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TECHNOLOGY OSIJEK

Understanding and possible mitigation strategies of the PSB BTV "like" impedances

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Acknowledgments: S. Burger

Summer Student 2019 (01.07.-23.08.)

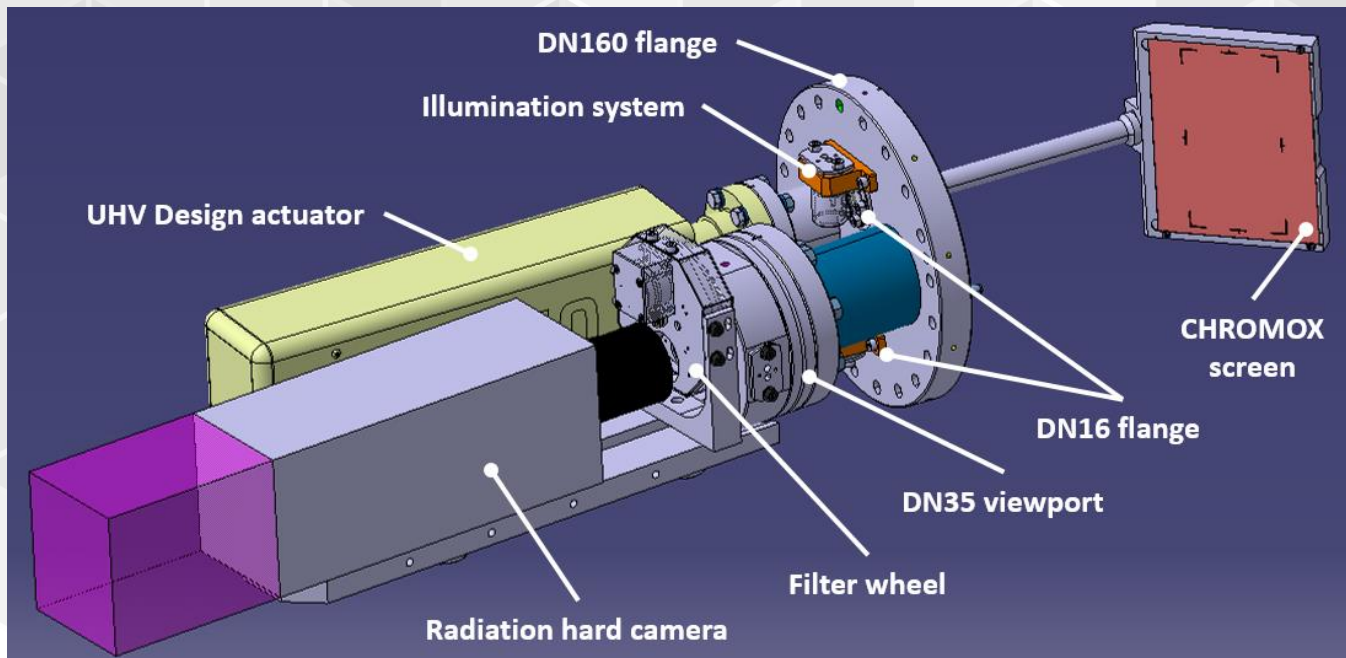


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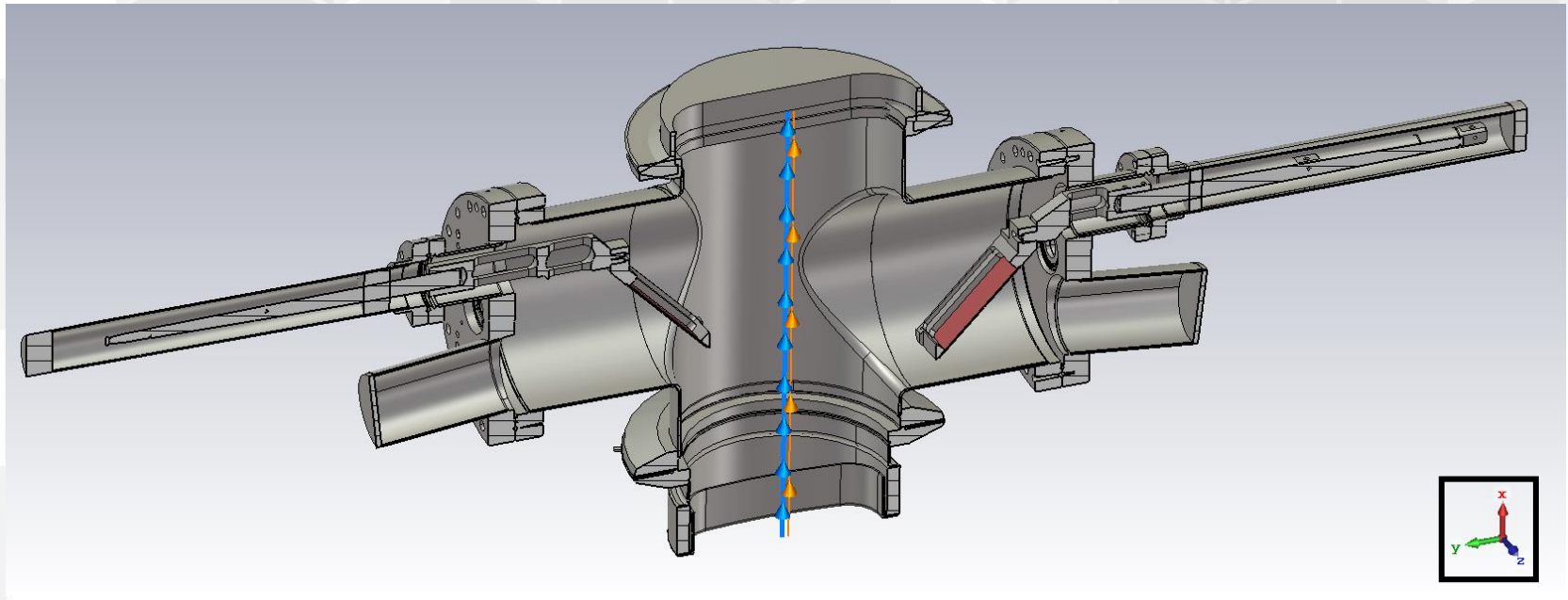
- Introduction
- Preliminary BTV studies
- Simulation of the BTV impedance:
 1. Numerical validation:
 - a. Convergence studies
 - b. Comparison between Eigenmode and Wakefield solver
 2. Step by step computation of the impedance
- Investigation of impedance mitigation possibilities
- Future work

