

# An Open Radiofrequency Accelerating Structure

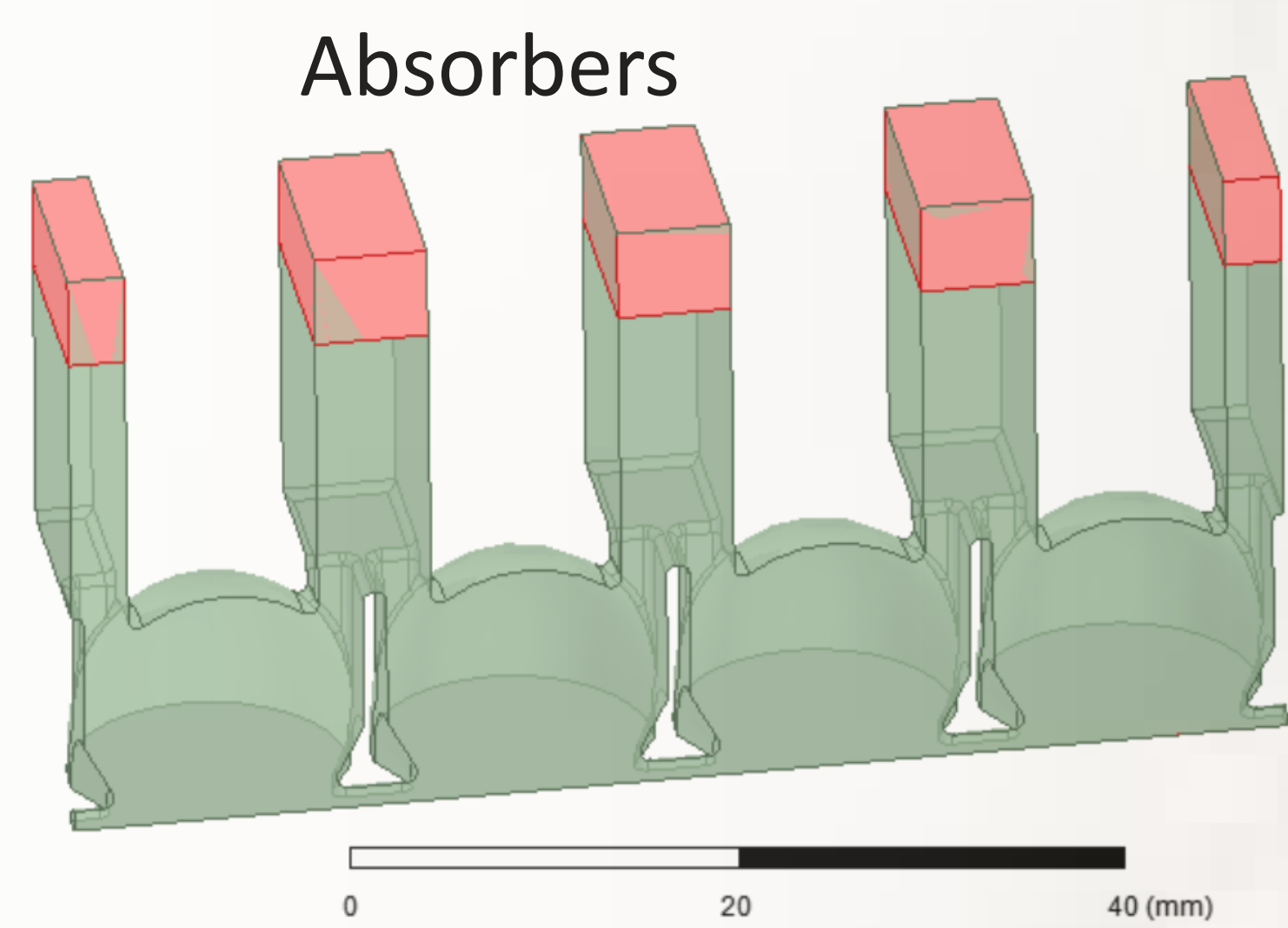


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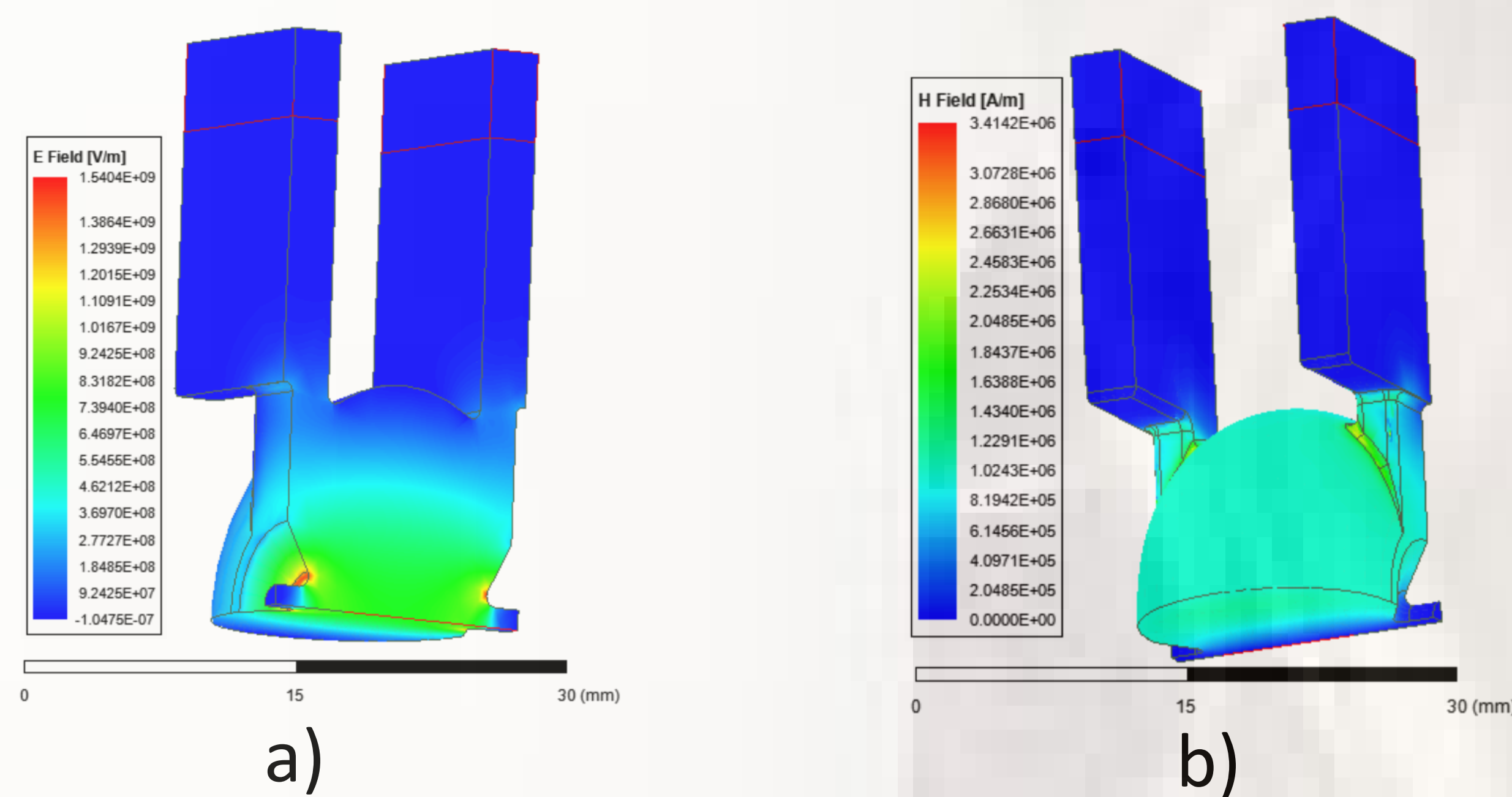
## Introduction

