HOMs Study in the 500 MHz BESSY Cavity

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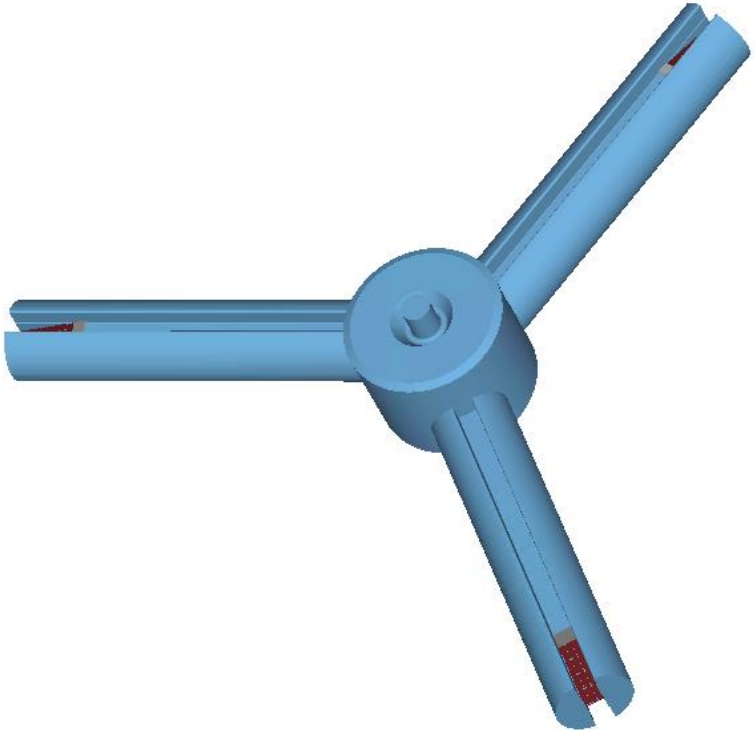

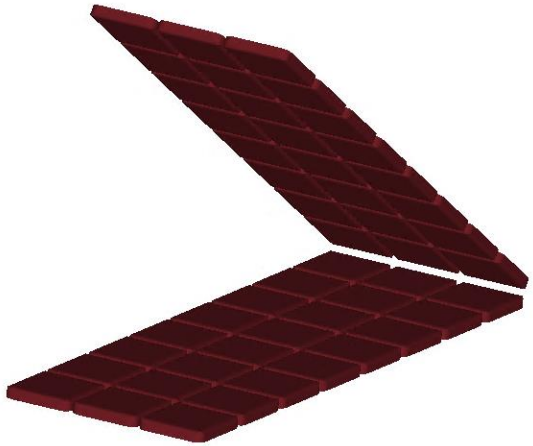

Outline

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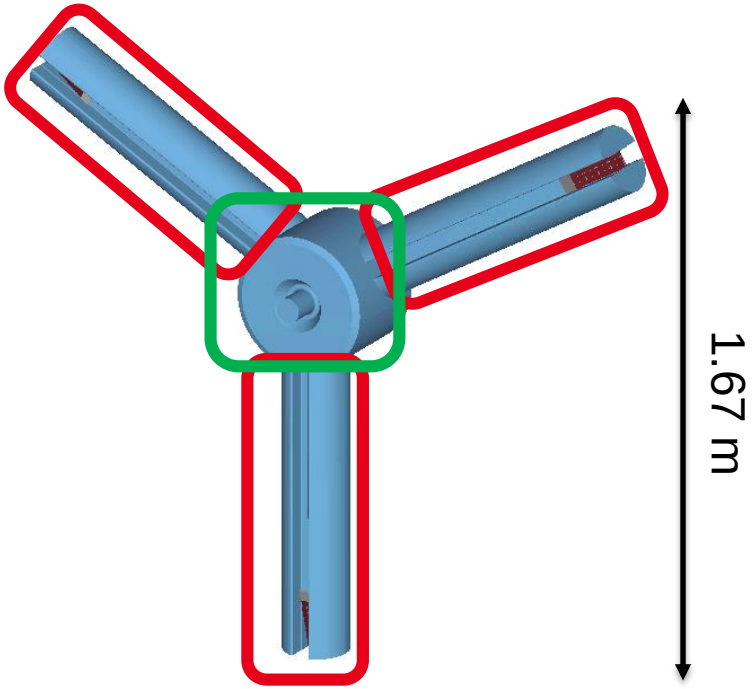
- 500 MHz cavity
- Motivation
- Waveguide and ferrite load
- Longitudinal impedance
- Transverse impedance
- Eigenmodes
- Conclusion

500 MHz cavity

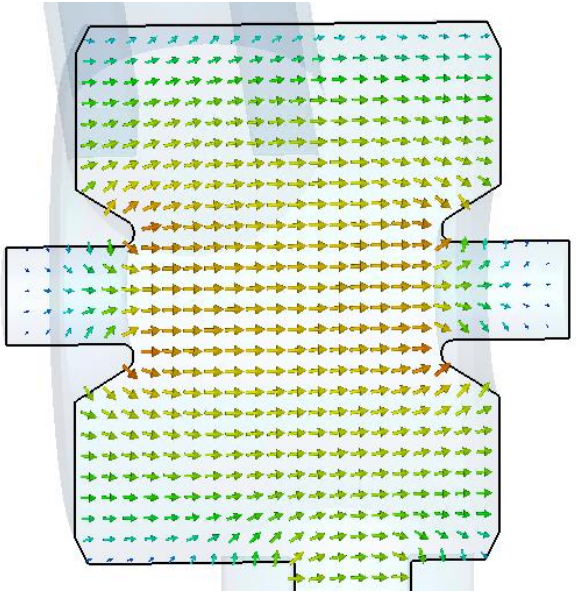
- 3D model:



Cavity
HOMs dampers

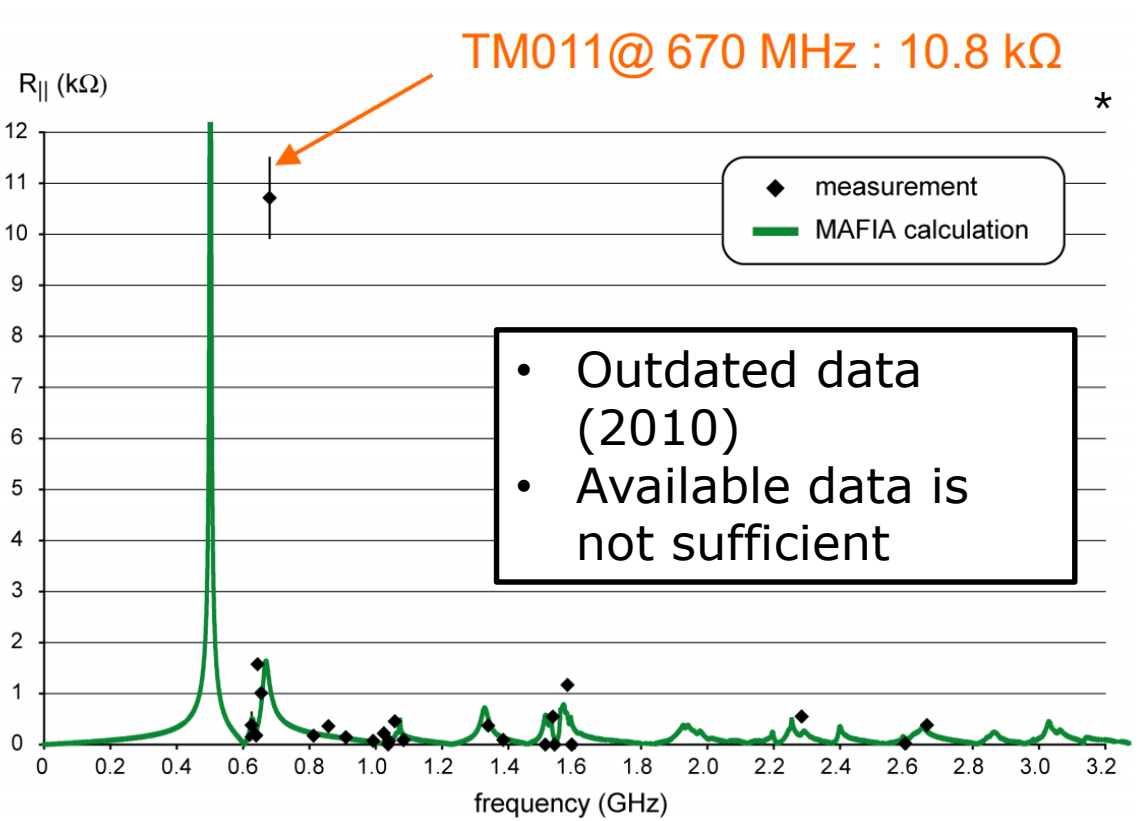
- Fundamental mode TM_{010}:

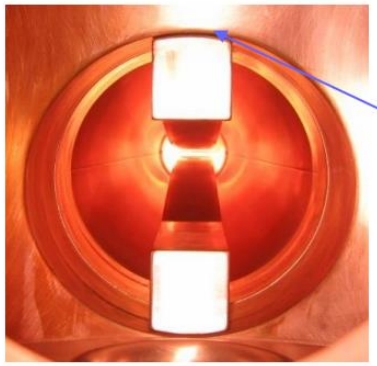
f = 502 MHz



Motivation

- Calculated value of the longitudinal impedance did not match experimental data (**only** for TM110 mode @ 670 MHz)



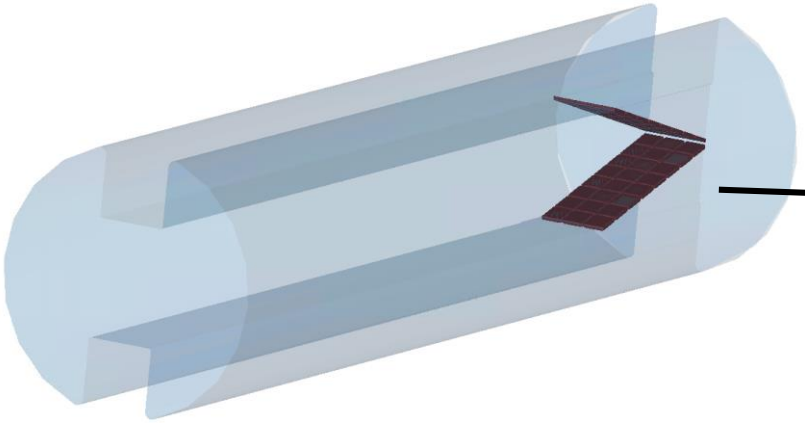


View along the WG axis

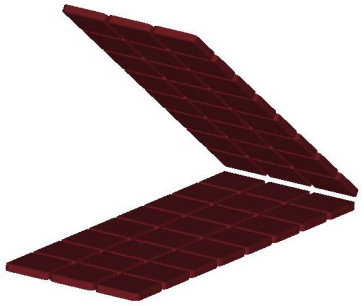
Eliminating the gap solved the problem

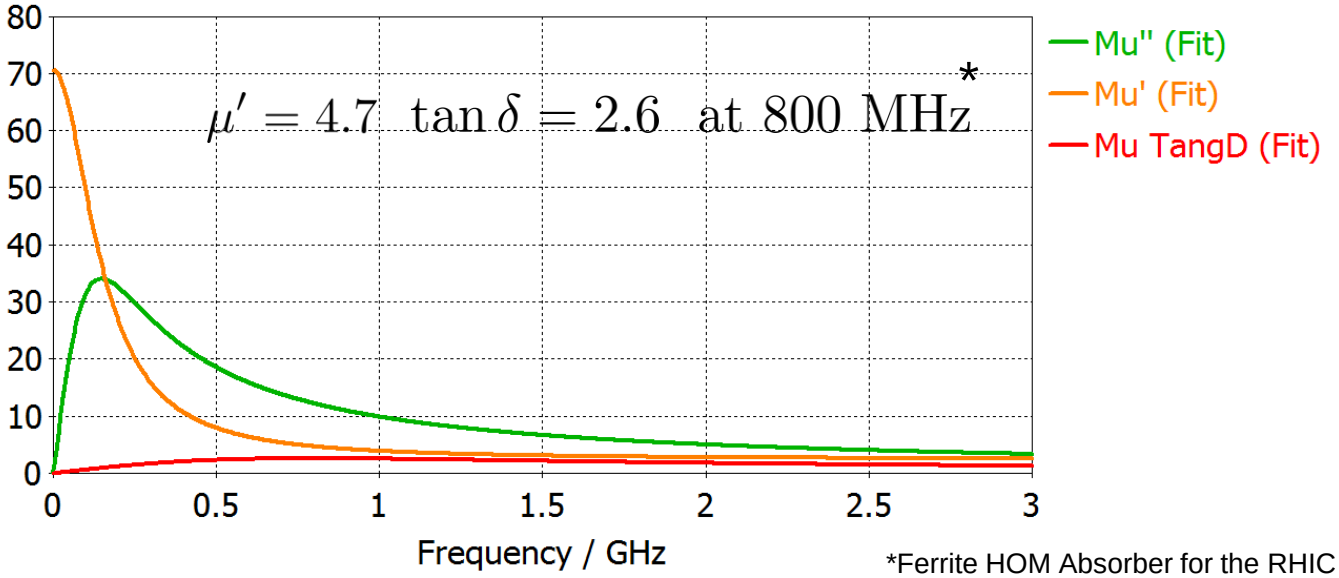
*ESLS-RF Meeting September 2010 ELETTRA, *Ernst Weihreter* / HZB BESSY II