Introduction

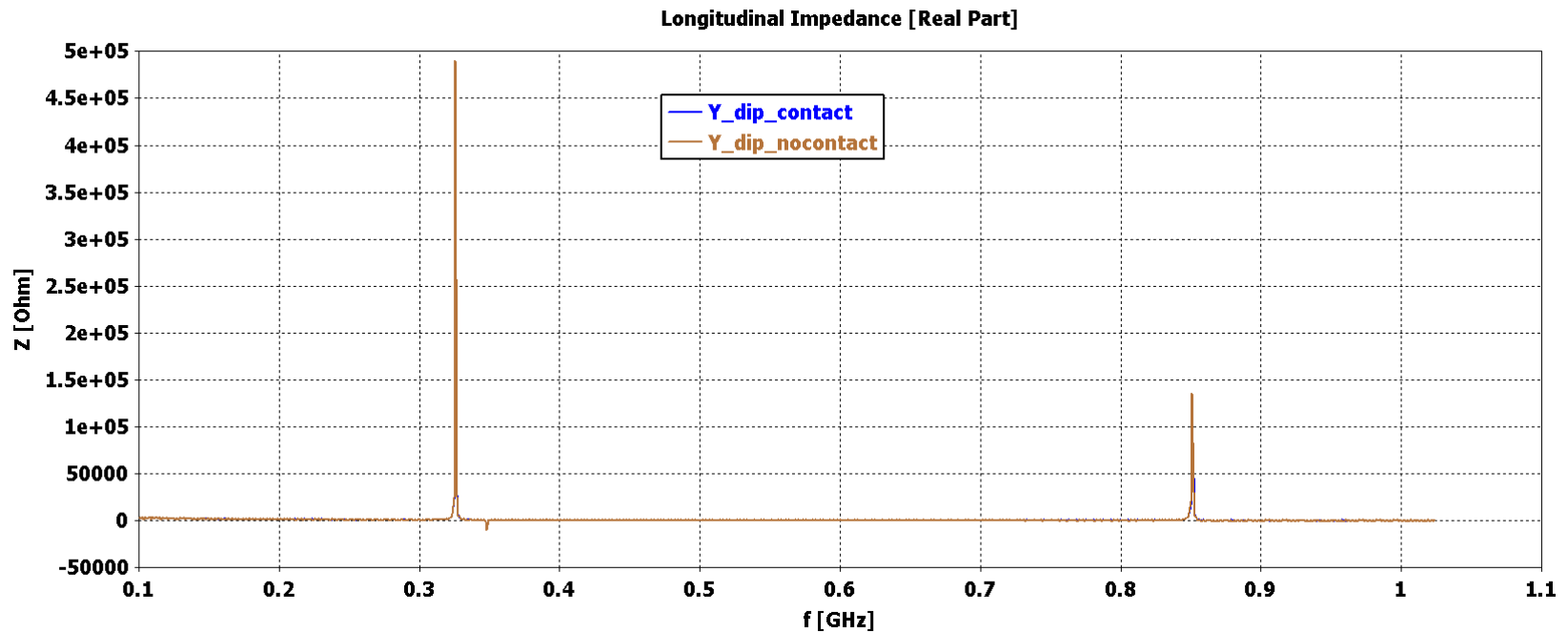
- BTV (beam imaging system) are devices used for beam position and transverse size measurements