We report an open multi-cell accelerating structure. Being integrated with a set of open-end waveguides, this structure can suppress high-order modes (HOMs). All the accelerating cells are connected at the side to rectangular cross-section waveguides which strongly coupled with free space or absorbers. Due to the anti-phased contribution of the cell pairs, the operating mode does not leak out, and has as high quality factor as for a closed accelerating structure. However, the compensation does not occur for spurious high-order modes. This operating principle also allows for strong coupling between the cells of the structure, which is why high homogeneity of the accelerating fields can be provided along the structure. We discuss the obtained simulation results and possible applications. Its include a normal conducting high-shunt impedance accelerator, a tunable photoinjector's RF gun, and a high-current, high selective SRF accelerators.

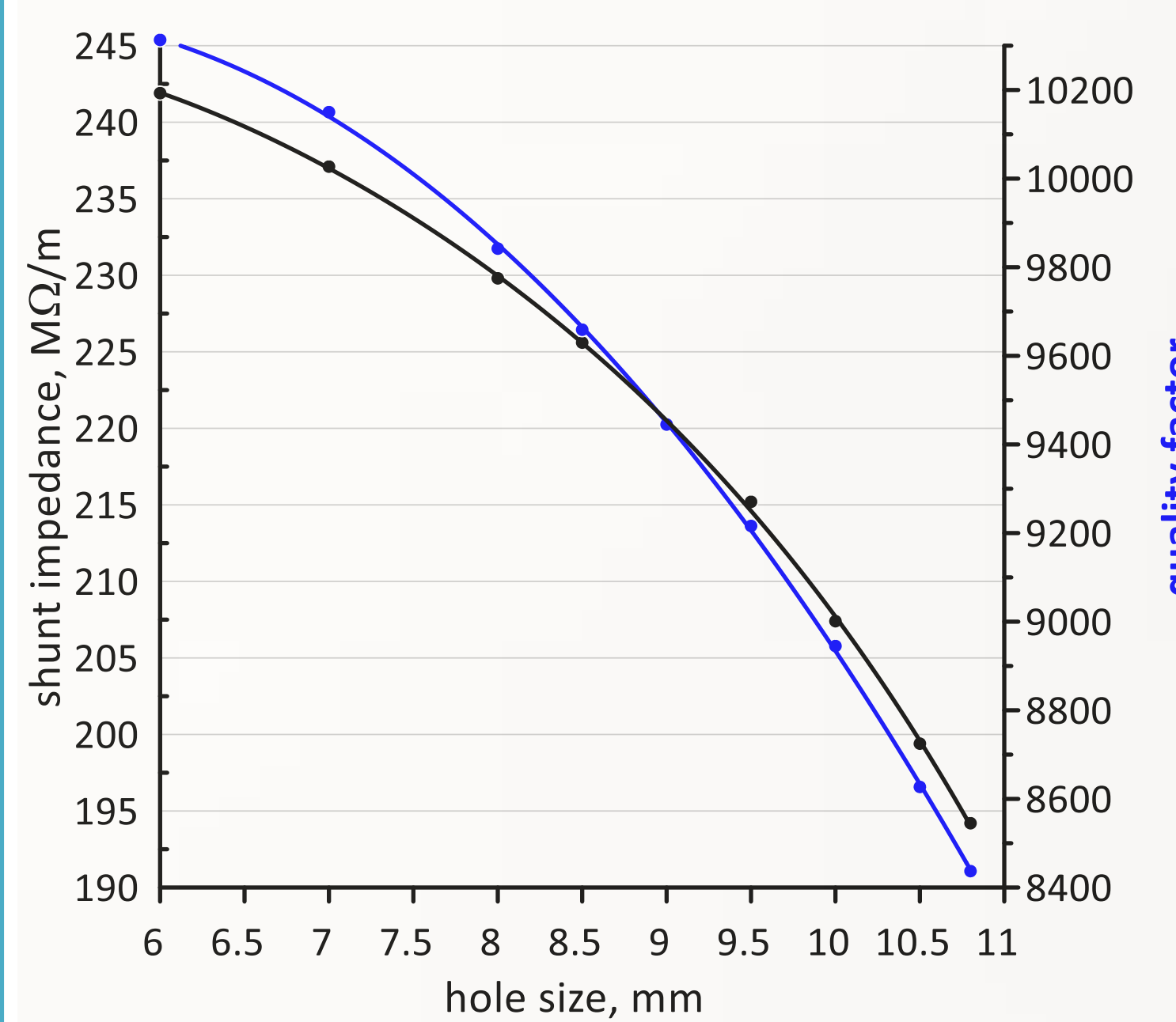
## High Shunt Impedance Accelerating Structure