Waveguide and ferrite load



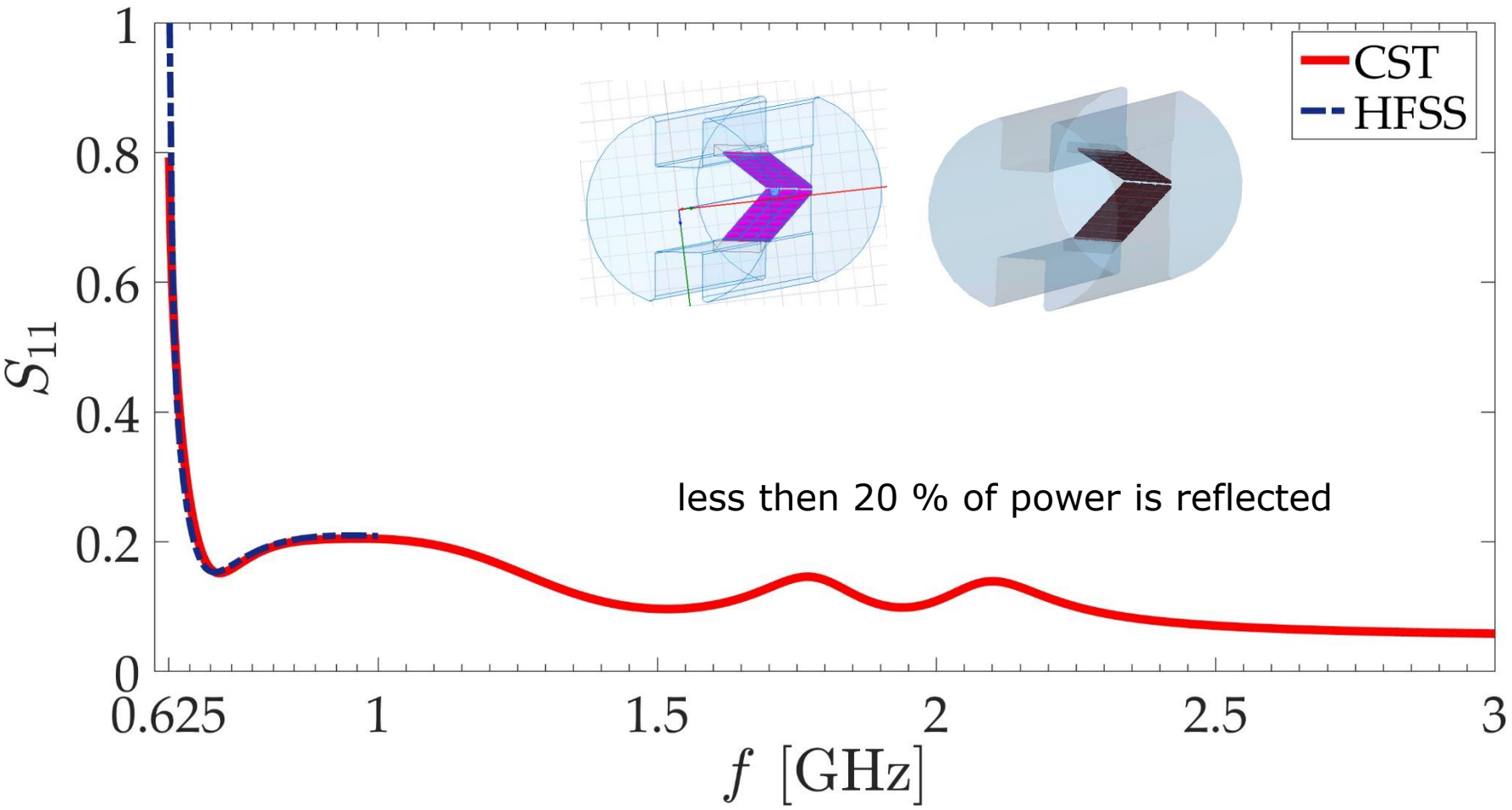
NiZn ferrite





*Ferrite HOM Absorber for the RHIC ERL *H. Hahn, et, al.*

Waveguide and ferrite load
Reflection coefficient



Considered boundary conditions

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