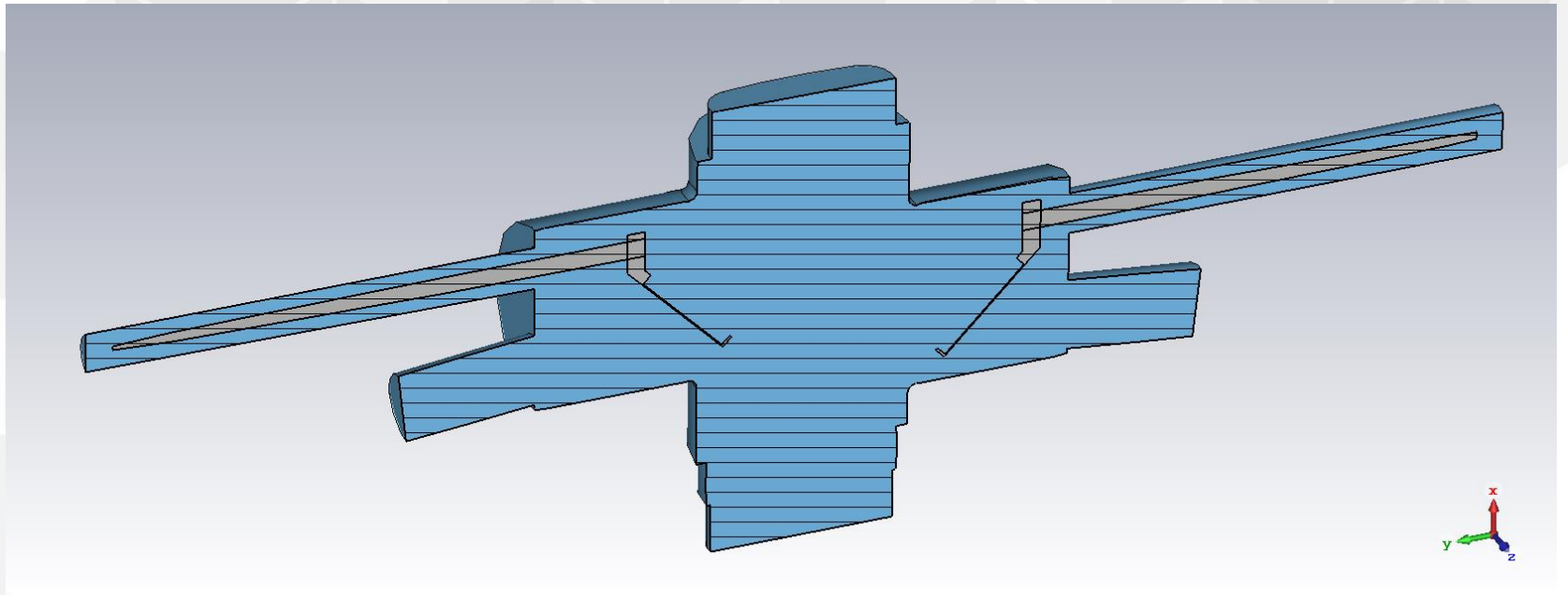
BTV model with vacuum tank



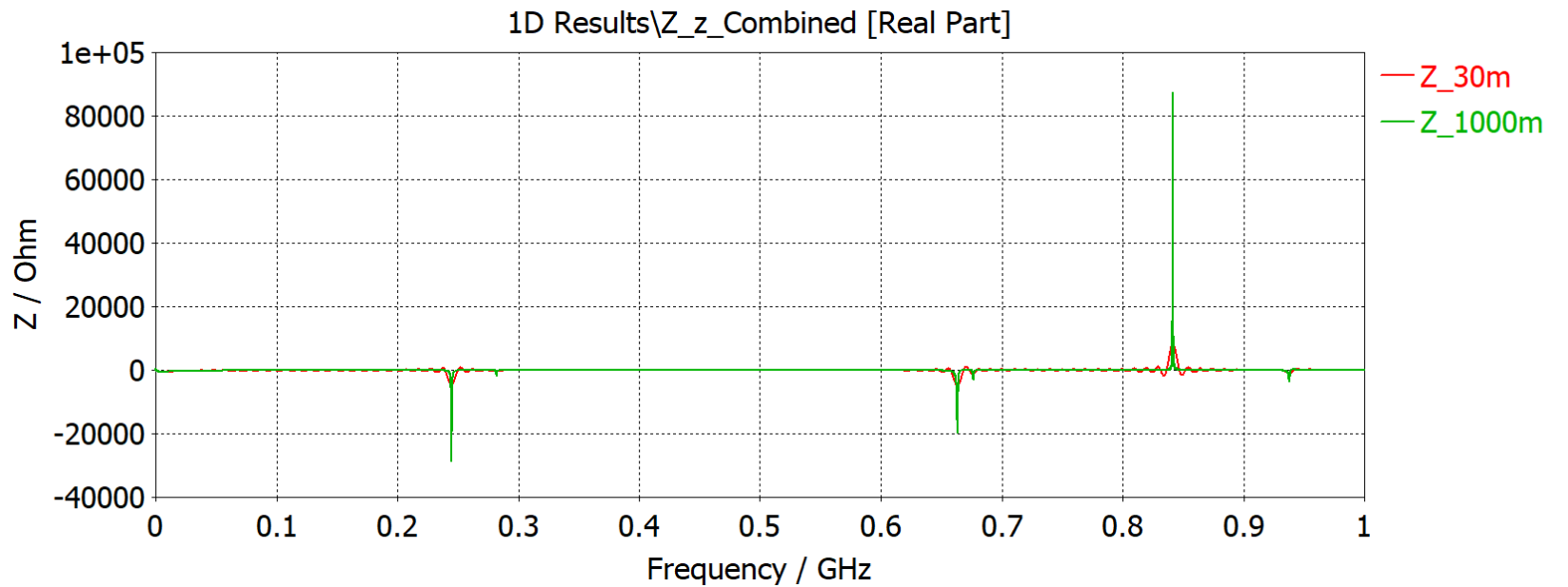
Preliminary BTV studies



BTV model for simulations



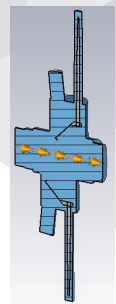
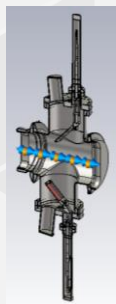
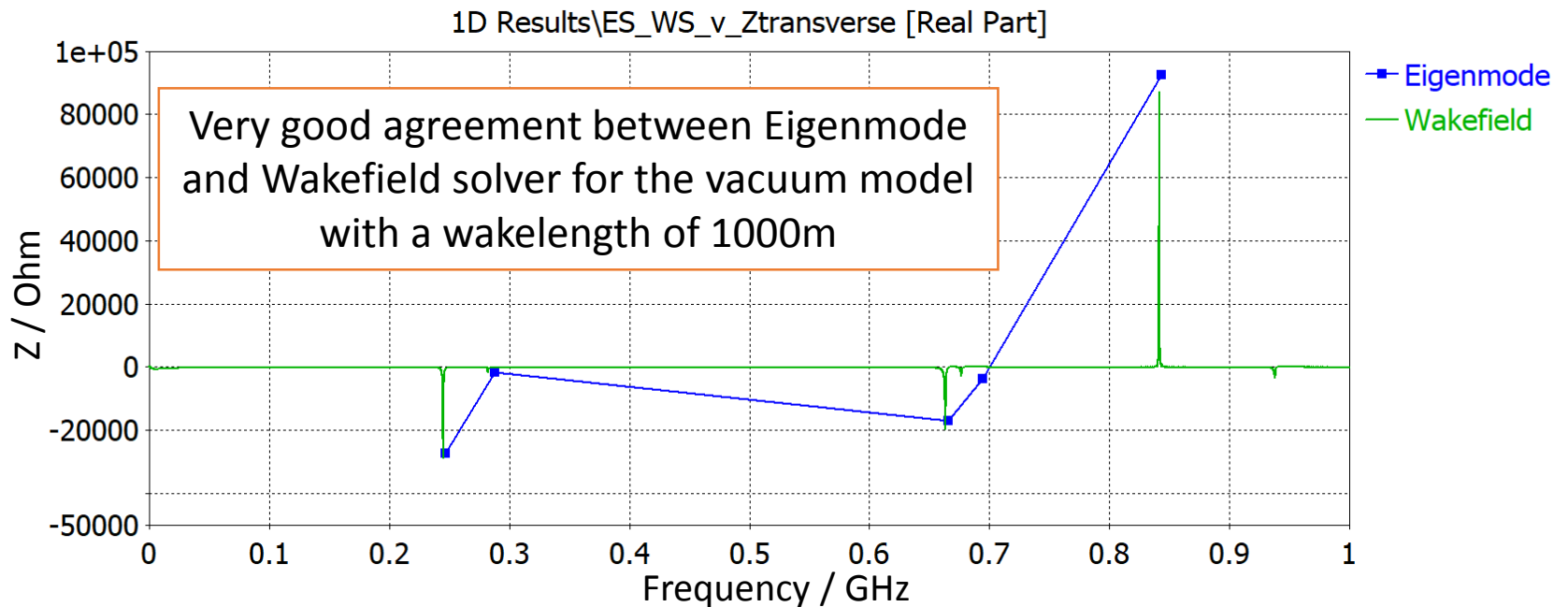
Numerical validation



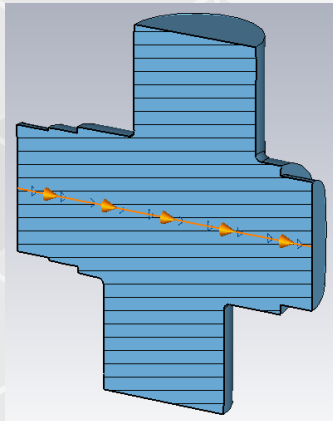


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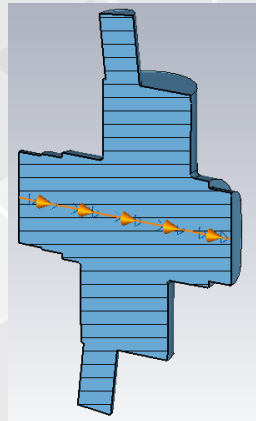
Numerical validation – Eigenmode and Wakefield solver comparison



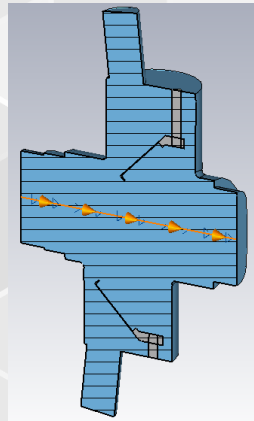
Step by step computation of the impedance