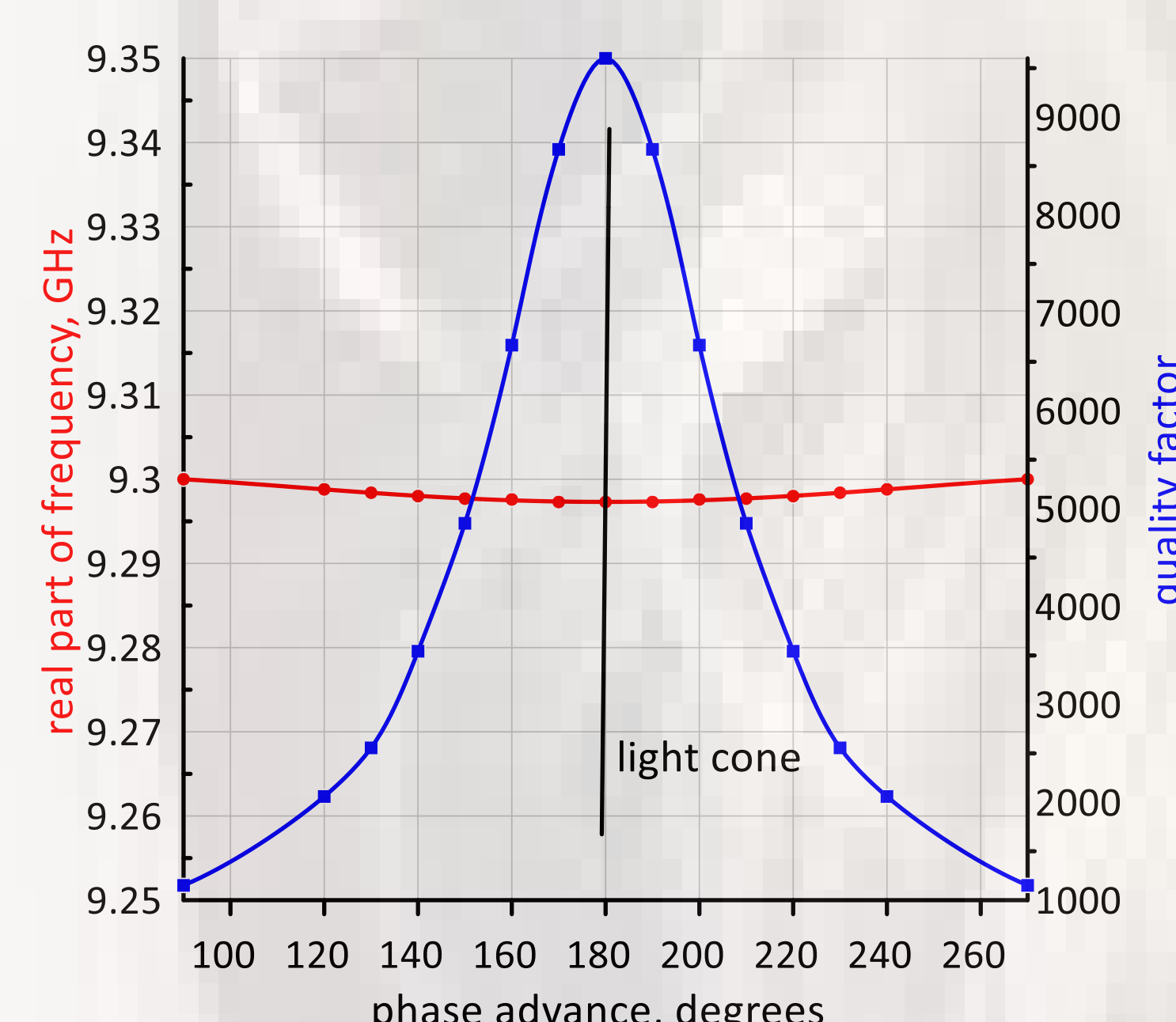
9.3 GHz  $\pi$ -mode standing wave structure.



E-field (a) and H-field (b) distributions for the operating mode.