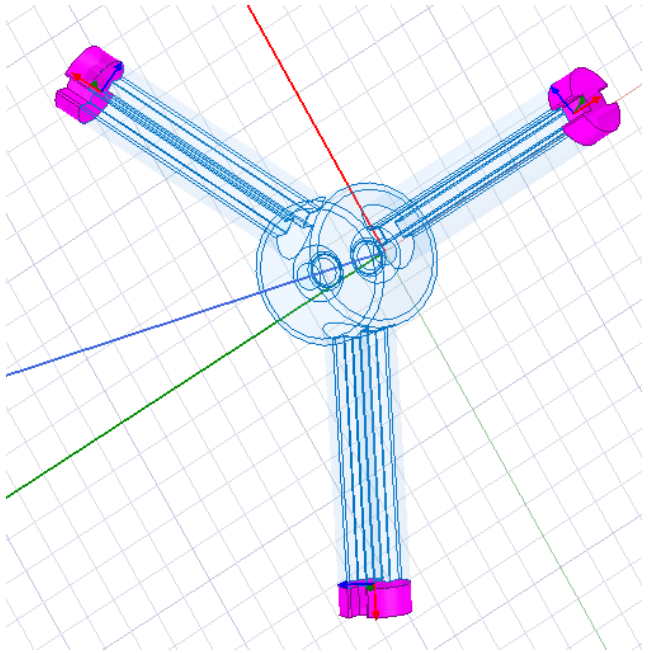
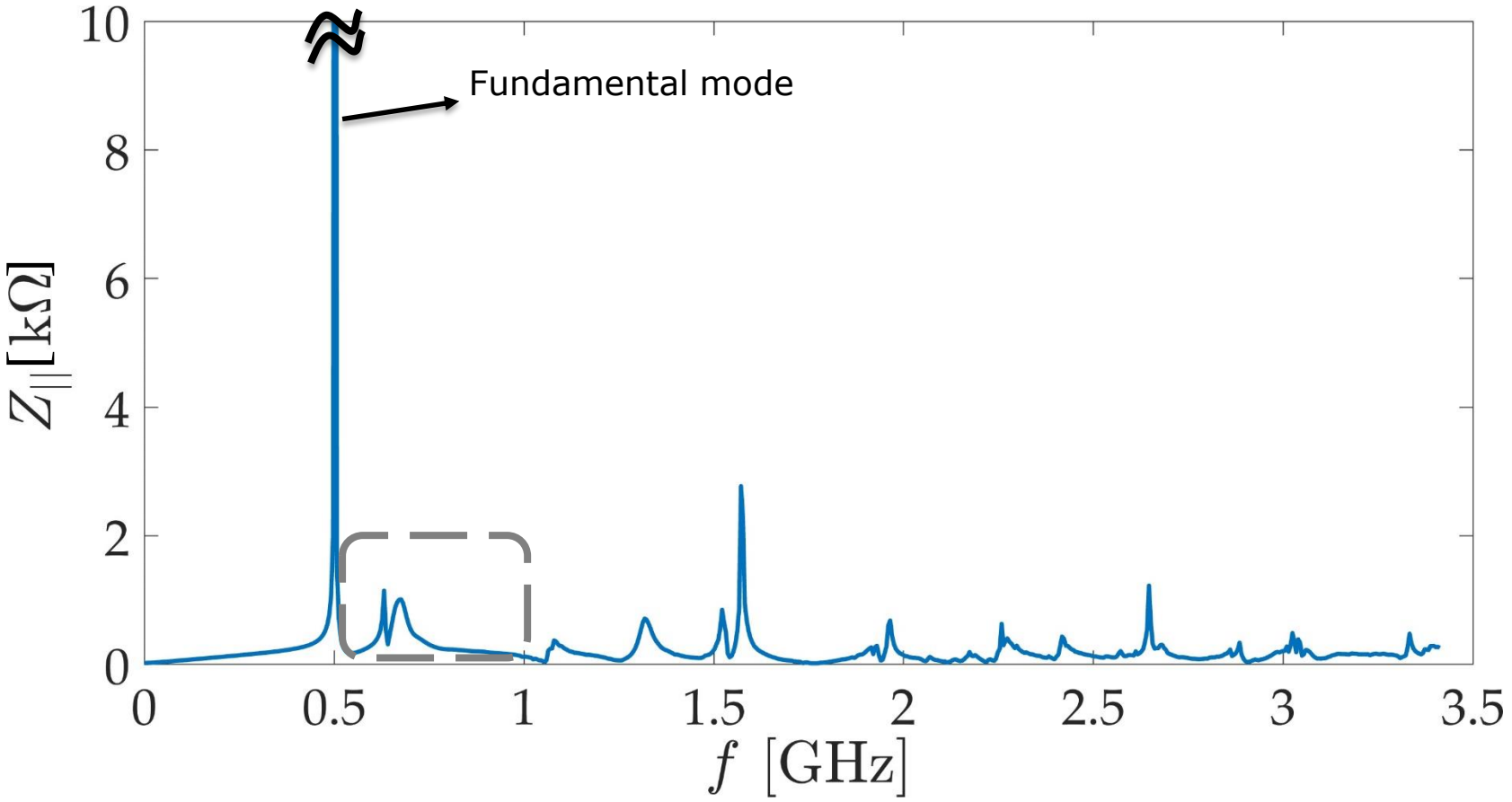
CST - > realistic model with **ferrite load** (wake field simulation)

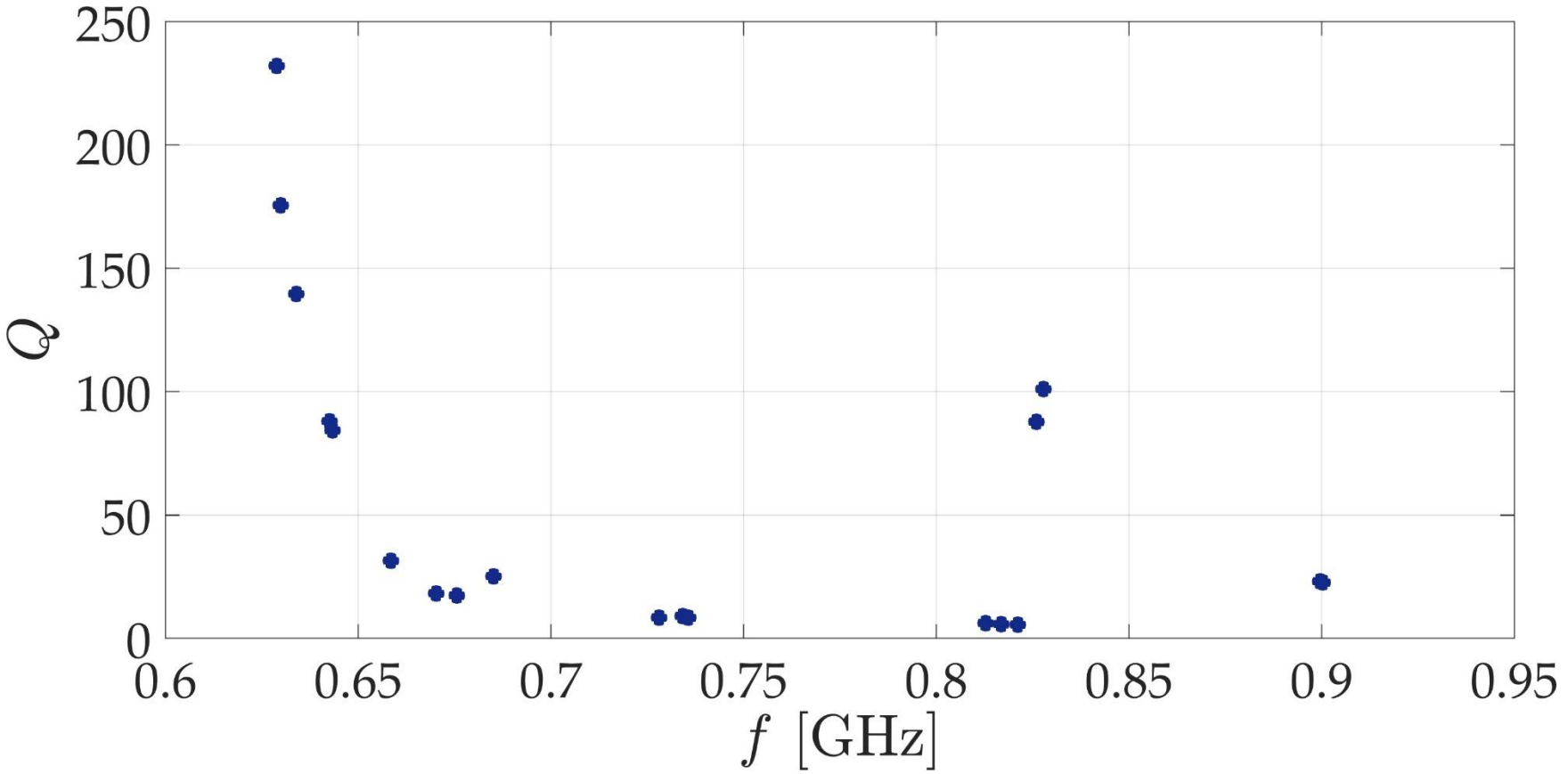
HFSS - > Perfectly Matched Loads (**PML**) (eigenmode simulation)