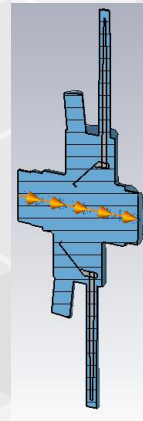
Step1



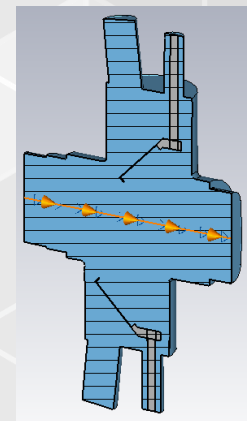
Step2



Step3



Step4



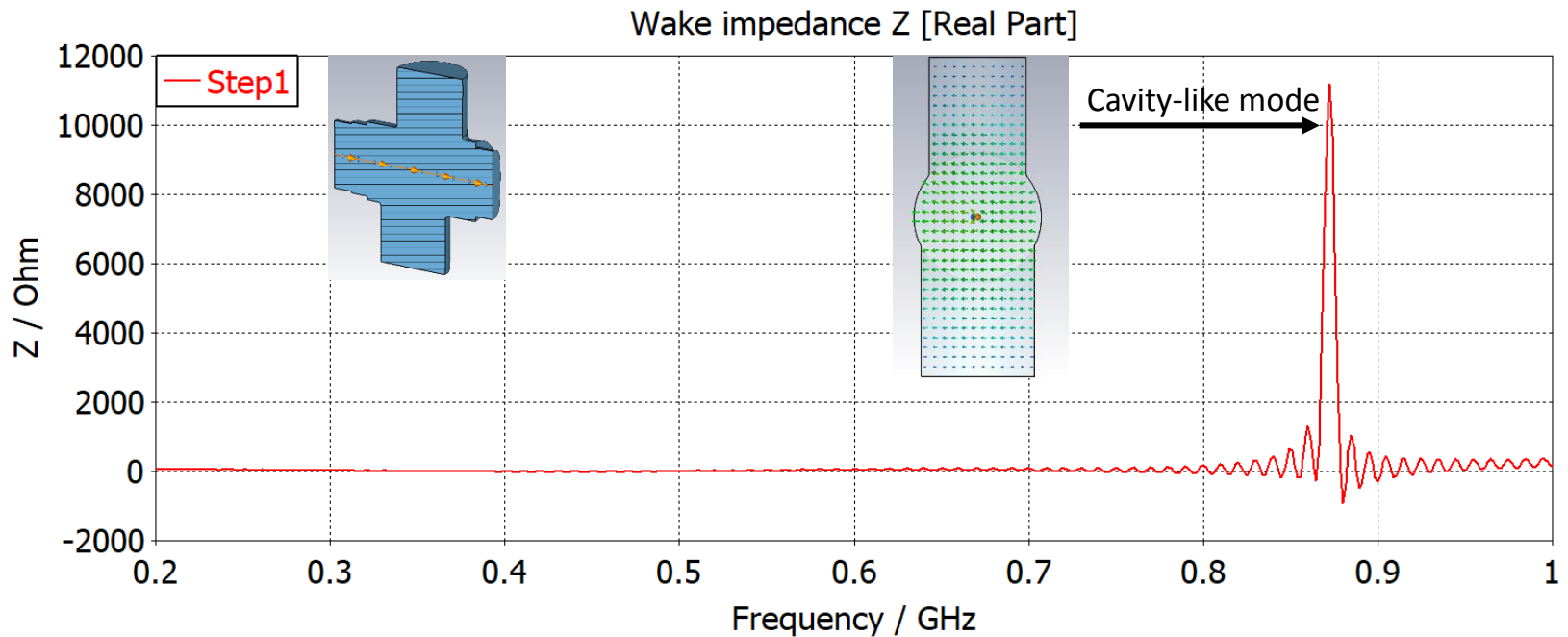
Step5

Shorter Wake (30 m) will be simulated for practical reasons



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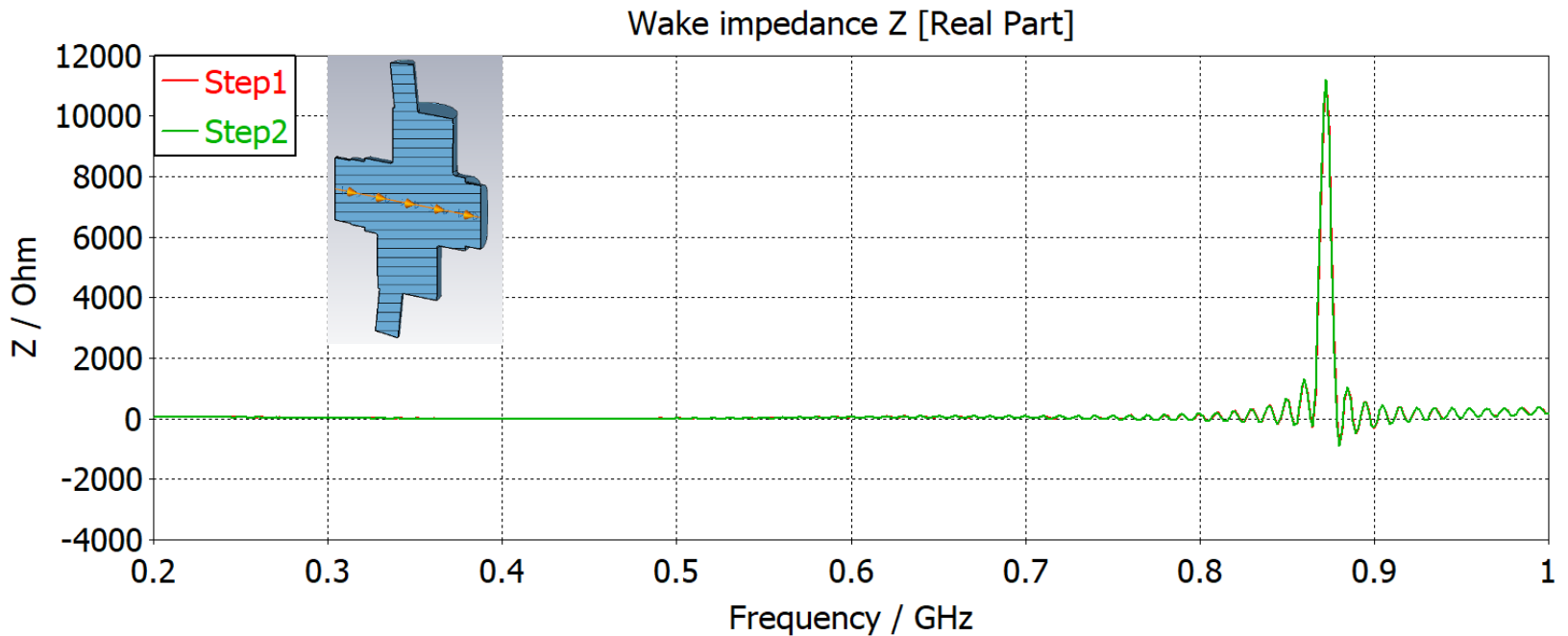
Step by step computation of the impedance – Step 1





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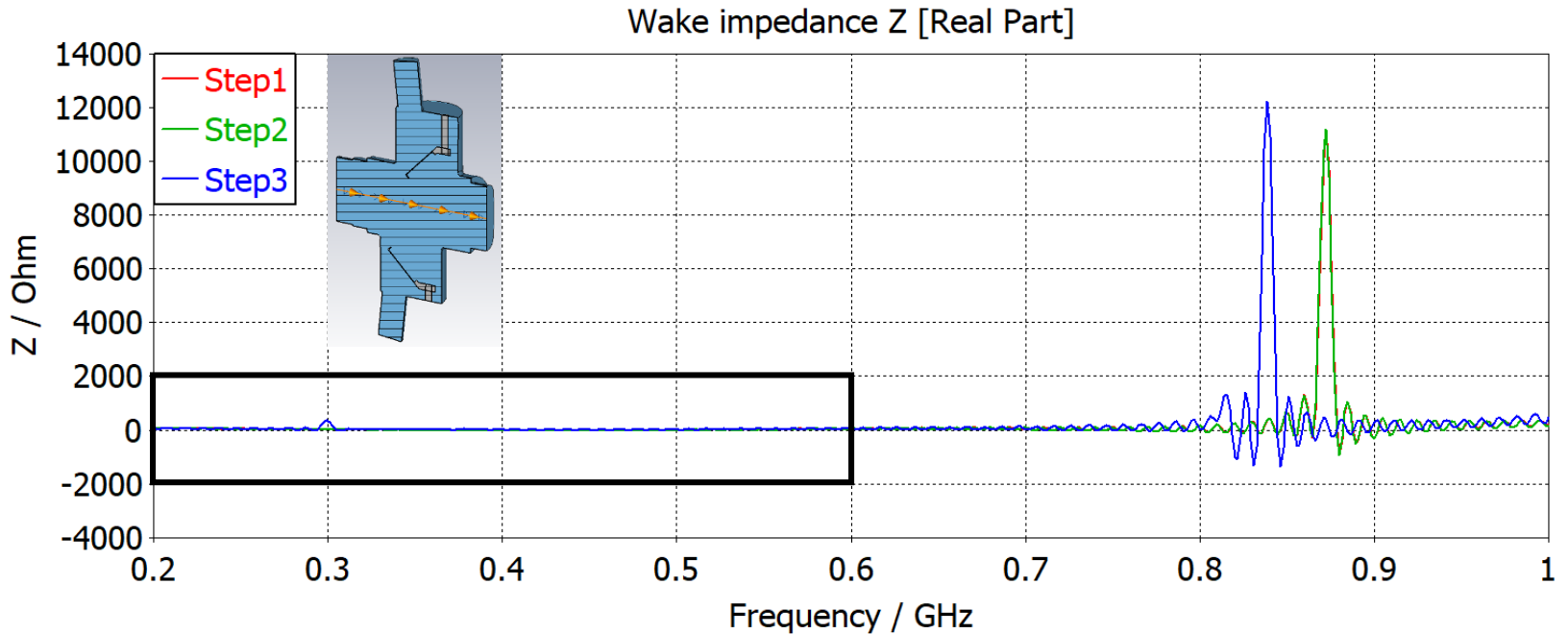
Step by step computation of the impedance – Step2





