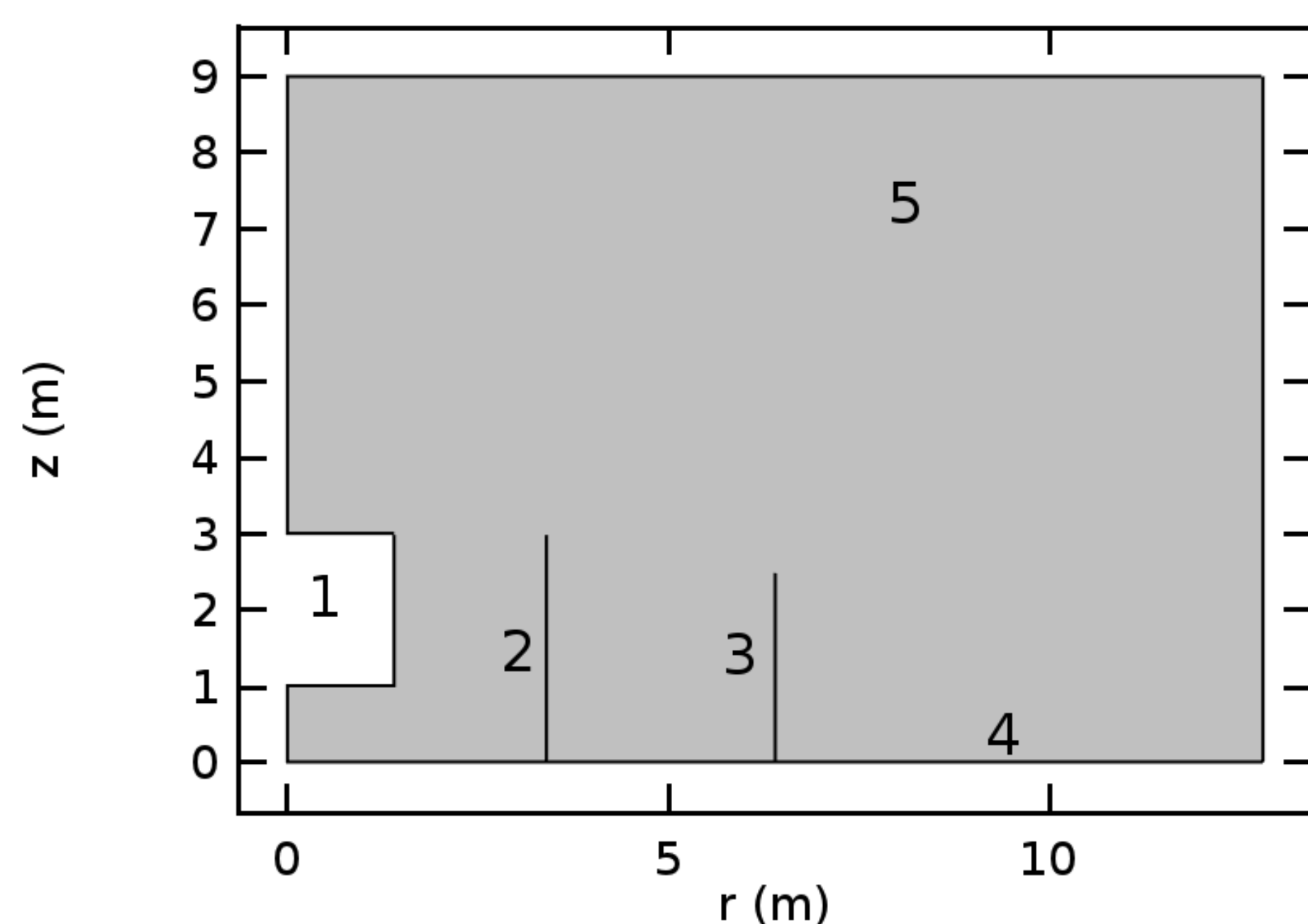


Figure 2. Simplified 2D geometry. (1) electrical components, (2-3) fence, (4) ground and (5) air box.

