



WA105 A graphic element consisting of two thin, light-colored sticks or rods crossed at their ends, positioned to the right of the text 'WA105'.

Update on electrostatic simulations for protoDune-DP

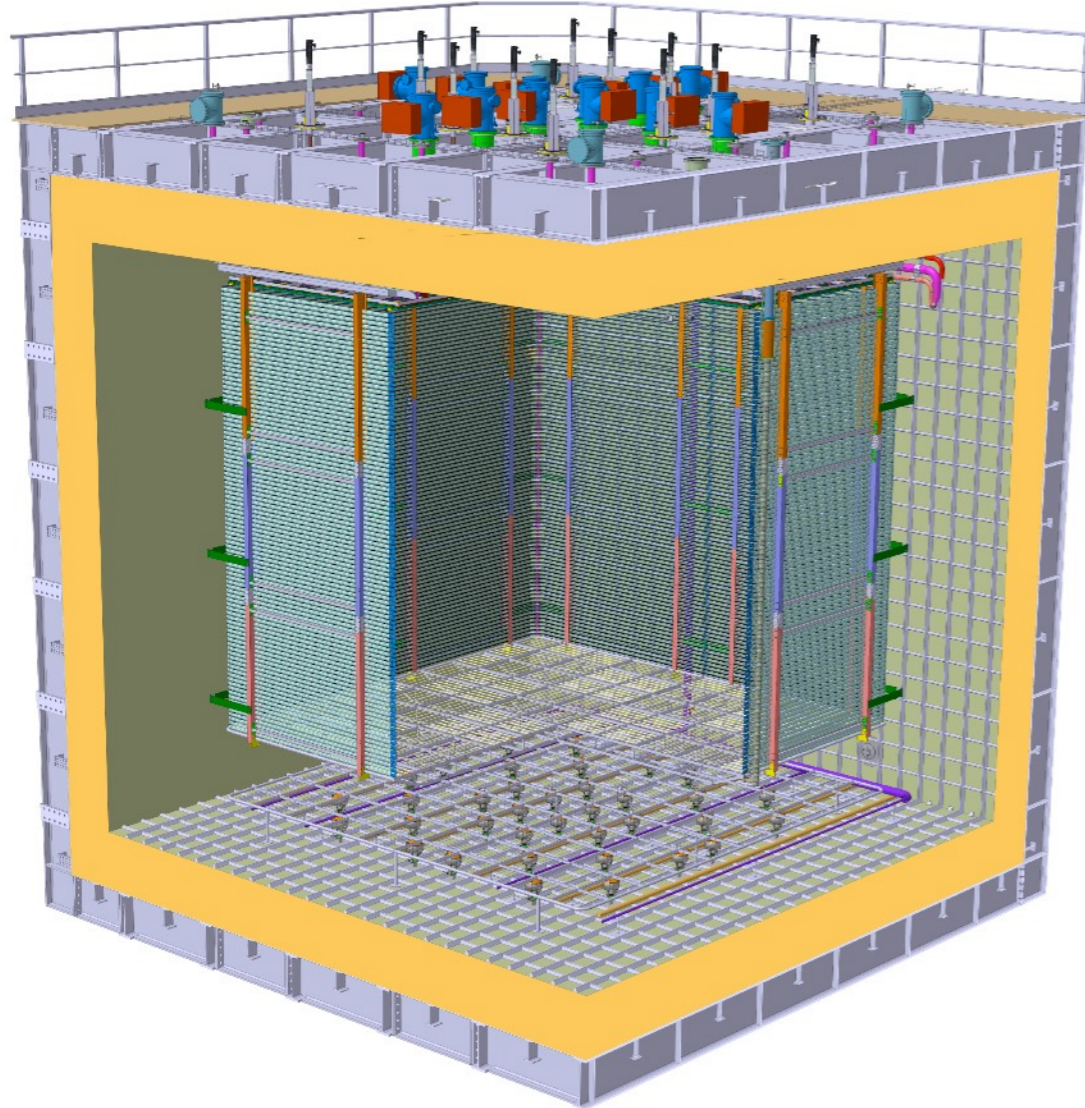
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Technical Board 3.05.2017

Summary

- During the design review the committee pointed out that the simulations of the different parts of the detector were done at 300 kV. **At this voltage our guideline is satisfied and the field is below 40 kV/cm inside the LAr.** They mentioned that this guideline should be also accomplished at 600 kV, specially in those parts of the detector which can not be changed if we go to a second run at this higher voltage (field cage, cathode and ground grid).
- **The voltage for the “nominal” drift field of 0.5 kV/cm for ProtoDUNE-DP , which has 6m drift, is 300kV.** Our goal is to have a design that is safe for stable “nominal” operation over this distance. We know that 1kV/cm, if reachable stably, improves drift performance but we do not know if it is reachable.
- We have currently assumed that the DUNE-FD 10kton module has 12m drift and with 0.5kV/cm that gives 600kV operation voltage. **ProtoDUNE-DP could be an opportunity to do R&D towards DUNE-FD 10kton but it is not a requirement for the 6x6x6.**
- It might be useful to use the 6x6x6 cryostat to test 600kV but before we will need to think and perform tests on smaller scale. For example, we do not have a power supply for 600 kV for the moment. This requires a dedicated R&D and resources.