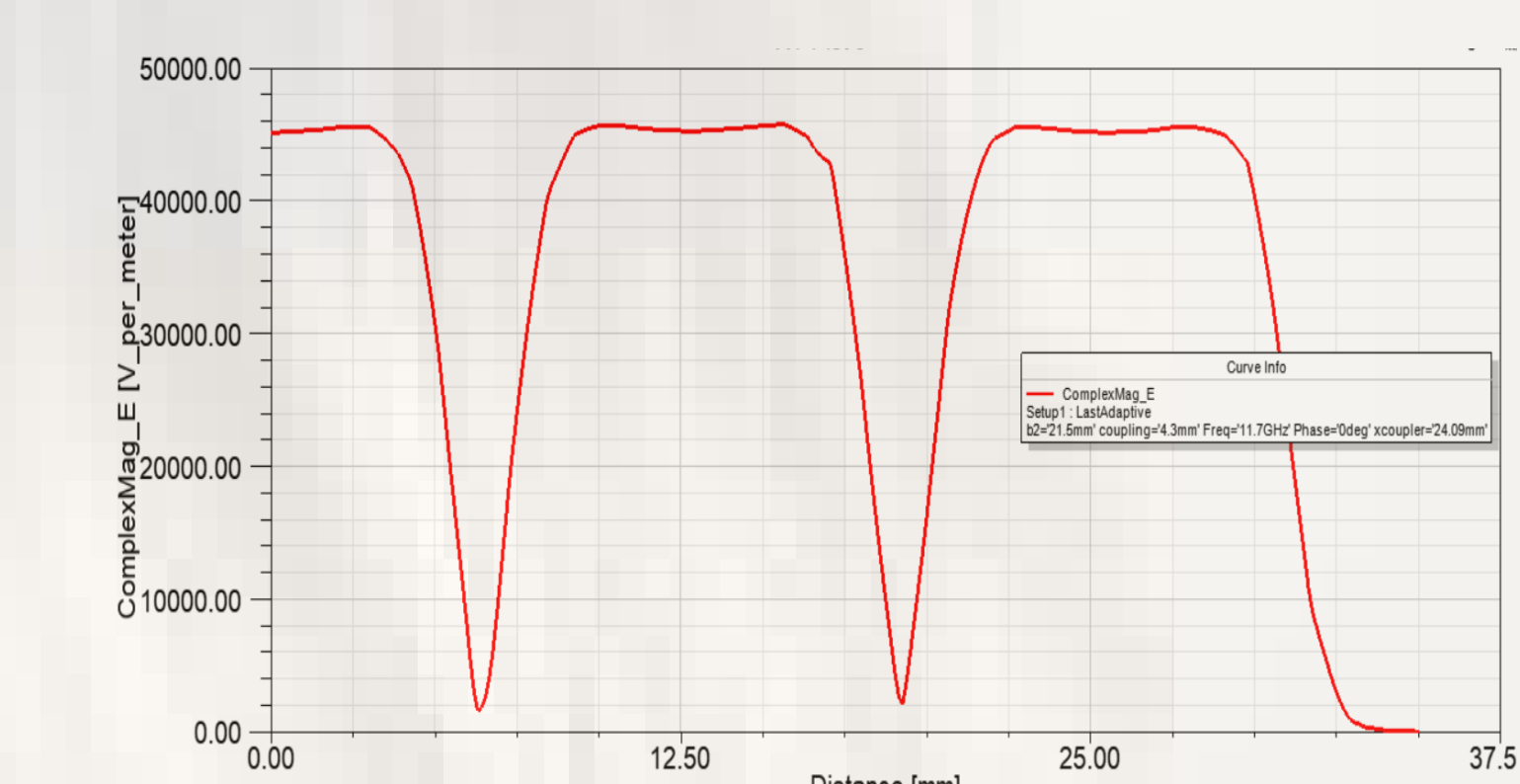
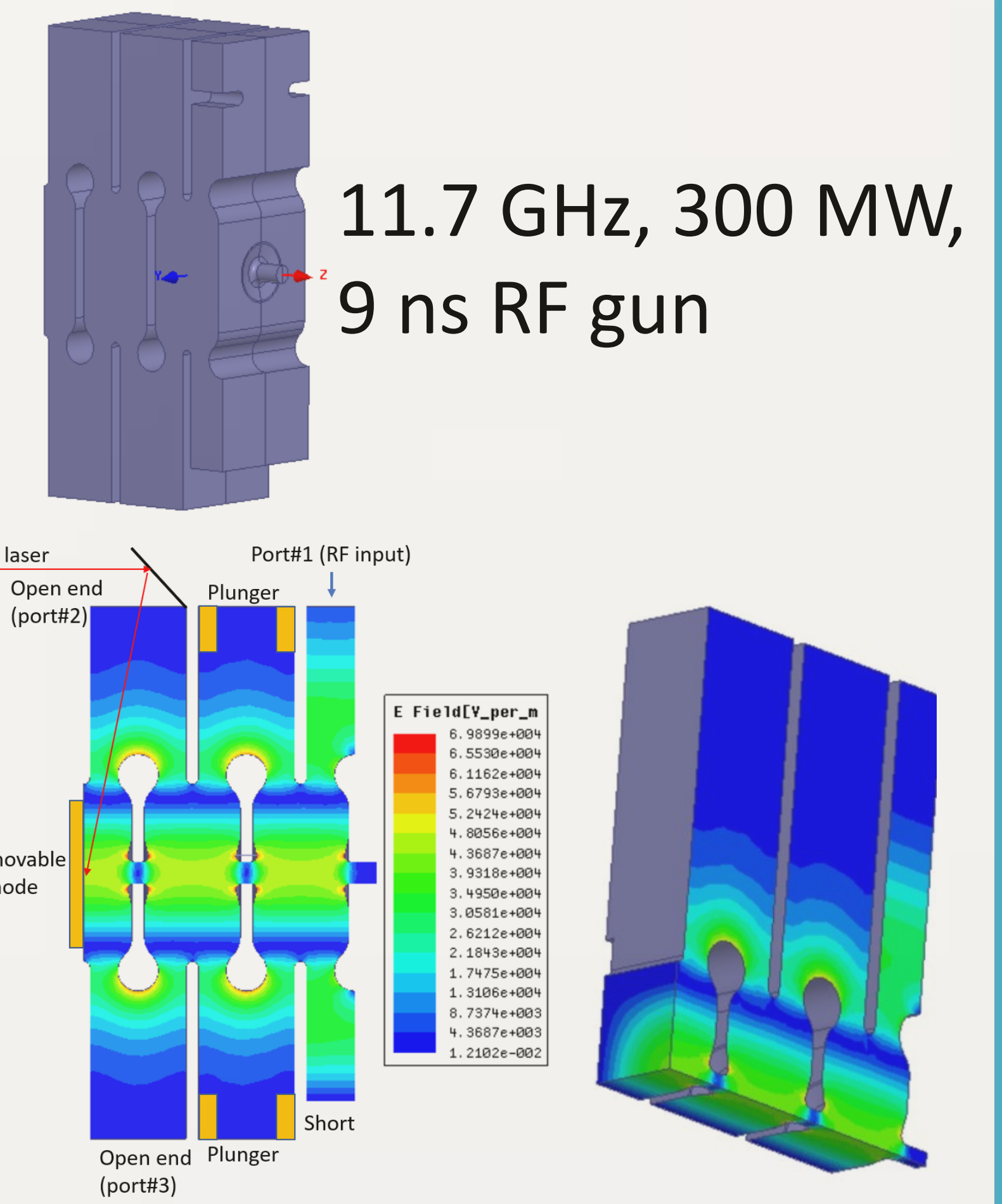
Shunt impedance and Q-factor vs coupling hole size