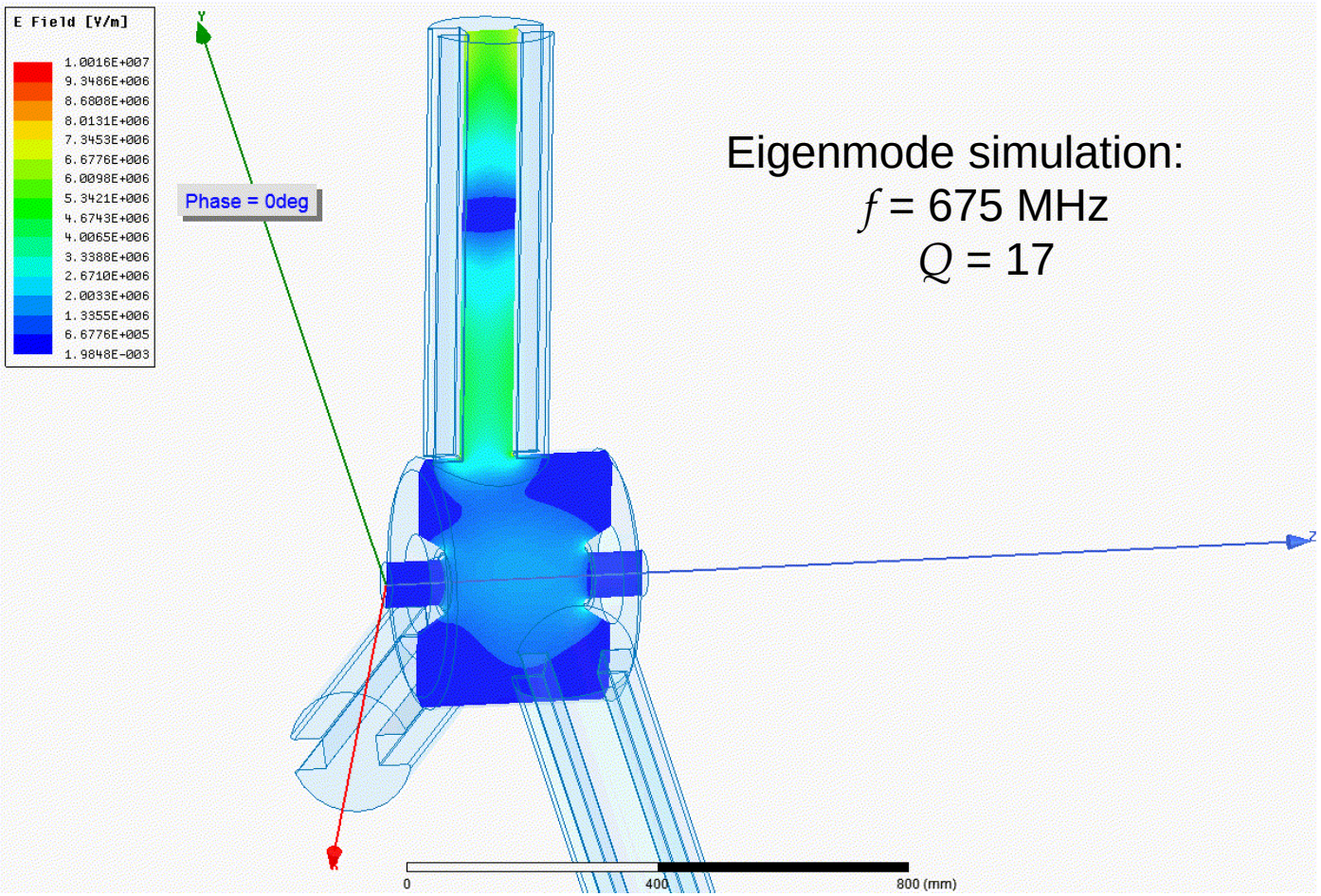
Full model
Longitudinal impedance (CST)



Full model
Eigenmodes (HFSS)