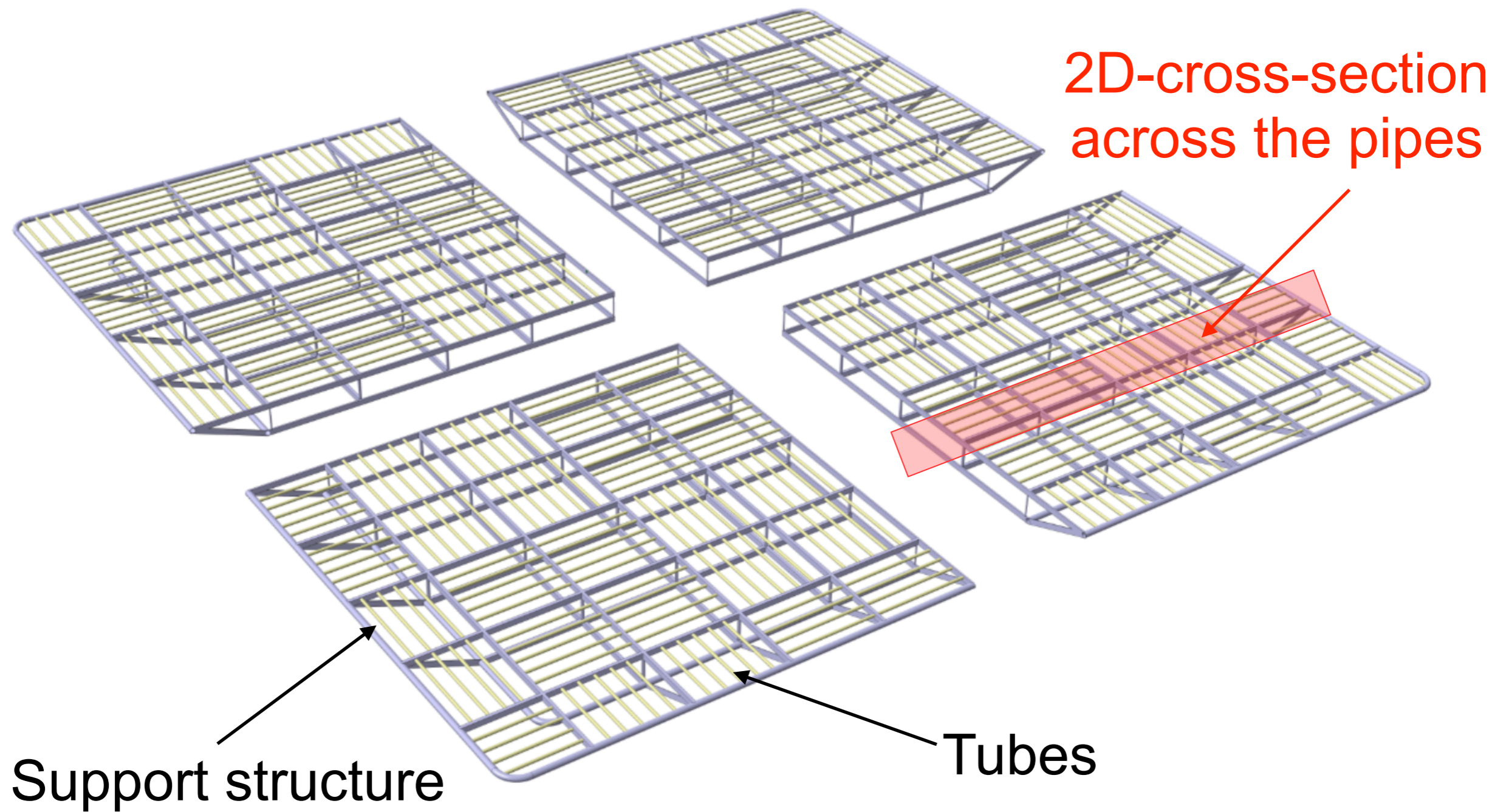
Simulations at 300 kV



98 Field shapers separated 60 mm and with a potential difference between them of 3 kV.

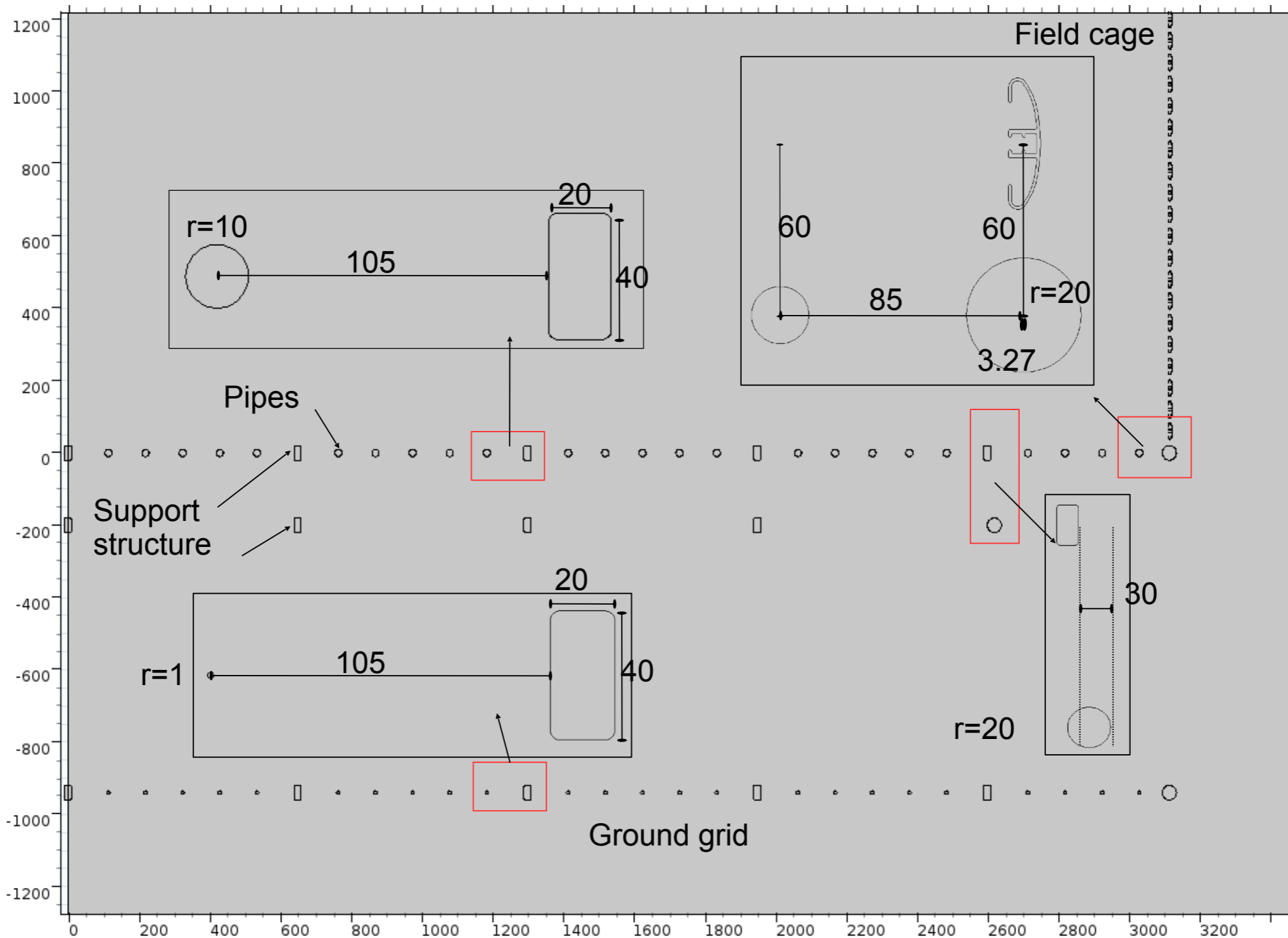
	Distance to the stage above [mm]	Operating potential [kV]	Field to the stage above [kV/cm]
Anode	-	0	-
LEM(upper electrode)	2	-1	5
LEM(lower electrode)	1	-4	30
LAr level	5	-	-
Extraction grid	5	-6.5	2.5
First field shaper	60	-9.5	0.5
Last field shaper	60	-300.5	0.5
Cathode	60	-303.5	0.5