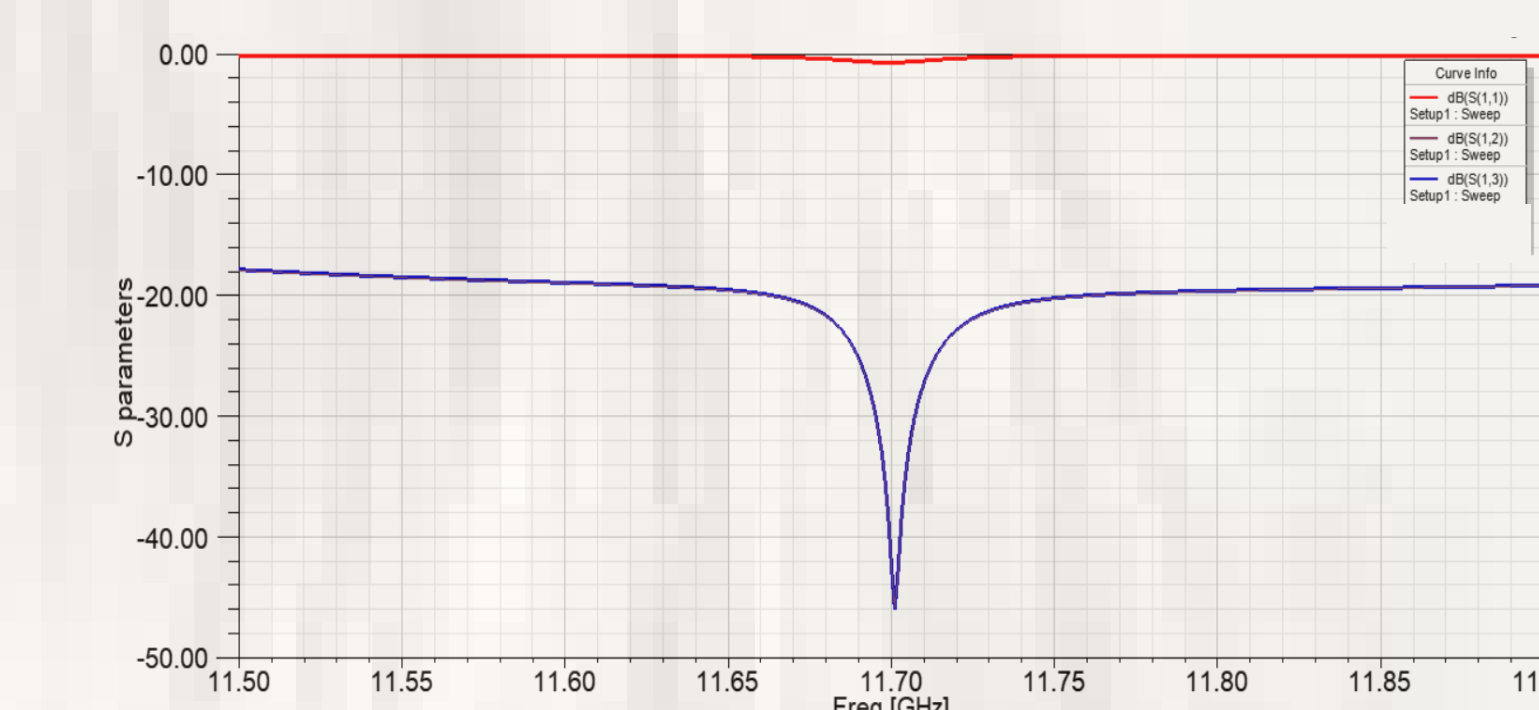
Real part of frequency and Q-factor vs phase advance per cell

## Photoinjector RF Gun

1. High-gradients and fully symmetric RF field distribution to minimize emittance;
2. Strong side coupling, in order to provide excellent field flatness, necessary mode separation and suppression of HOMs;
3. Design allows easy laser beam access to cathode;
4. Brazeless design and removable cathode.

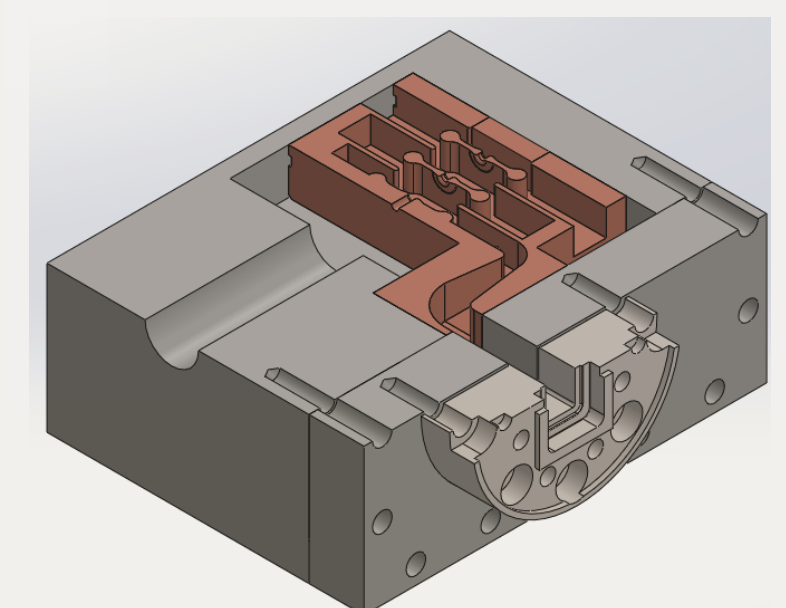


E-field distribution at gun's axis



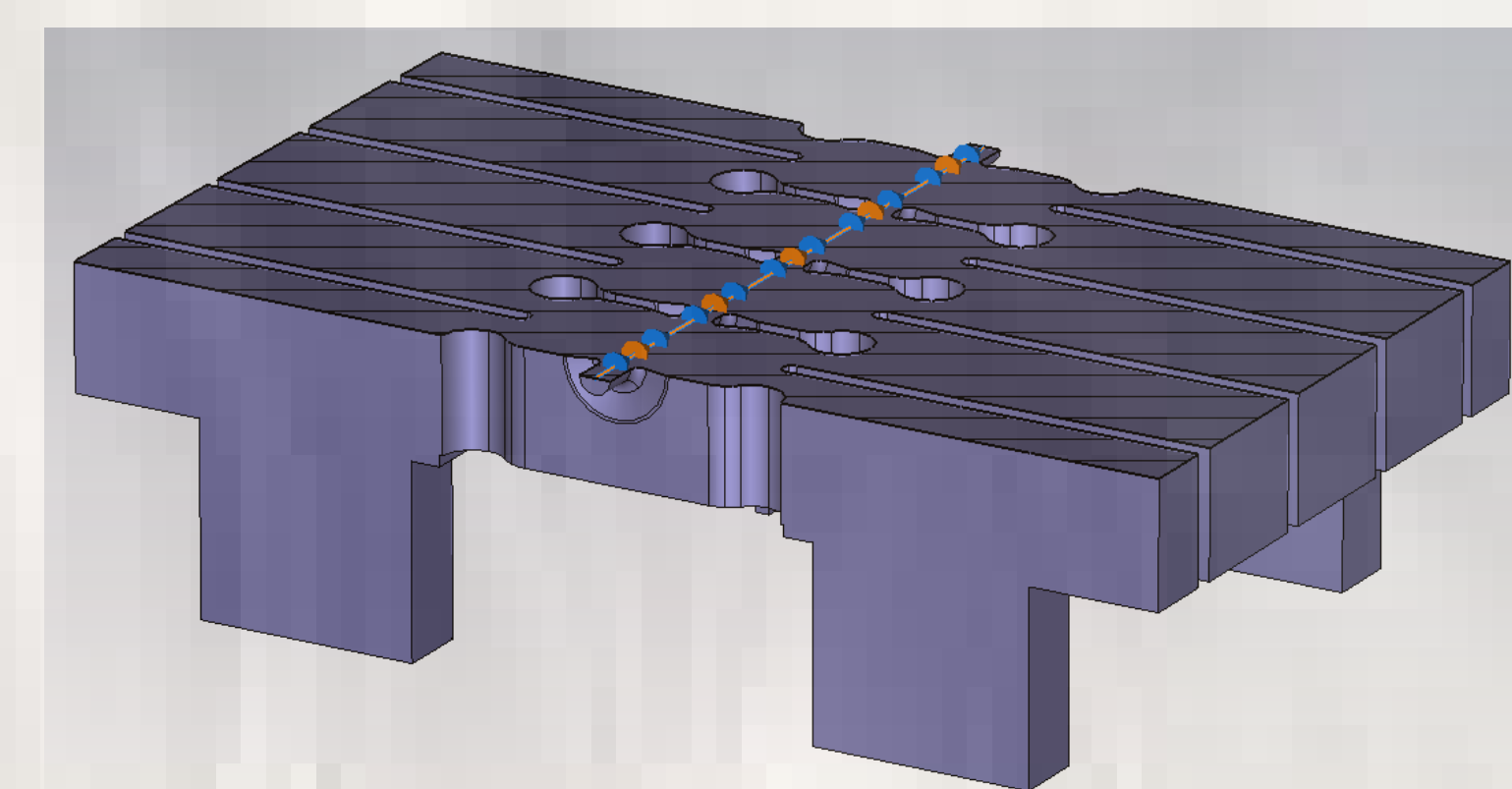
$S_{11}$ ,  $S_{12}$  and  $S_{13}$  parameters