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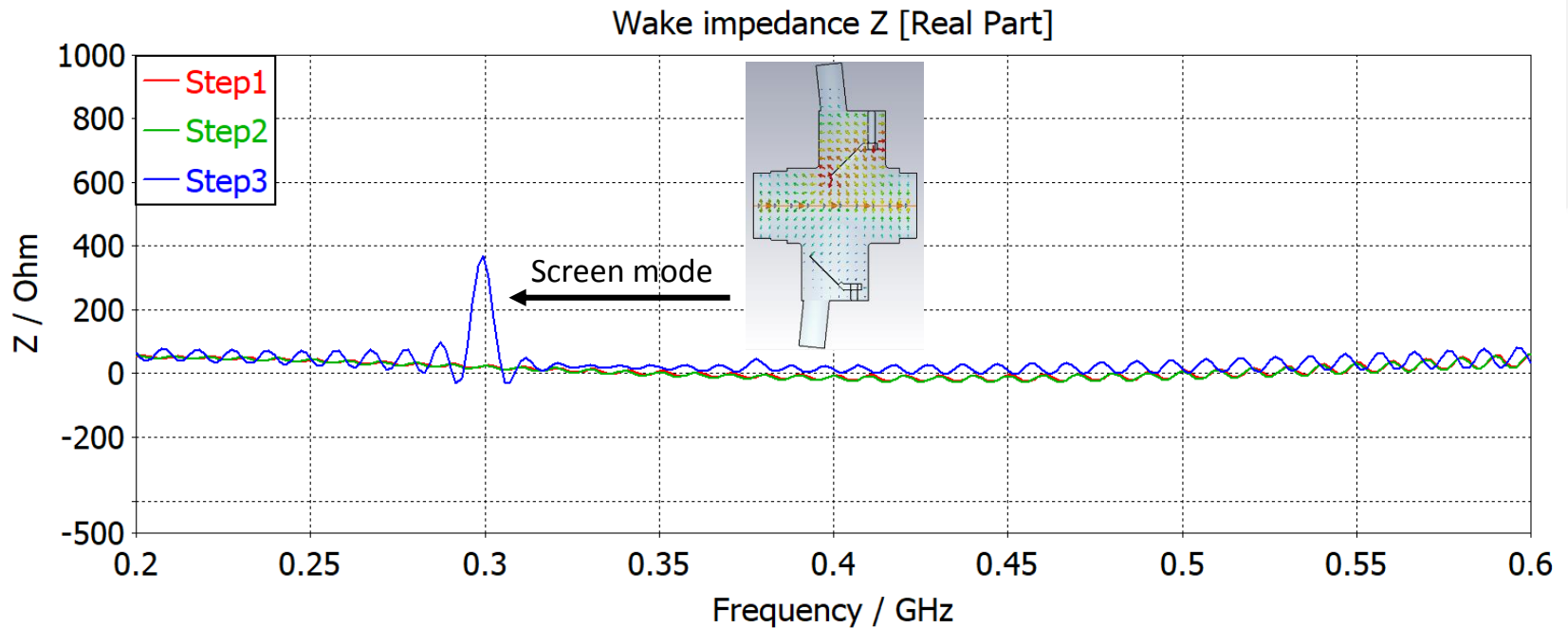
Step by step computation of the impedance – Step3





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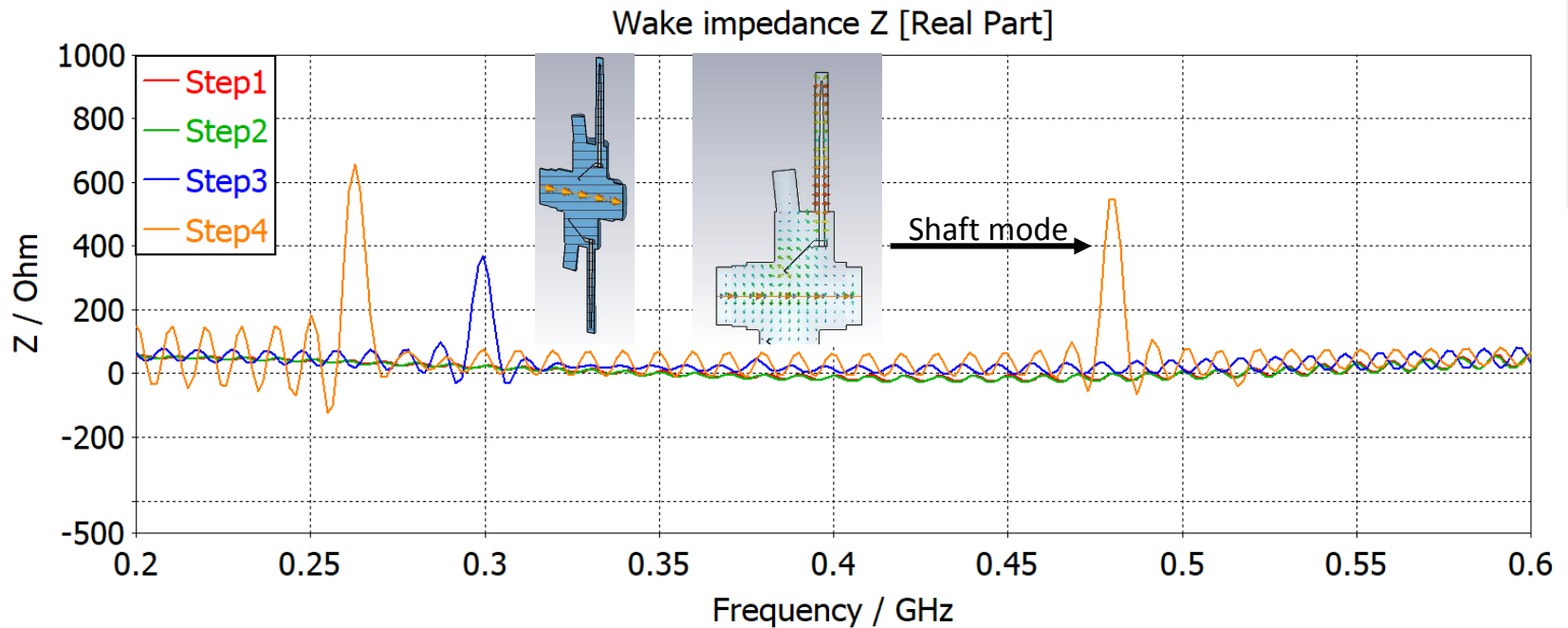
Step by step computation of the impedance – Step3





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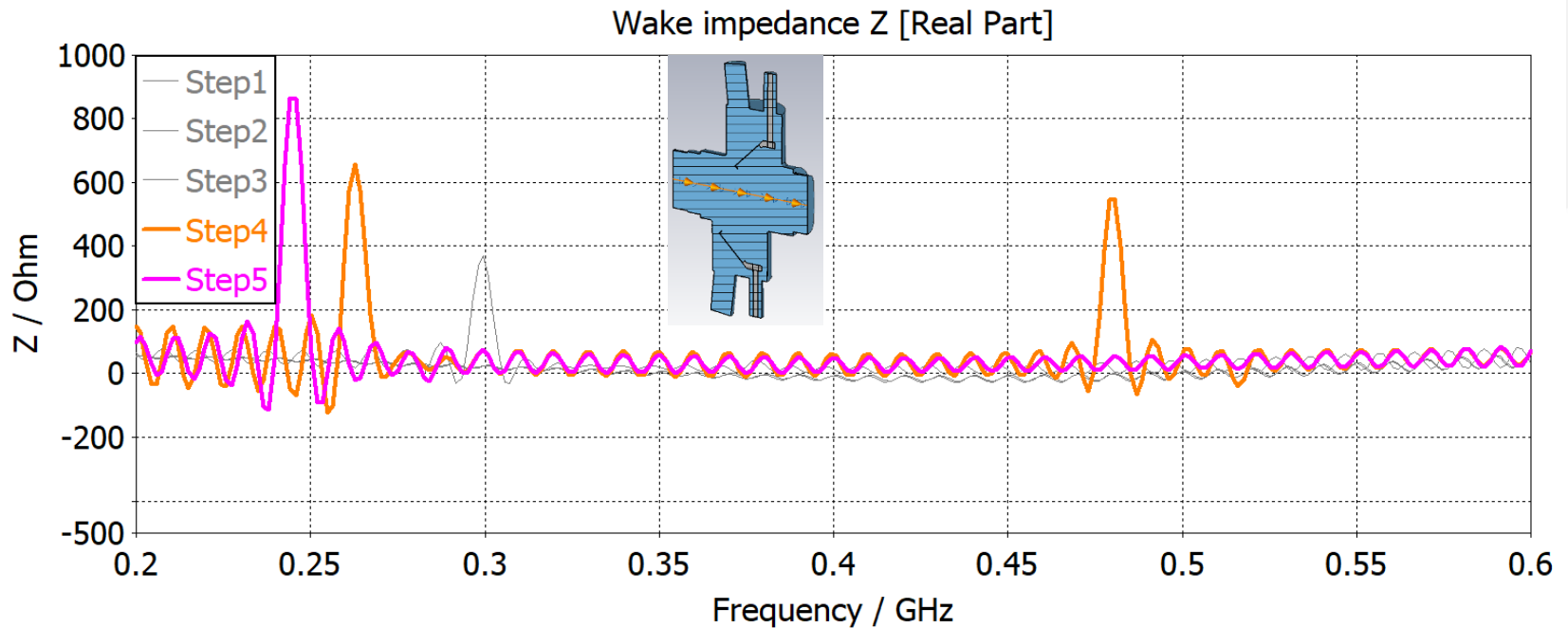
Step by step computation of the impedance – Step4