A) Cathode

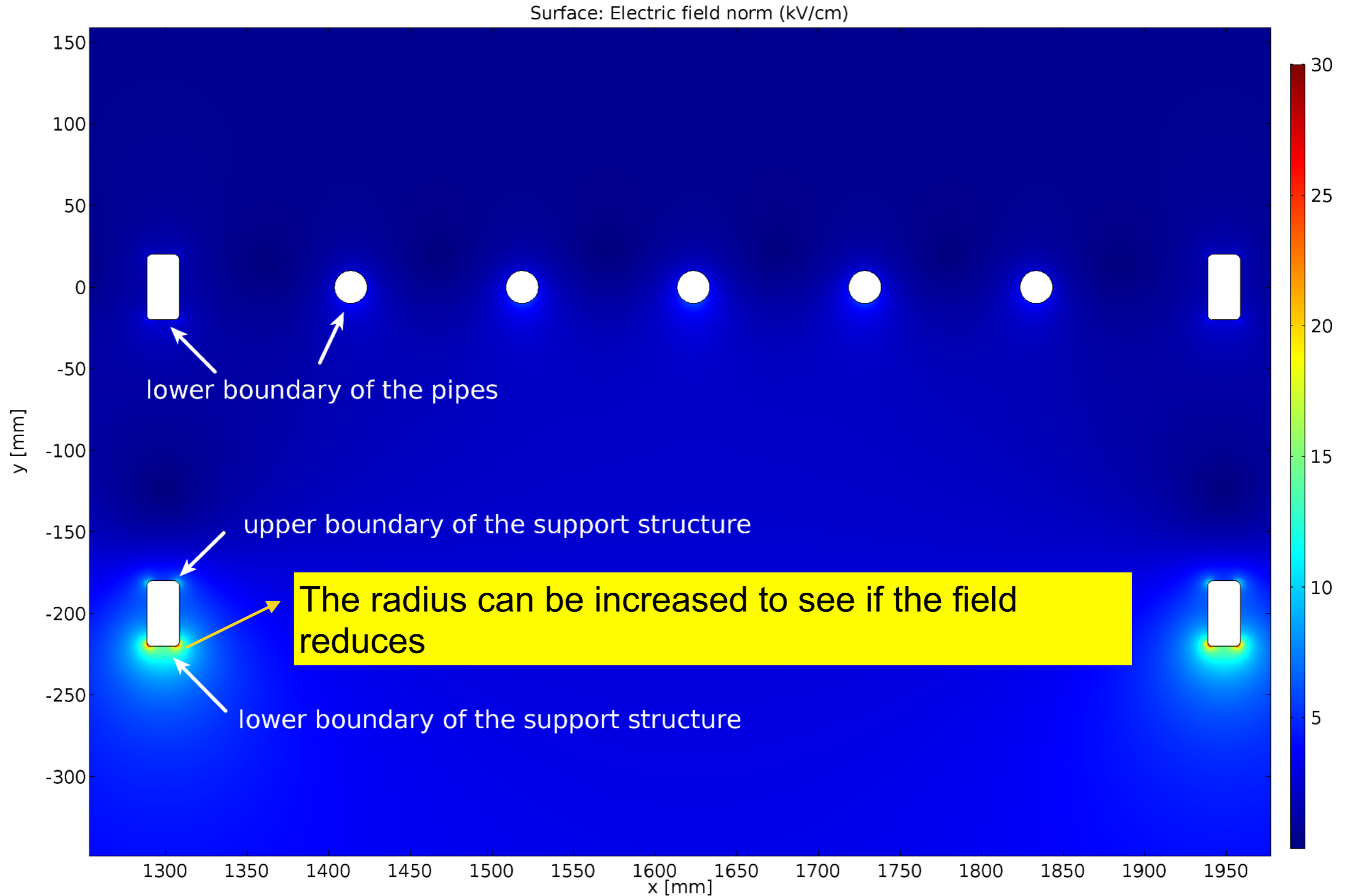


A) Cathode

2D-cross-section across the tubes

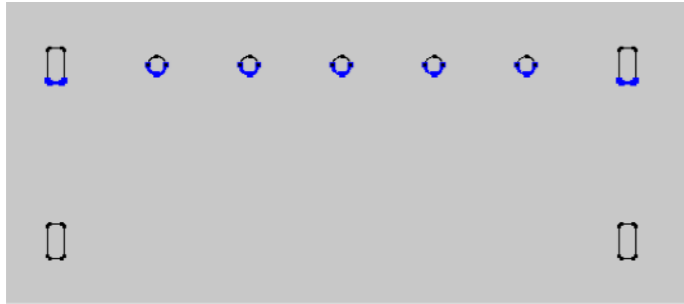