HOM extraction at 675 MHz

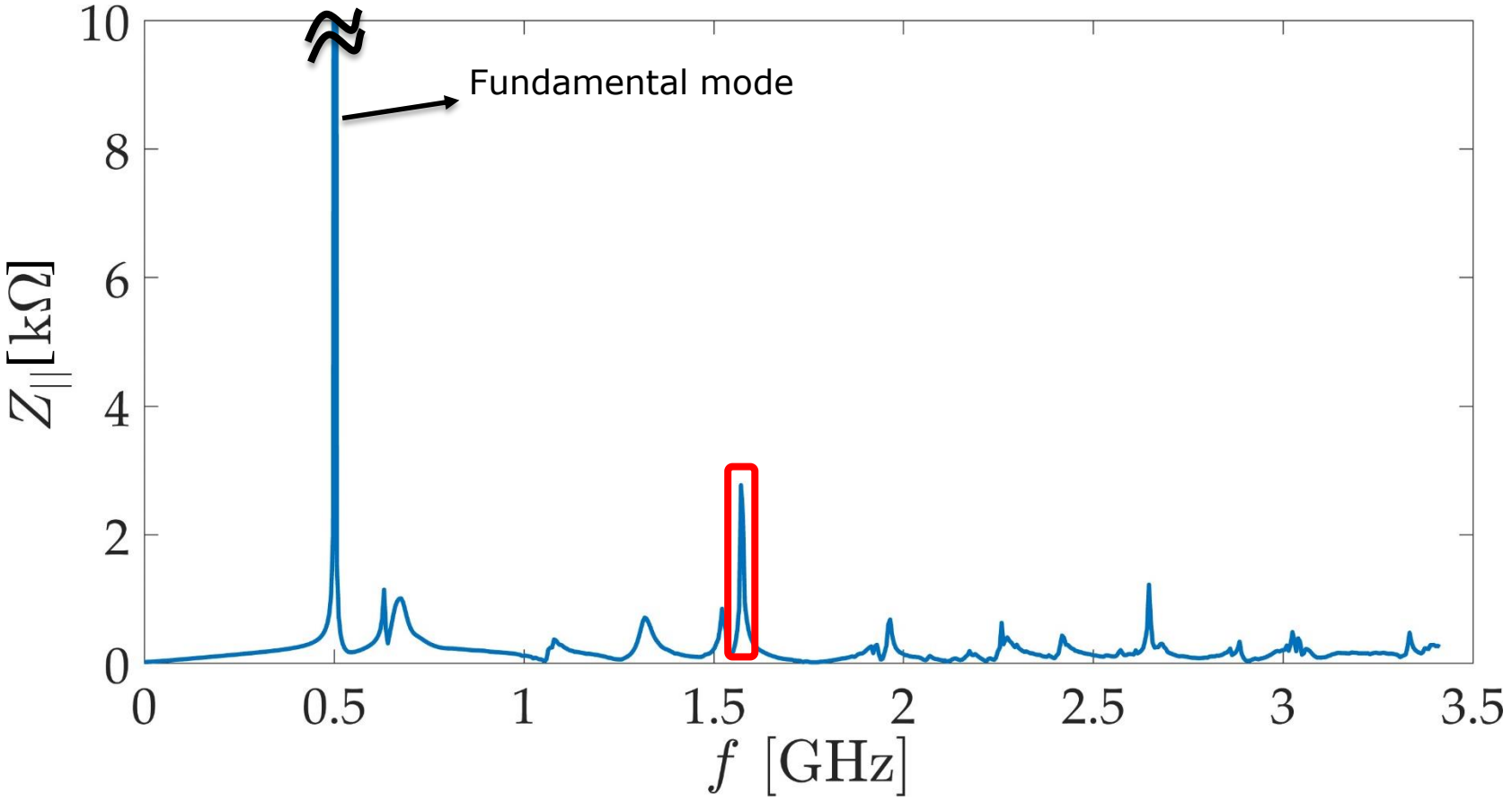


Eigenmode simulation:

f = 675 MHz

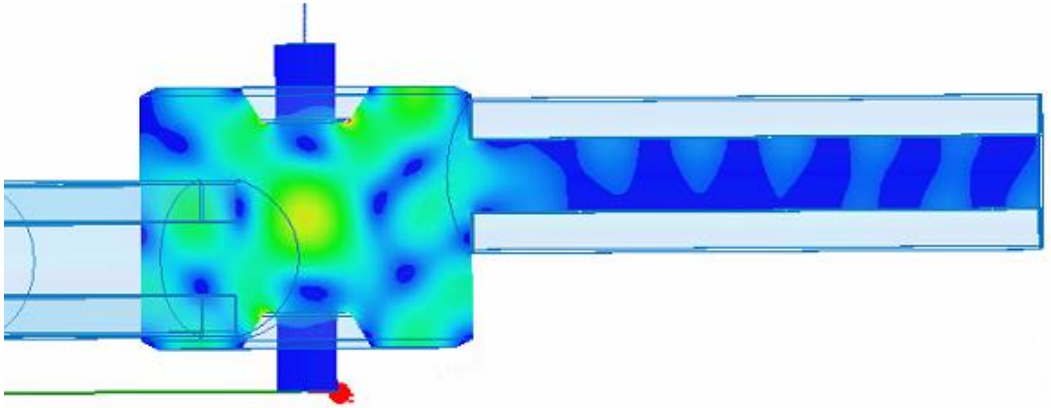
Q = 17

Full model
Longitudinal impedance (CST)

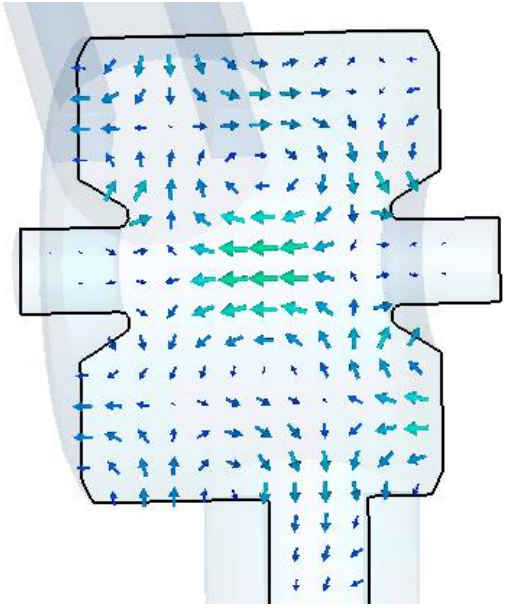


1.576 GHz longitudinal mode

Electric field map (HFSS):



CST MWS:



$$f = 1.576\ \text{GHz}$$
$$Q = 650$$

1.576 GHz longitudinal mode

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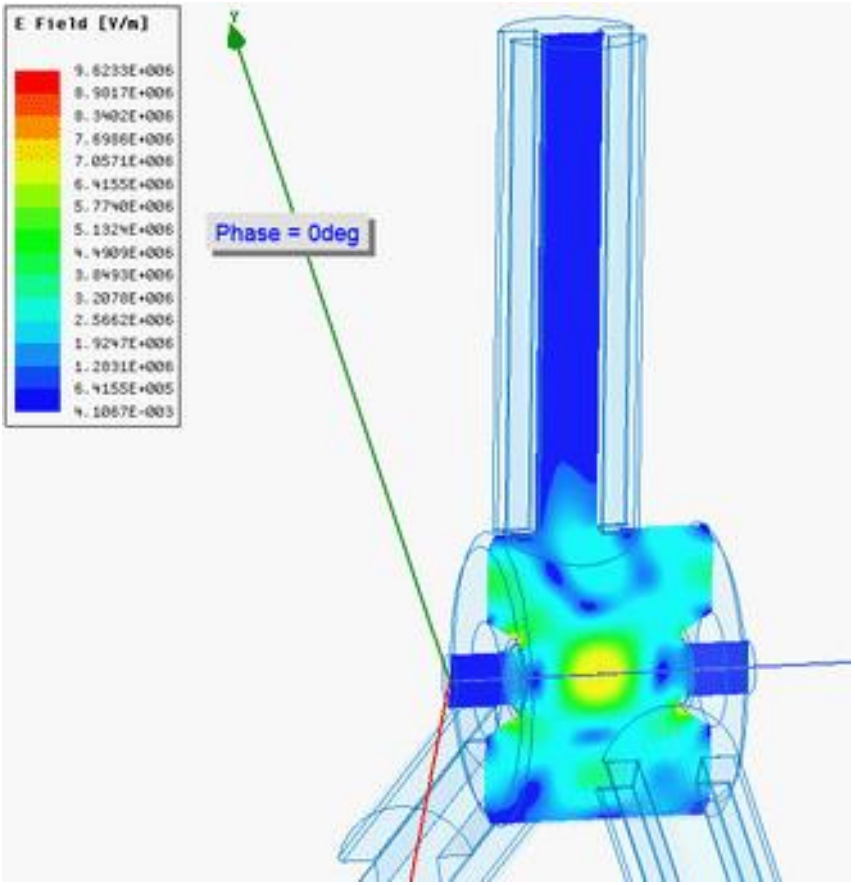
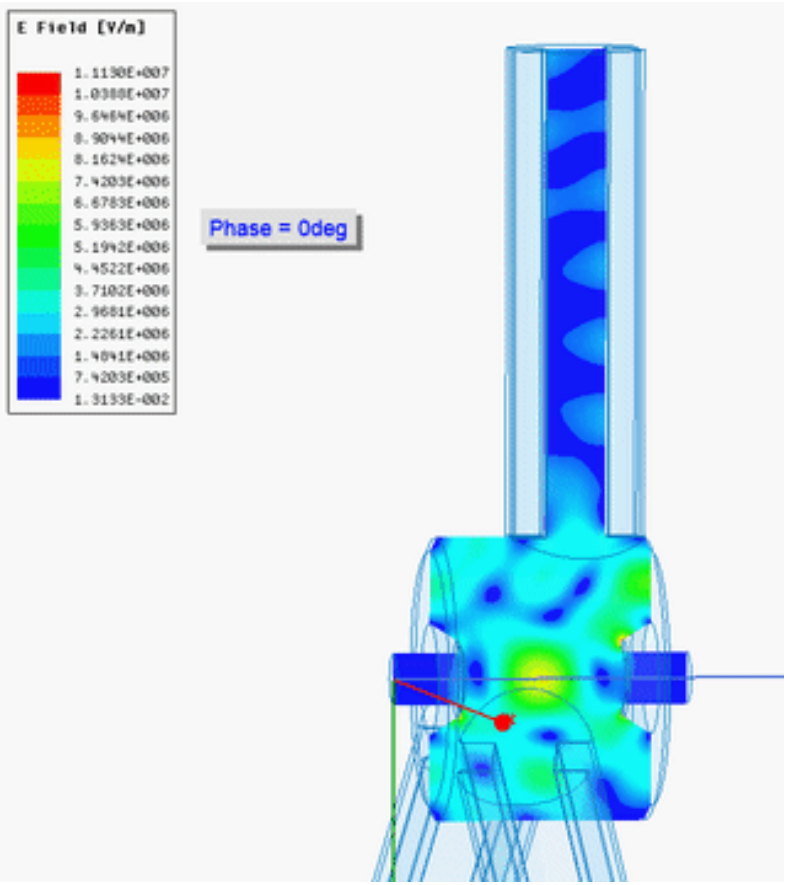
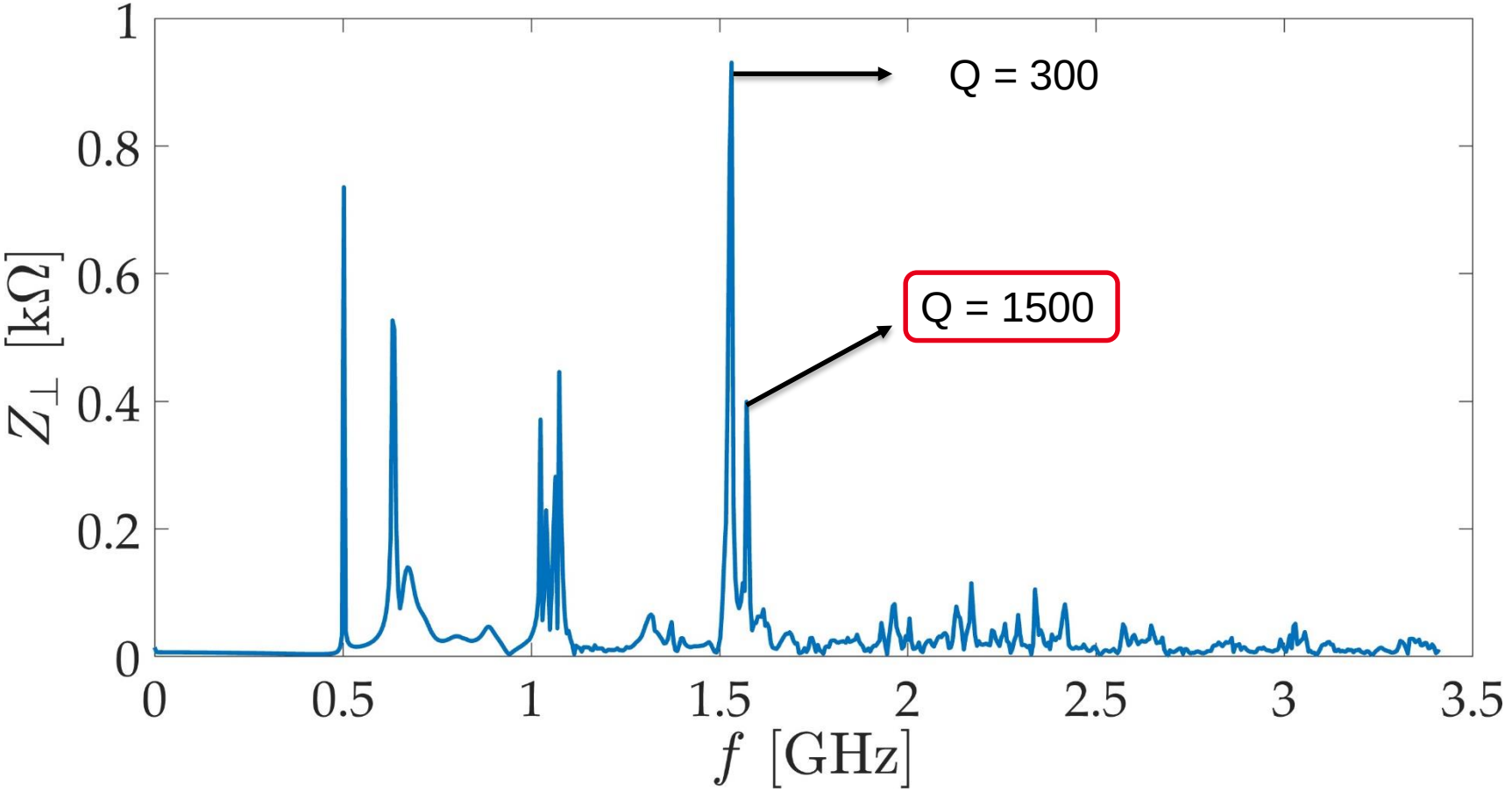
- 1st waveguide cut plane