E-field structure

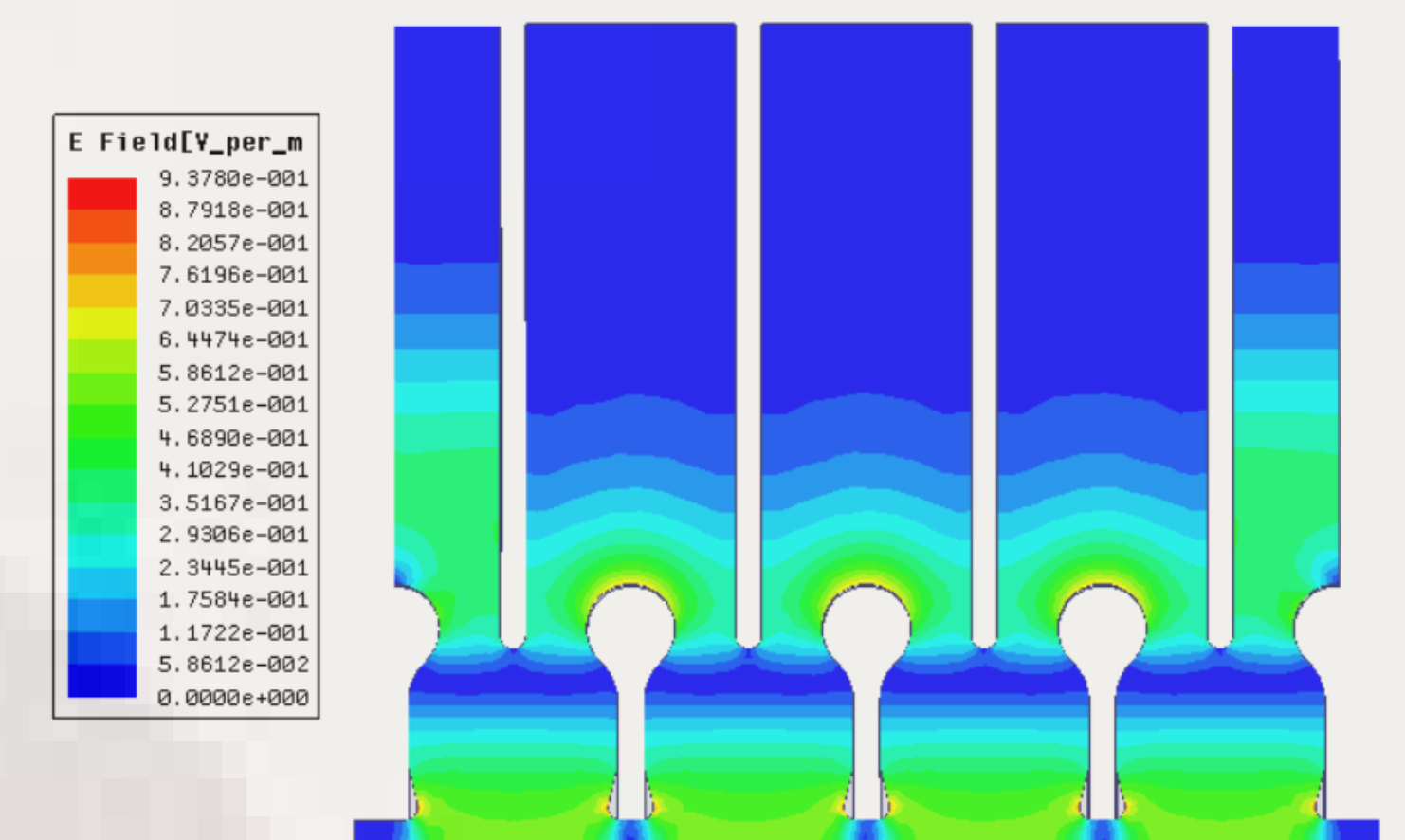


Brazeless engineering design

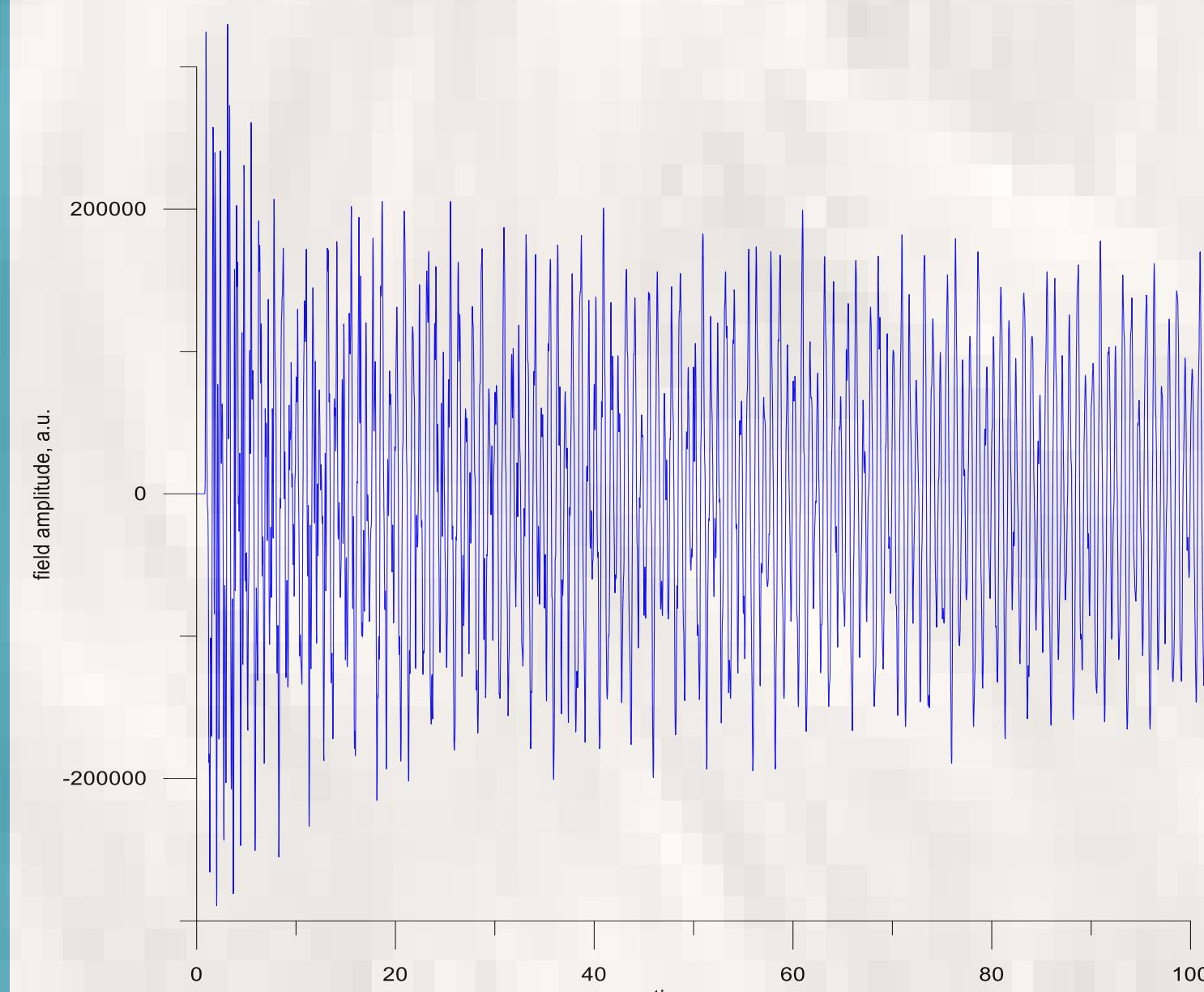
## SRF Accelerating Structure