A) Cathode



A) Cathode

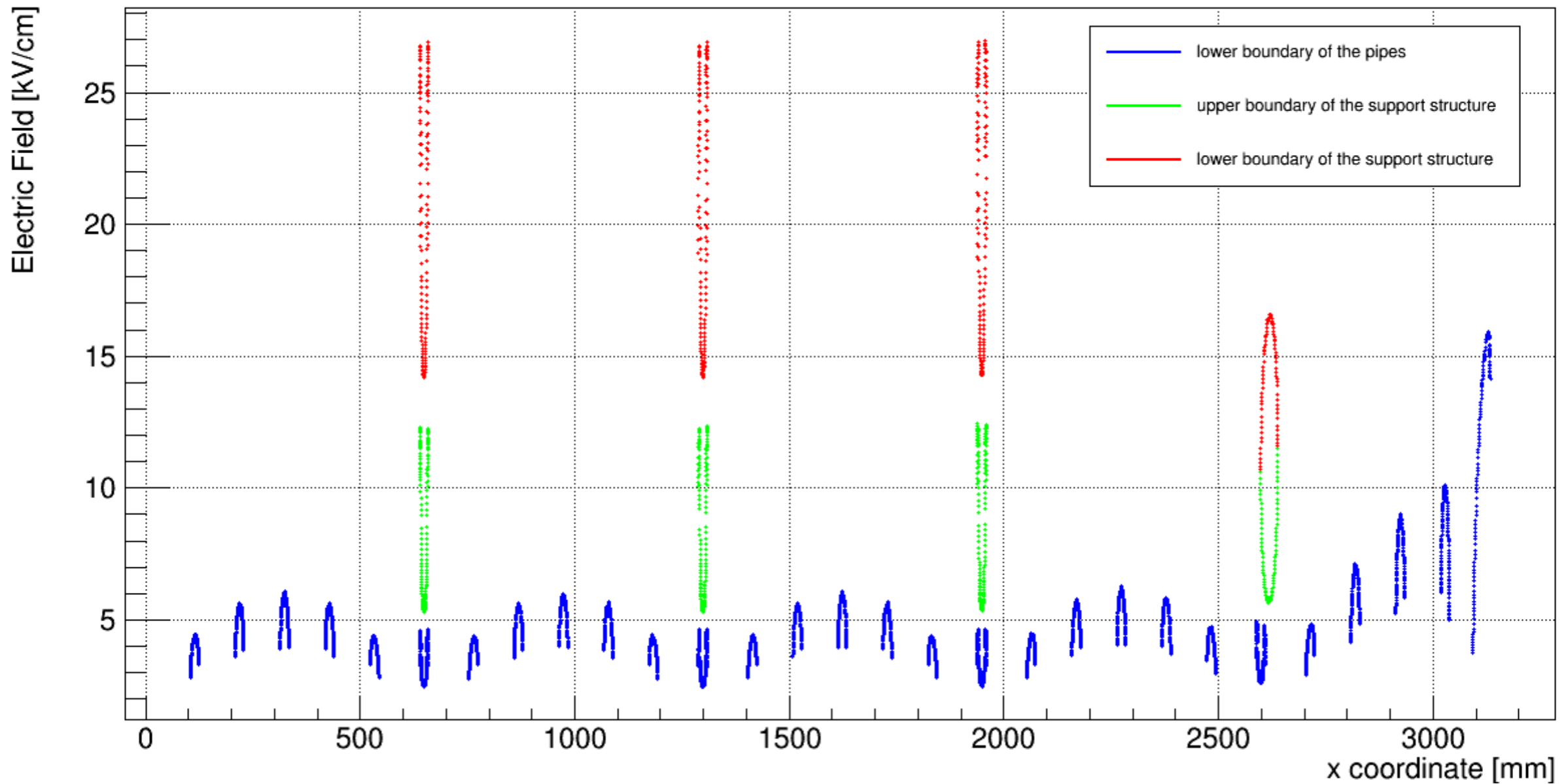
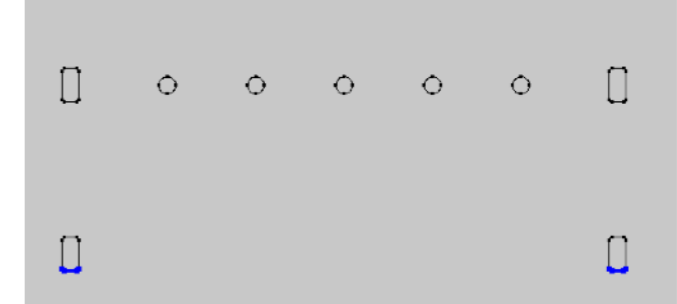
lower boundary of the pipes