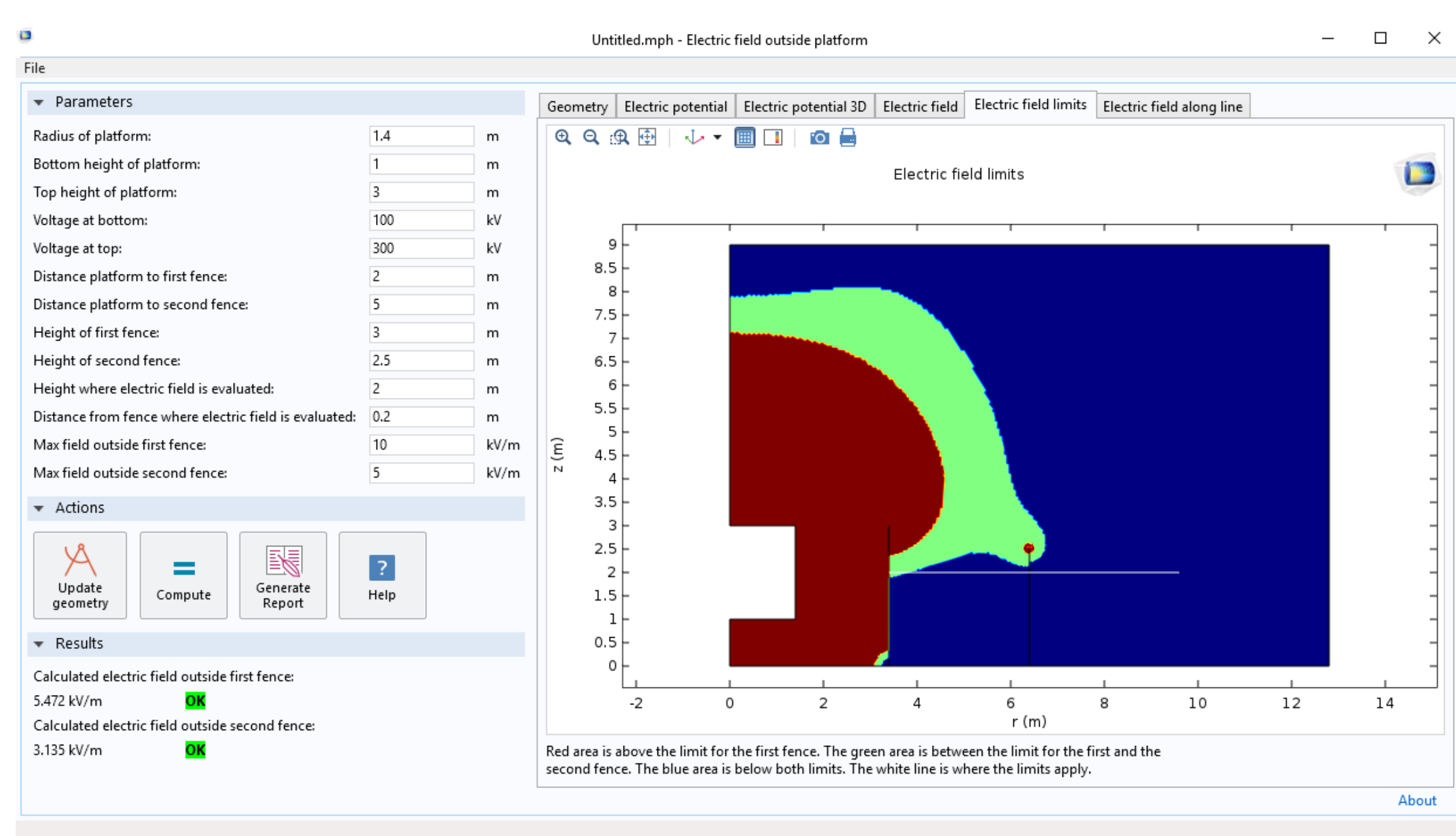


Figure 3. Snapshot of the app.

Results: The 2D parametric geometry is validated by comparing the results to a 3D geometry. A slight loss of accuracy is seen, while a careful choice of parameters guarantees that the 2D results slightly exceed those from the 3D model.