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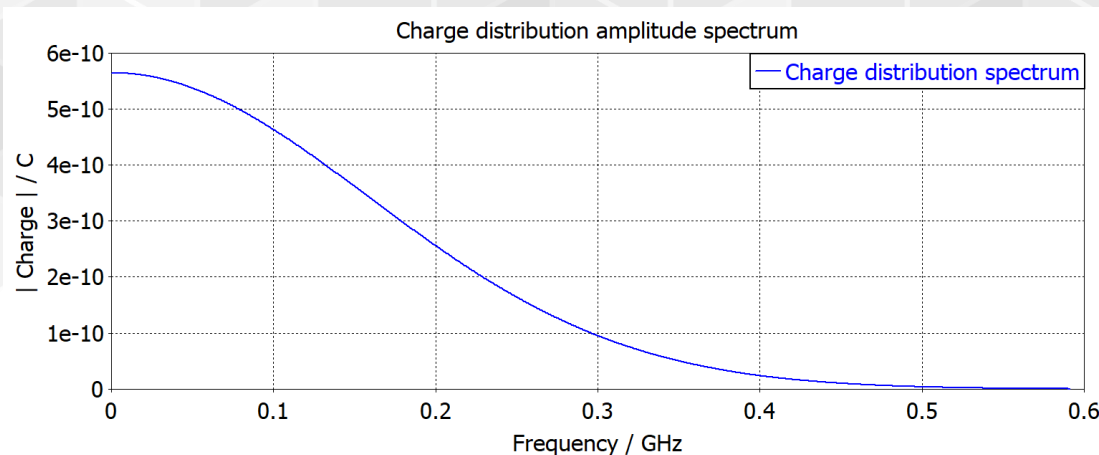
Step by step computation of the impedance – Step5





Beam coupling impedance effects

- Beam coupling impedance is having negative effects on:
 1. Heating
 2. Mechanical stress
 3. Beam stability
- In order to minimize the beam coupling impedance effects it needs to be reduced (damped) or shifted to another frequency range





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Investigation of impedance mitigation possibilities

- Possibilities:
 1. Mode damping
 2. Frequency shift of the mode
- Modes introduced by the screen holder and the shaft are of primary interest



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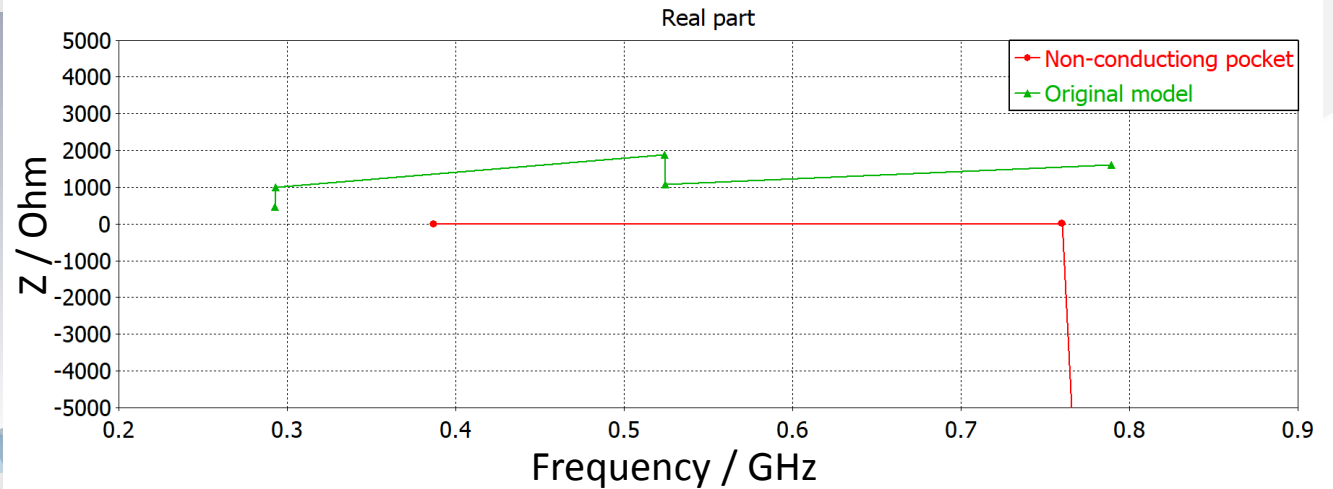
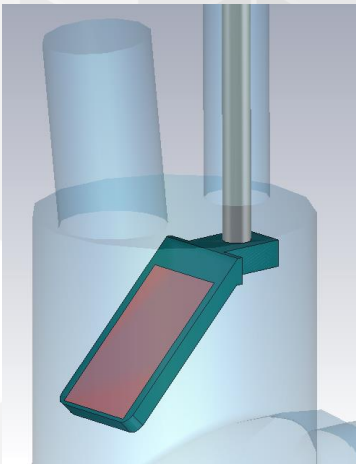
Potential solutions

- Making the screen holder non-conducting
- Insulating the screen holder and the shaft
- Insulating the screen holder and the shaft with inserted ferrite
- Inserting ferrite



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Investigation of impedance mitigation possibilities – making the screen holder non-conducting

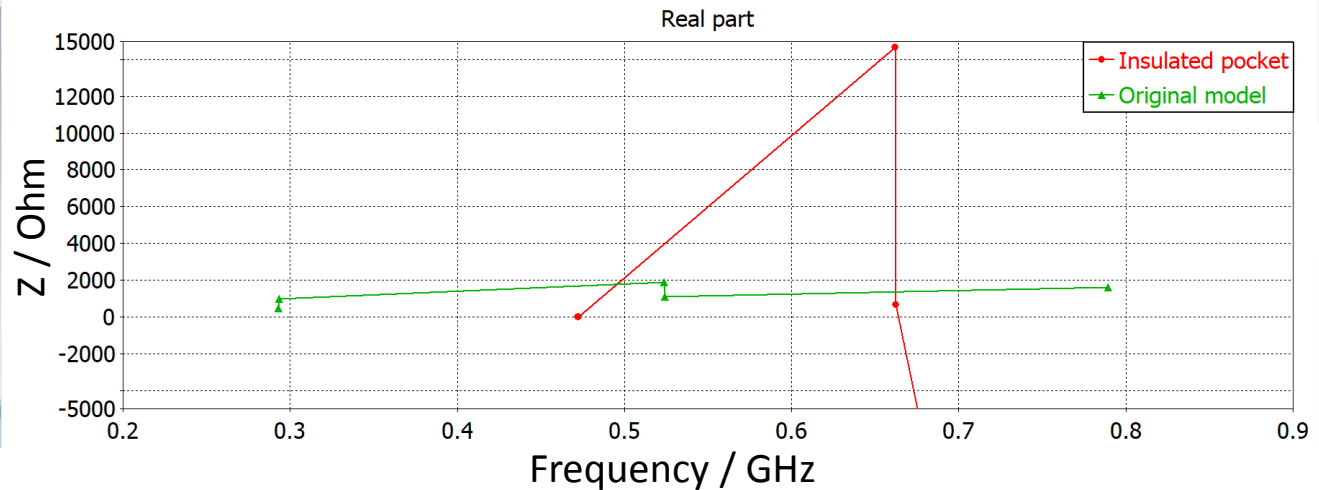
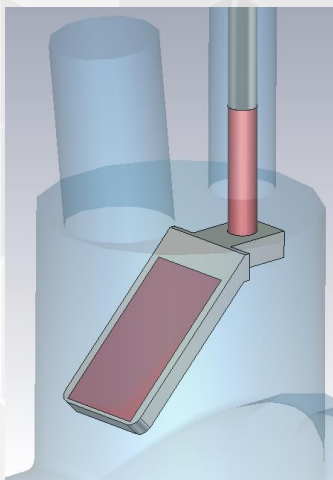


Screen mode is eliminated
Shaft mode is damped



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Investigation of impedance mitigation possibilities – insulating the screen holder and the shaft