upper boundary of the support structure



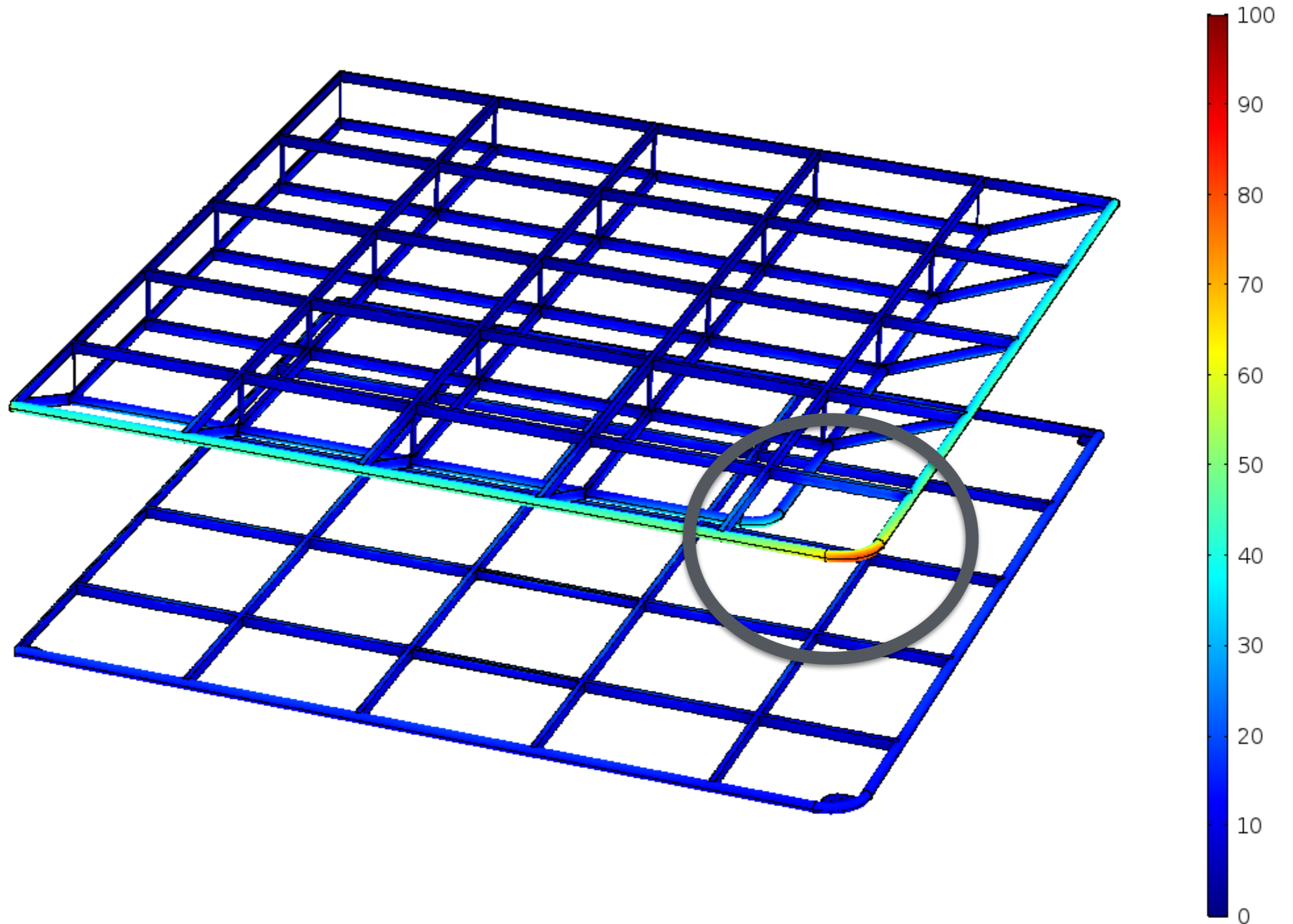
lower boundary of the support structure



A) Cathode

Simulation performed at 600 kV!

Surface: Electric field norm (kV/cm)