- 2nd waveguide cut plane

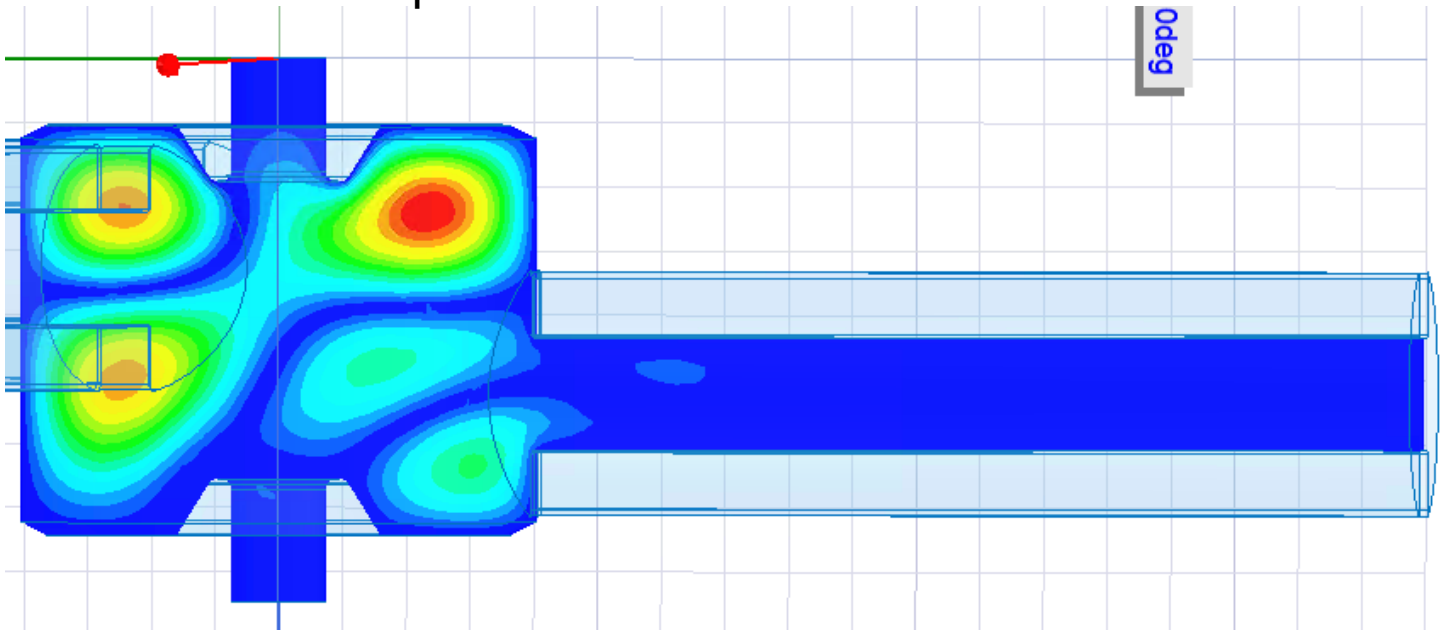


Full model
Transverse impedance (CST)



1.577 GHz transverse mode

Electric field map:



$f = 1.577\ \mathrm{GHz}$

$Q = 1500$

Transverse kick? -> calculation of kick factor TBD

Ways to improve HOMs damping for 500 MHz cavity

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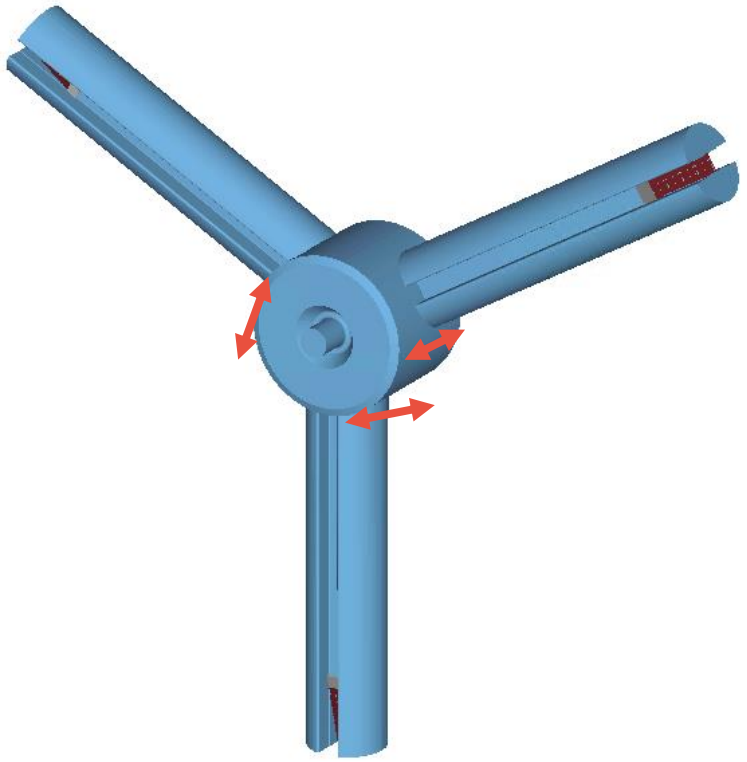
- Change position of waveguides
- Modify geometry of the cavity



Conclusion

- Large scale non-symmetric model -> long computational time
- HFSS with PML boundary conditions -> max. 20 modes per one run
- One longitudinal HOM with relatively high Q-factor and longitudinal impedance is observed at 1.576 GHz
- Transverse modes with relatively high Q-values are present -> potentially increased RF losses in the cavity

Outlook

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- Evaluation of an optimal position of waveguides
- Consider modification of the cavity shape with aim to improve HOMs damping
- Calculation of eigenmodes at high impedance regions

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Thank you for your attention!