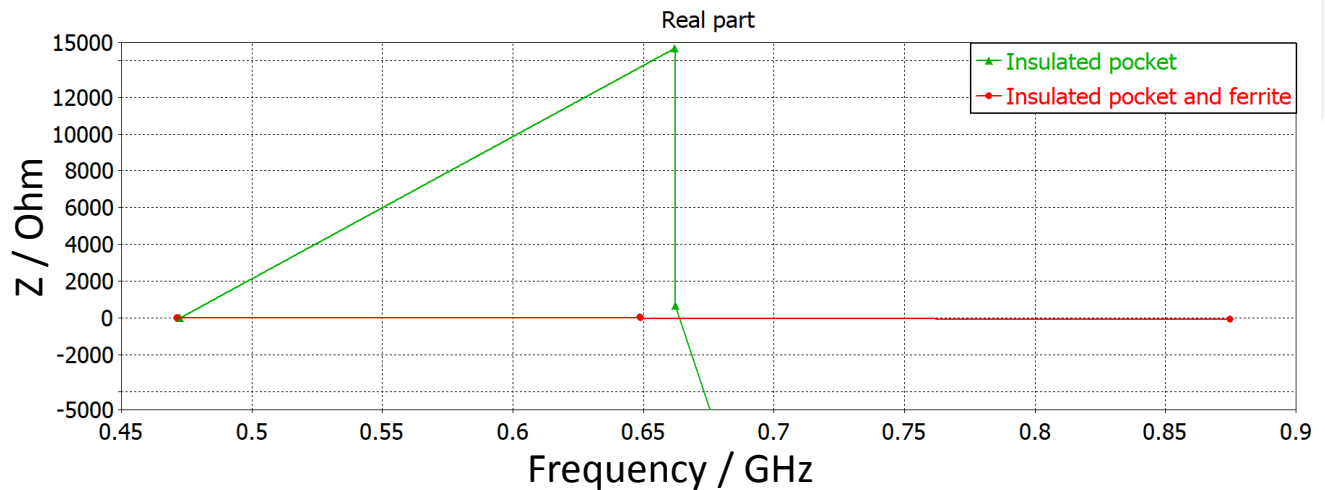
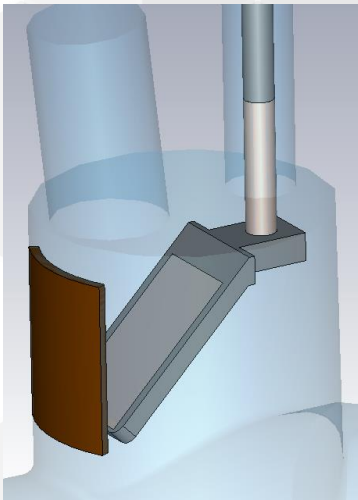


Screen mode is shifted
Shaft mode is damped



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Investigation of impedance mitigation possibilities – insulating the screen holder and the shaft and adding ferrite

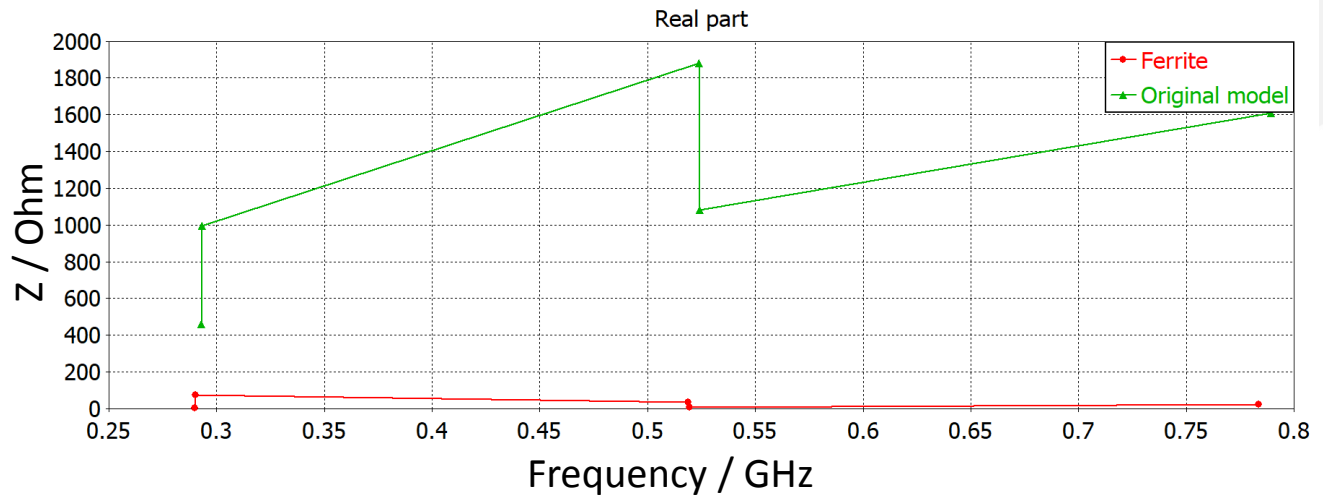
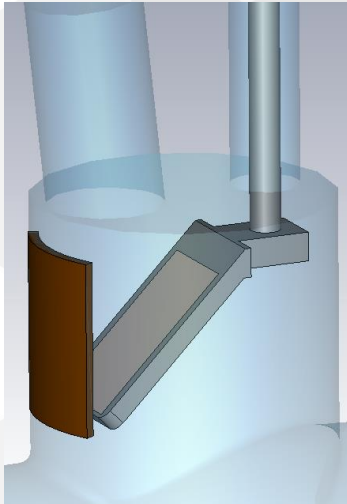


Screen mode is shifted and damped
Shaft mode is damped



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Investigation of impedance mitigation possibilities – inserting ferrite



Screen mode is damped
Shaft mode is damped



Conclusion

- Eigenmode and Wakefield show very good agreement (appropriate settings and convenient modeling of the 3D geometry for the Wakefield solver)
- The screen holder makes the biggest contribution to the beam coupling impedance
- Impedance is significantly mitigated using non-conductive screen holder or using ferrite for mode damping
- Impedance spectrum can be shifted to higher frequencies with shaft insulation



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Future work

- Feasibility studies:
 1. Material
 2. Thermal effects
 3. Mechanical effects
- Measurements