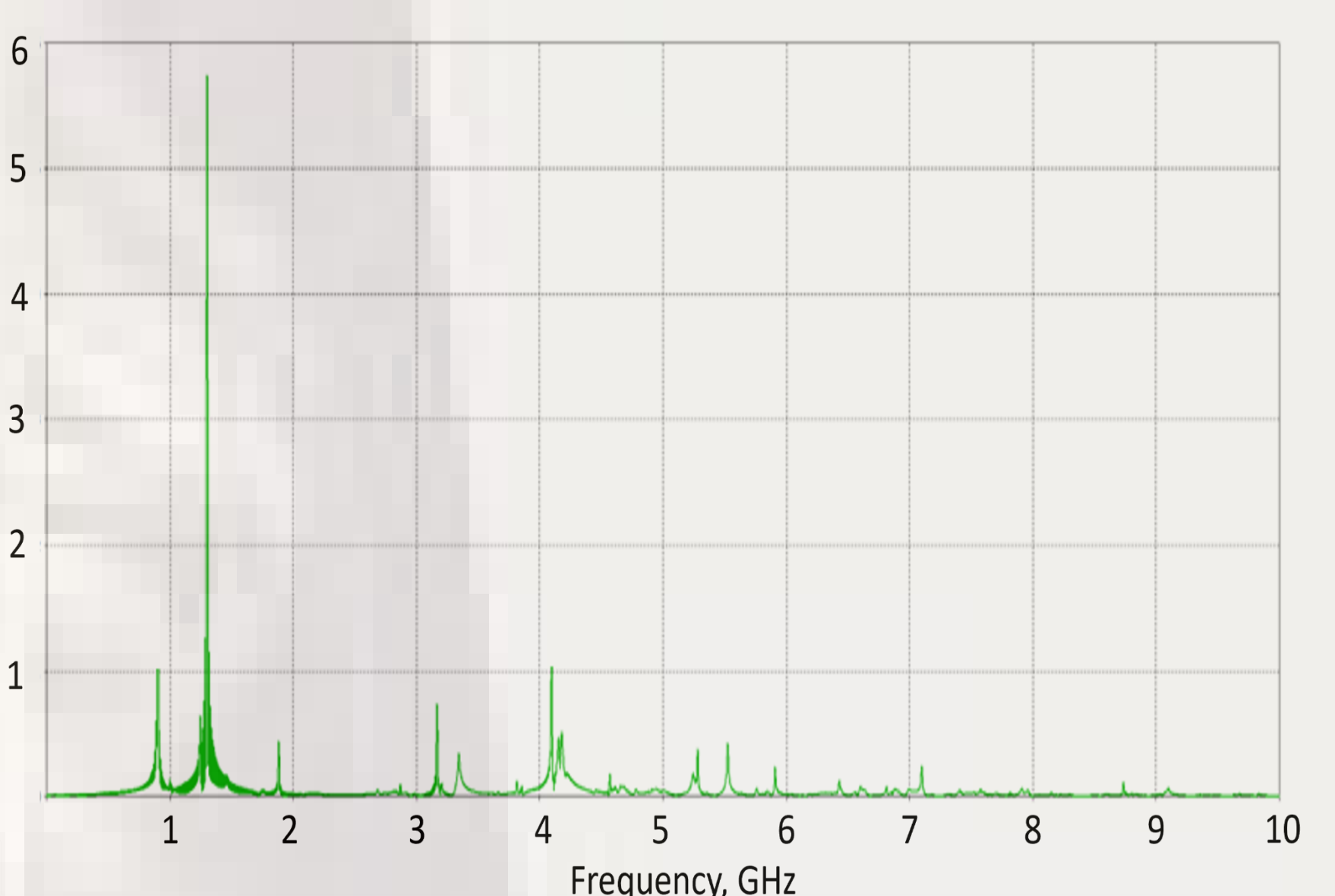
1.3 GHz SRF structure



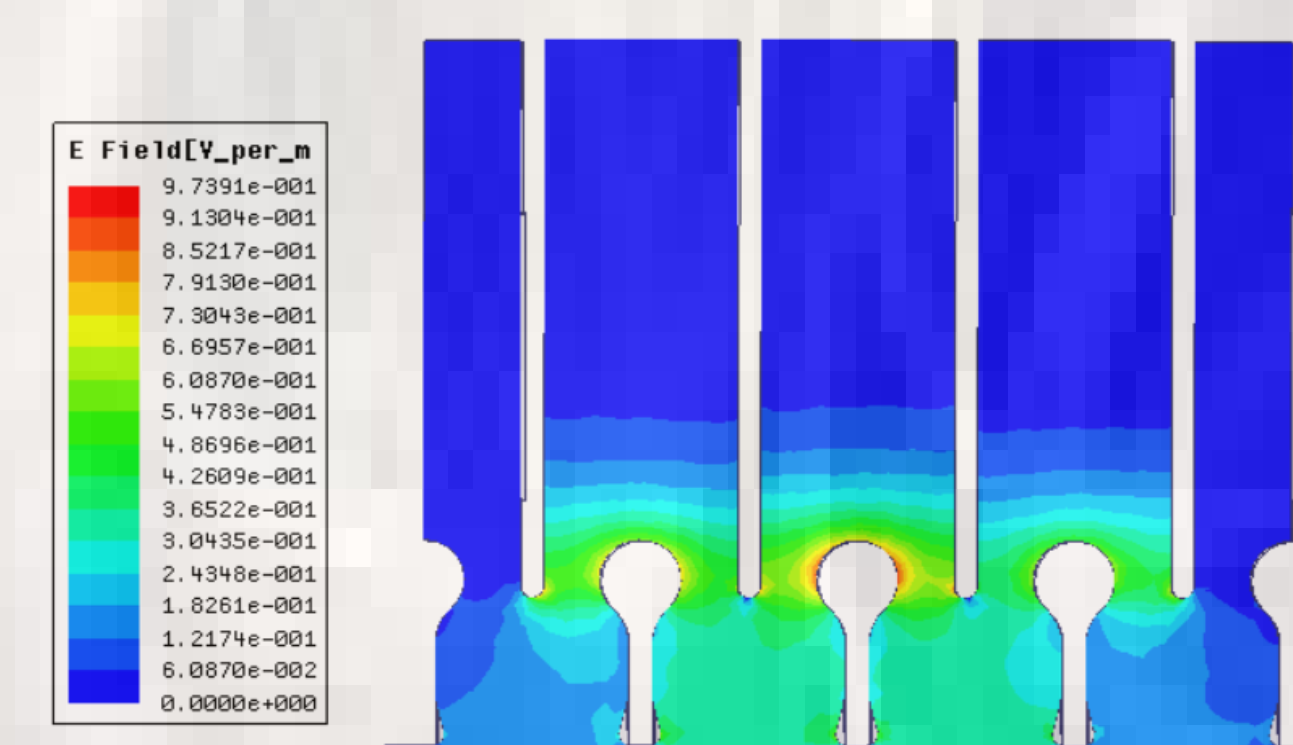
1.3 GHz operating  $\pi$ -mode ( $Q=10^8$ )



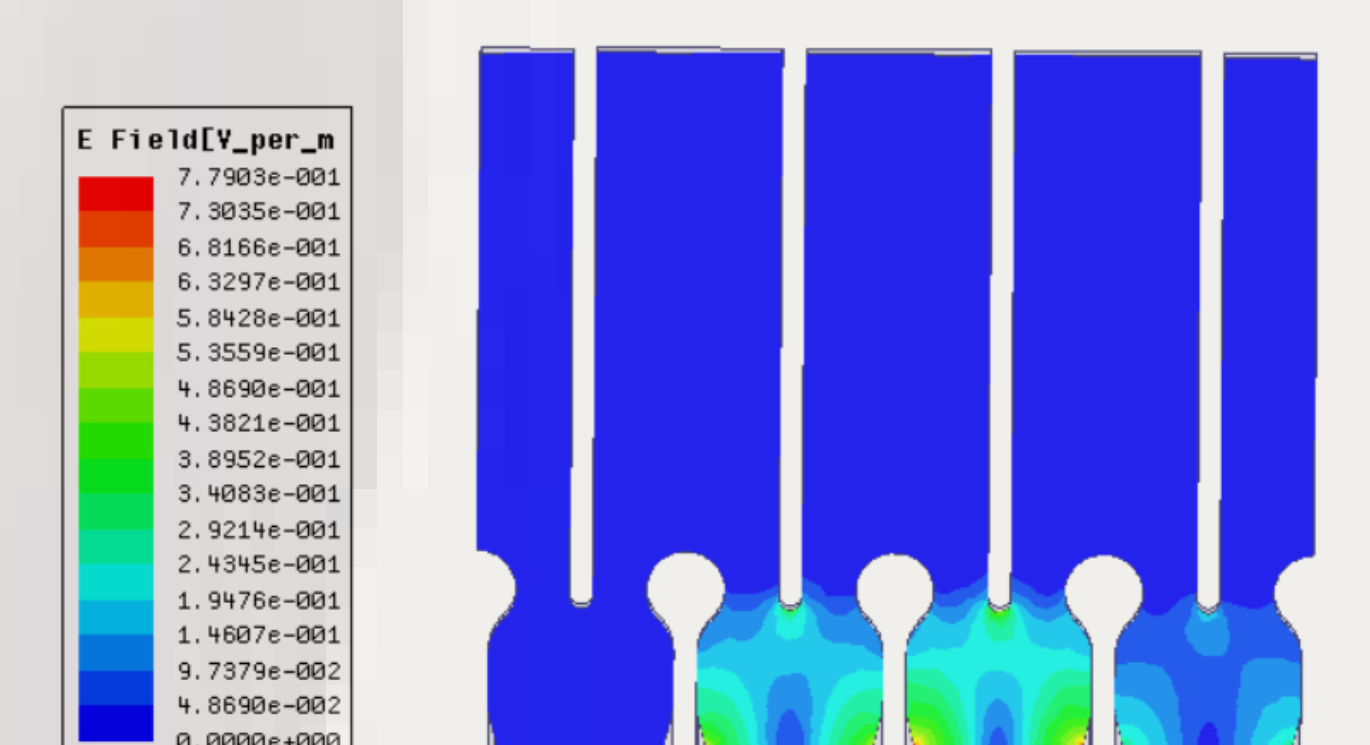
Field excited by point charge



Spectrum excited by point charge



0.9 GHz spurious mode ( $Q \sim 10^4$ )



1.8 GHz spurious mode ( $Q \sim 10^4$ )