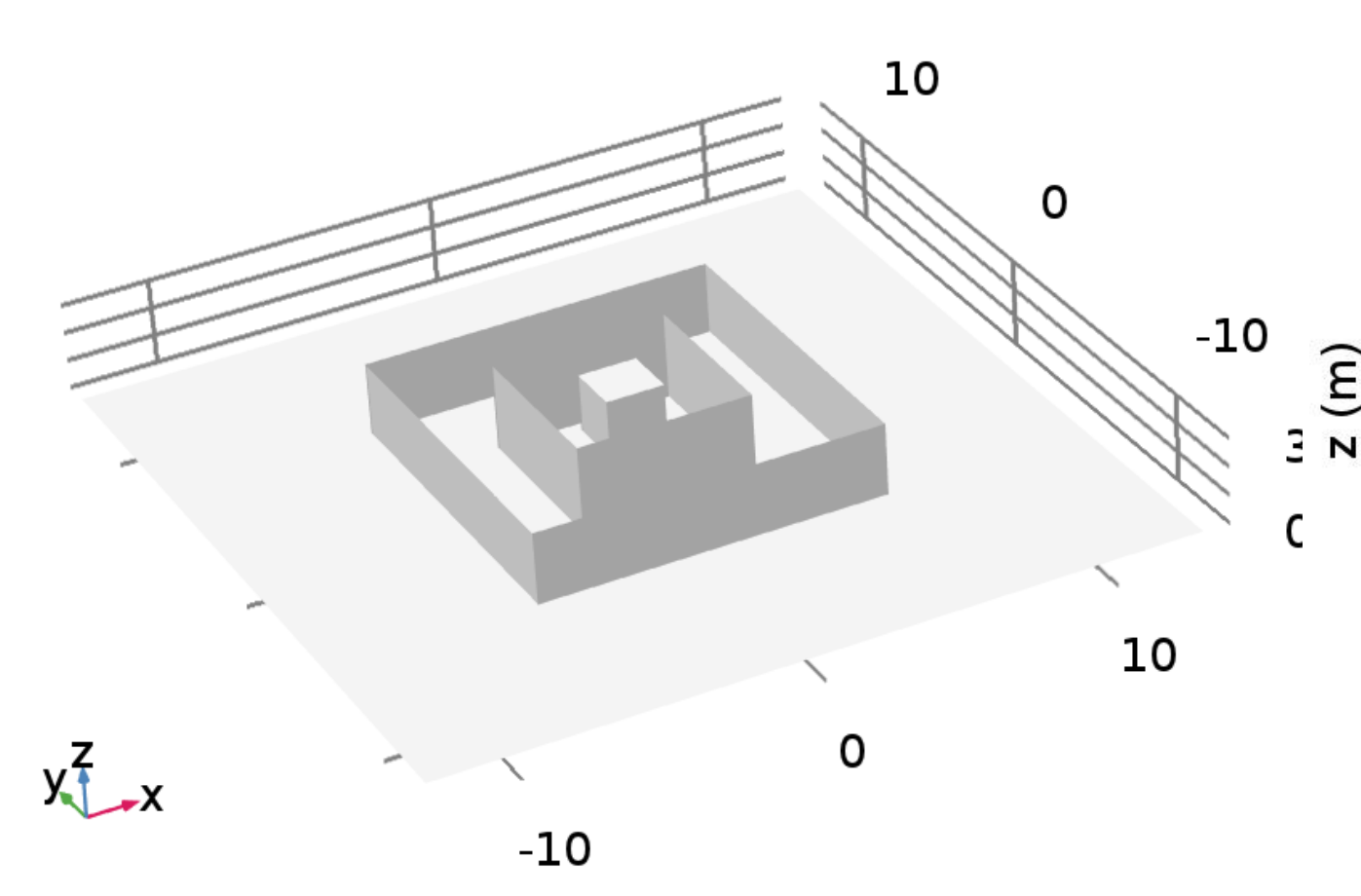


Figure 4. 3D geometry

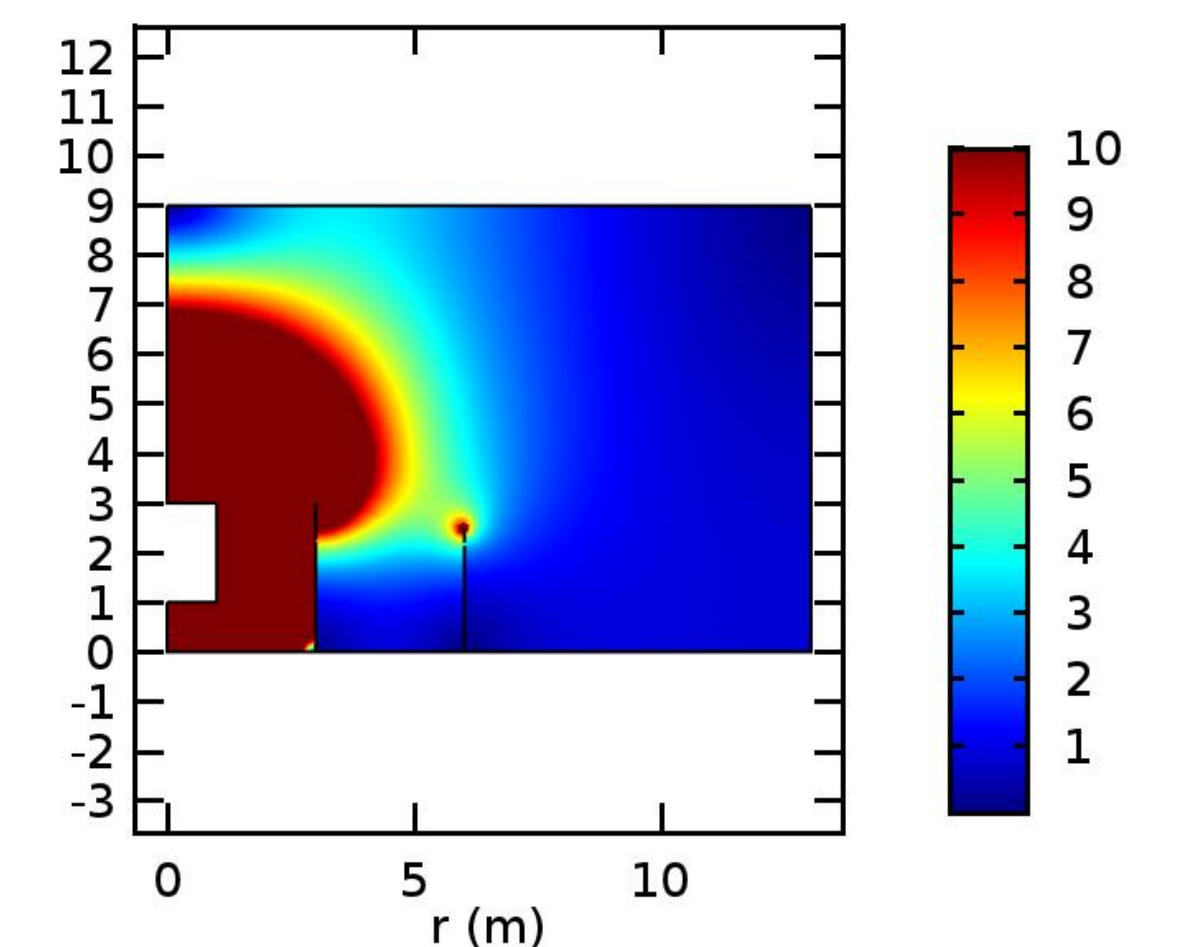


Figure 5. Electric field along 2D cut plane.

| Area | Maximum electric field |
|-------------------------|------------------------|
| Outside first fence 3D | 4.6 kV/m |
| Outside first fence 2D | 5.5 kV/m |
| Outside second fence 3D | 2.5 kV/m |
| Outside second fence 2D | 3.1 kV/m |