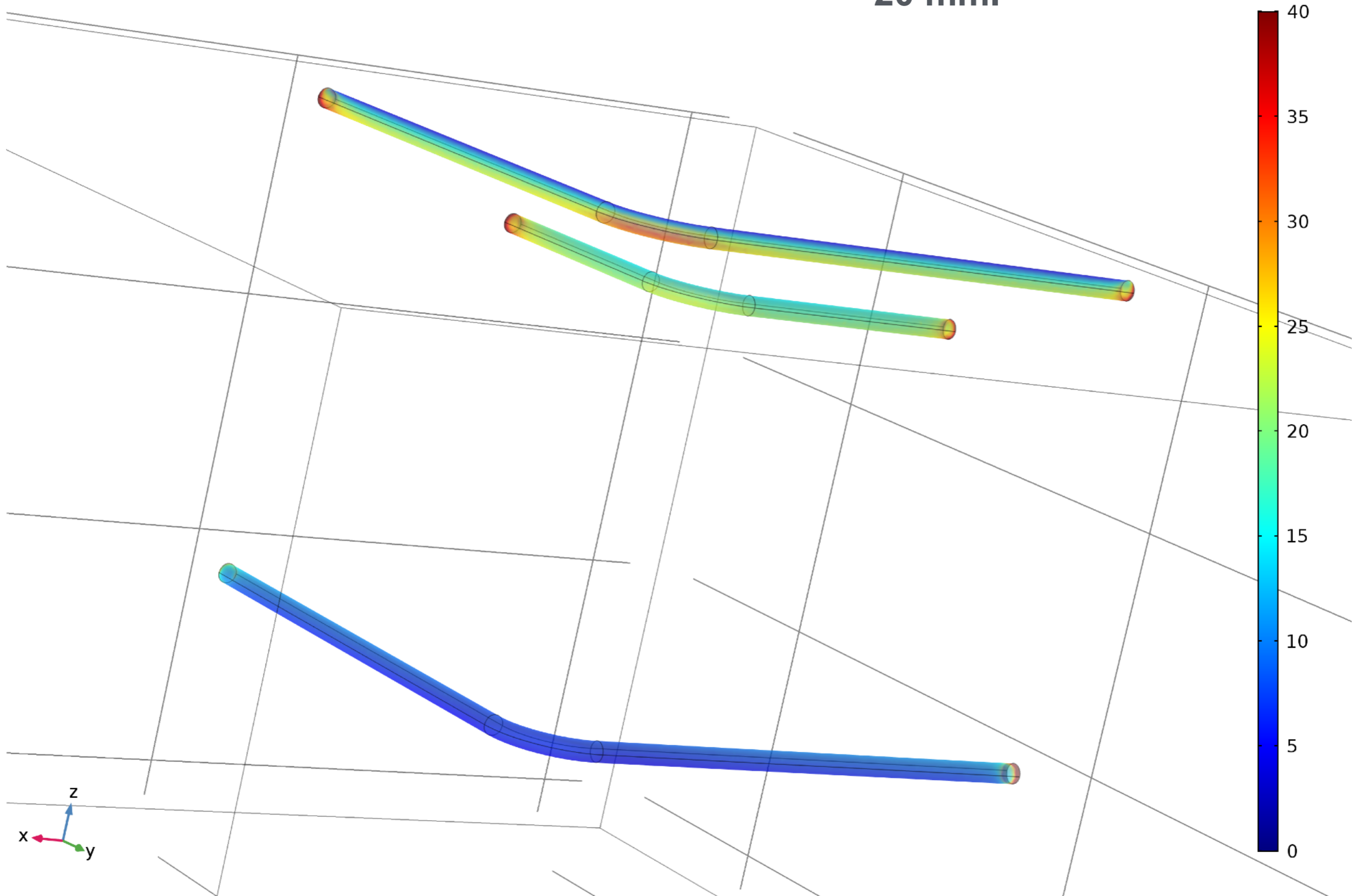


A) Cathode

Simulation performed at 600 kV!

Surface: Electric field norm (kV/cm)

Simplified model of the corner region with the current radius, 20 mm.



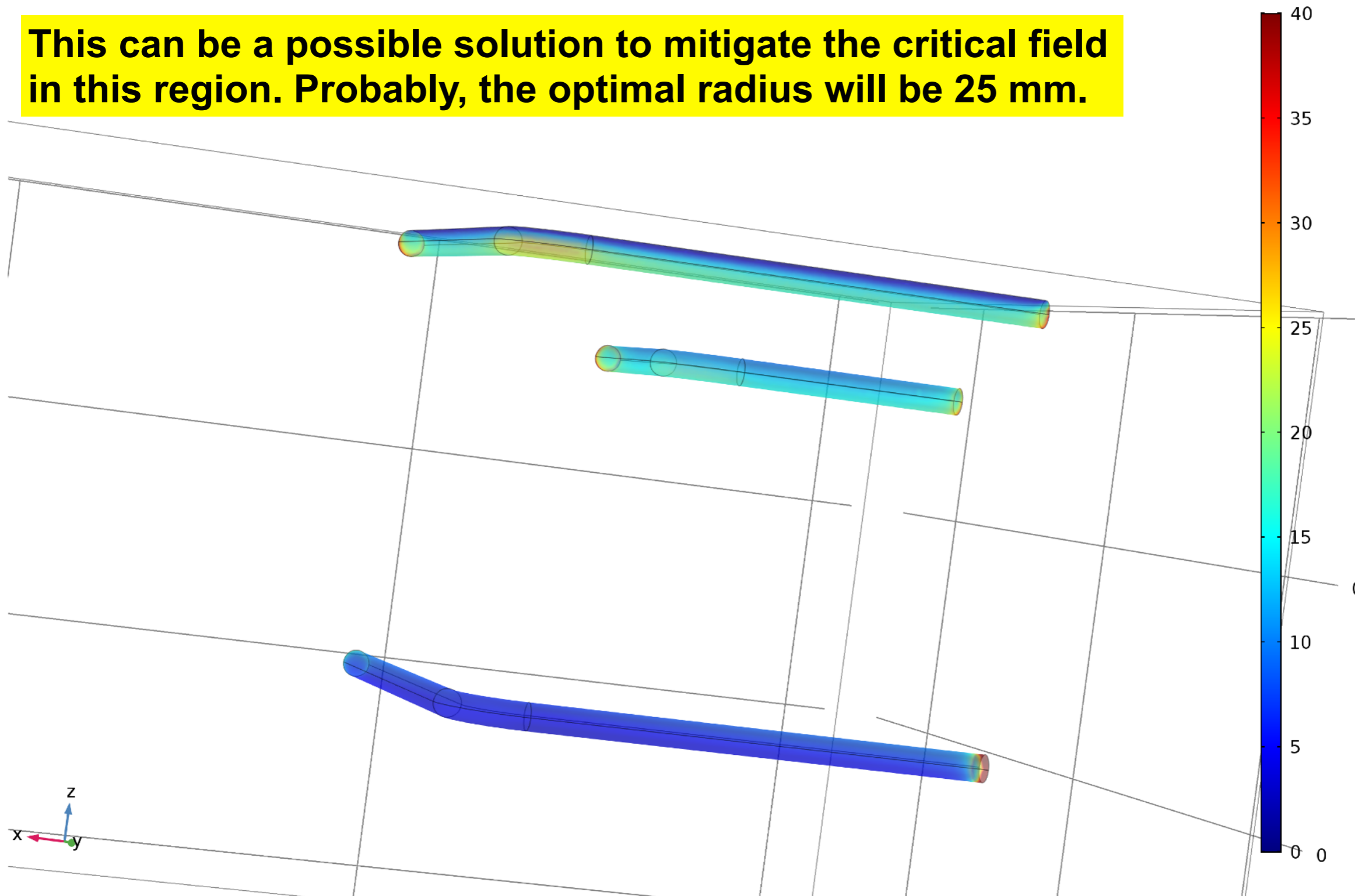
A) Cathode

Simulation performed at 600 kV!

Simplified model of the corner region with the current radius, 30 mm.

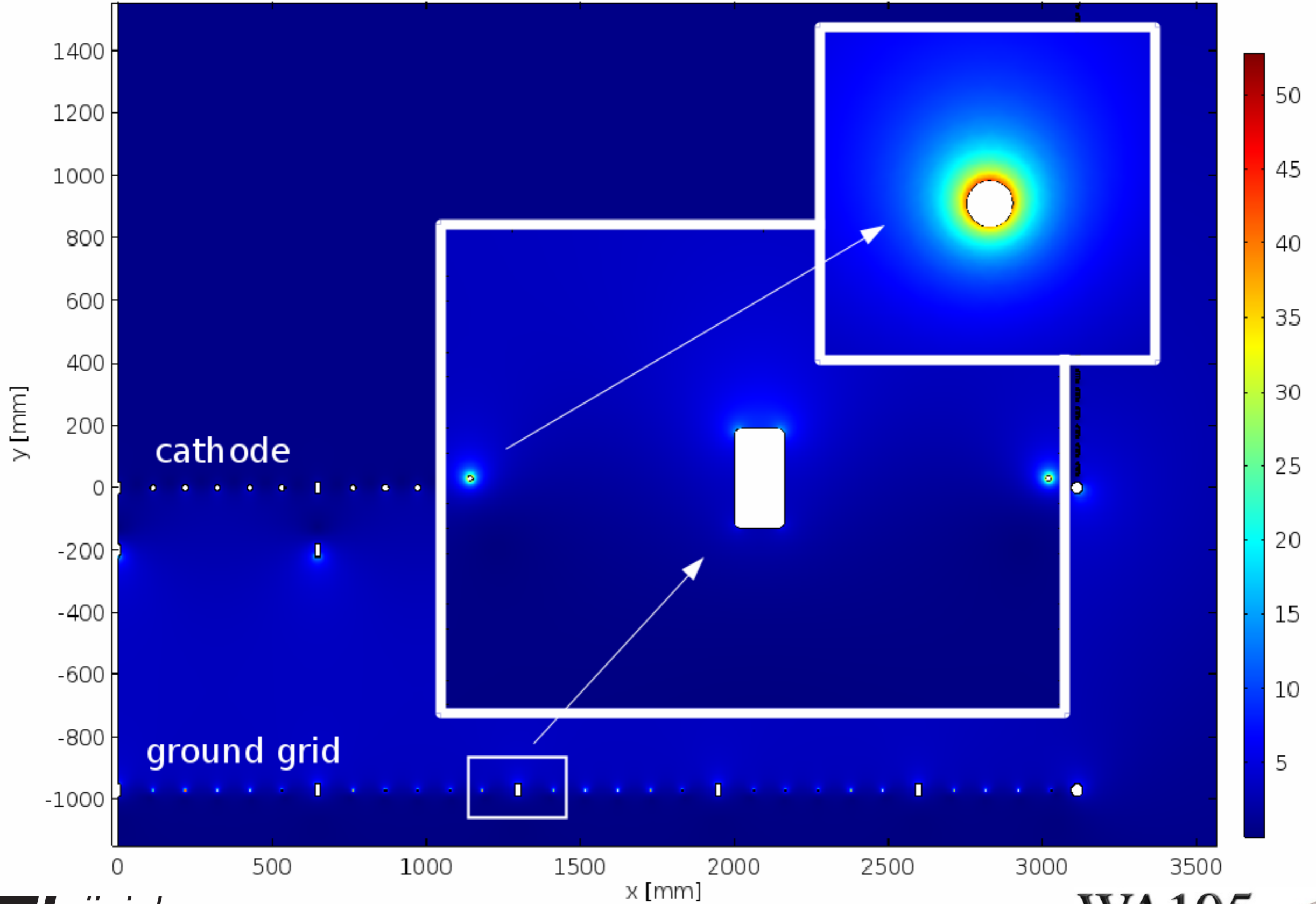
Surface: Electric field norm (kV/cm)

This can be a possible solution to mitigate the critical field in this region. Probably, the optimal radius will be 25 mm.



B) Ground grid

Surface: Electric field norm [kV/cm]



B)Ground grid