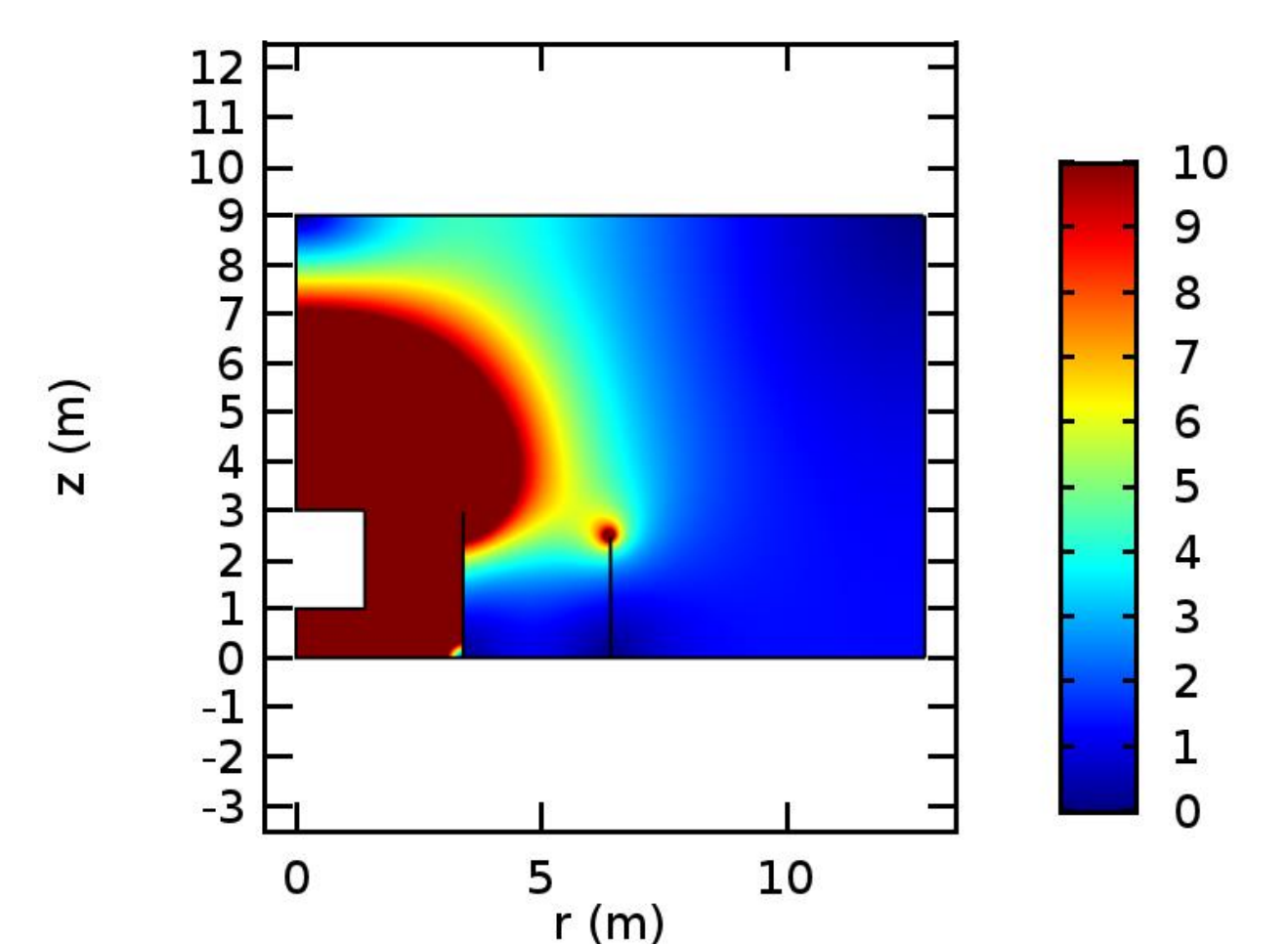


Table 1. Maximum electric field outside the fences. Figure 6. Electric field in the 2D model.

Conclusions: The app works as expected and the accuracy is good enough to be used in production design. The app is expected to be very handy in the design process and decreases the risk of late design changes.

References:

1. ICNIRP, Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz), Health Physics, 99(6), 818-836 (2010)
2. IEEE Standard C95.6 (2002)

Power and productivity
for a better world™