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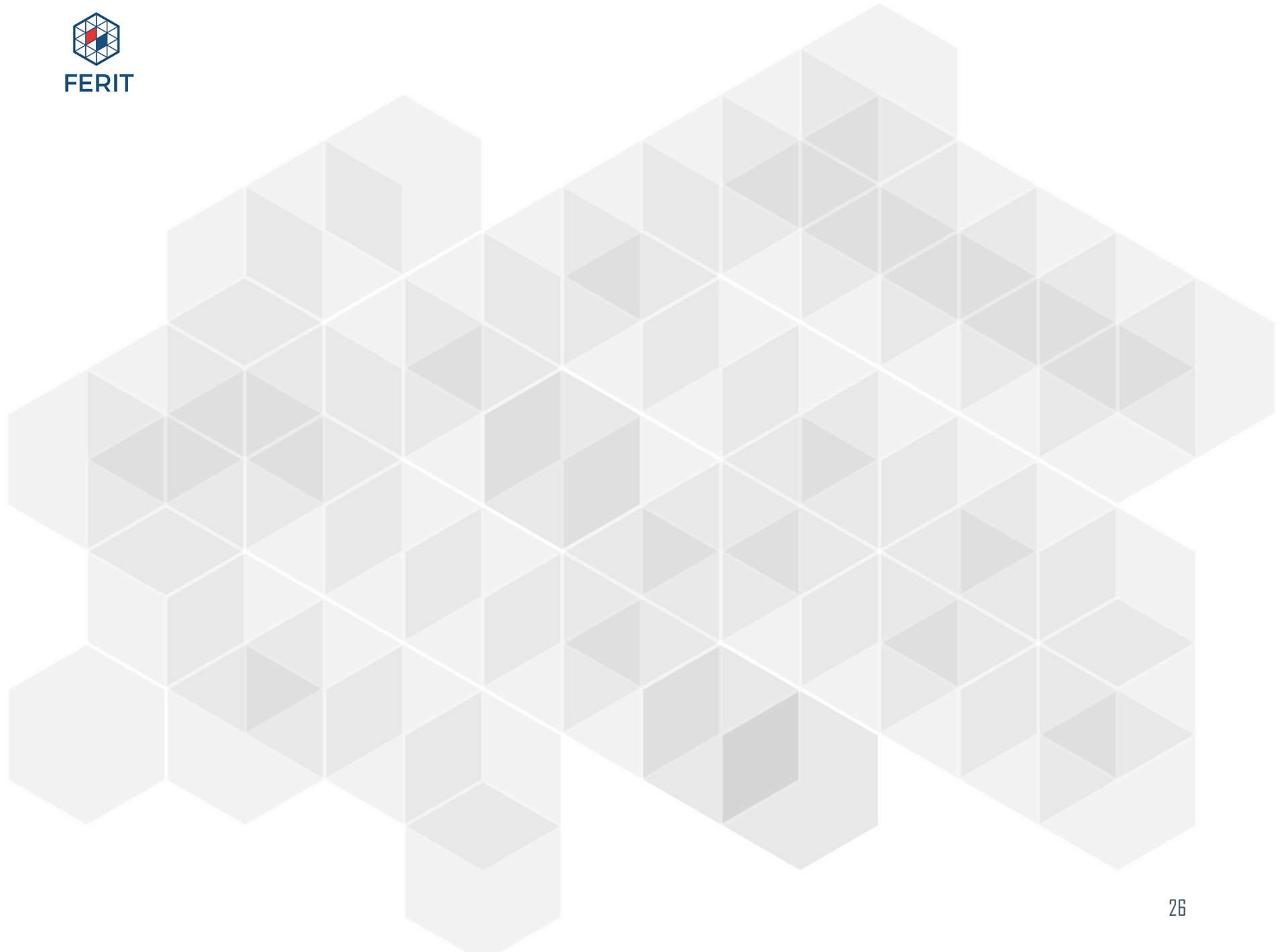
Thank You for Your attention!

Thank You for the amazing 8 weeks!

Questions and suggestions?



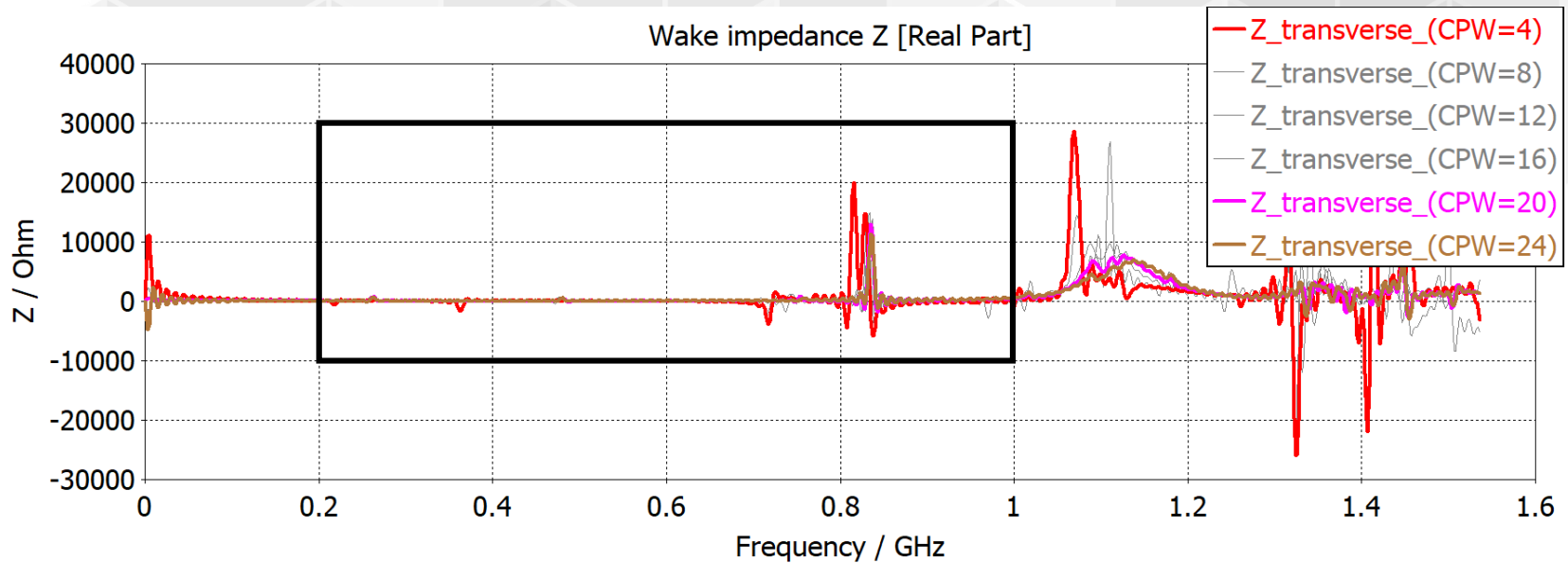
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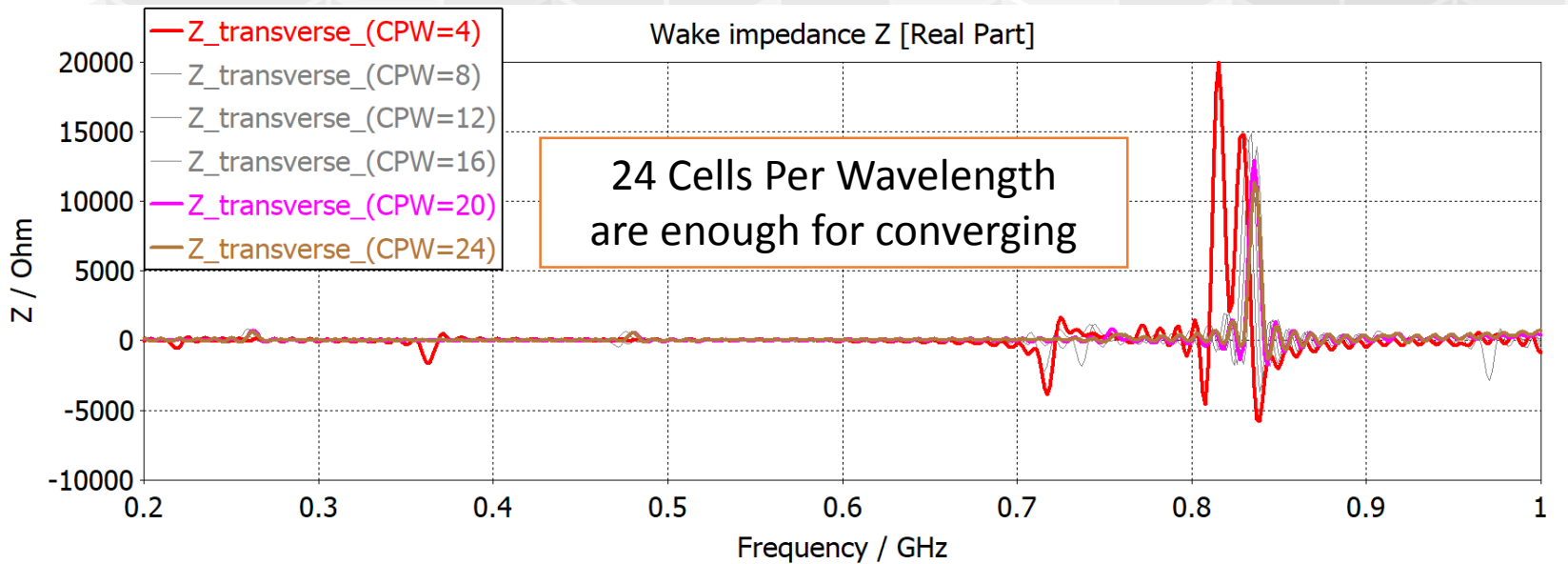
Backup – influence of mesh parameters on Wakefield solver





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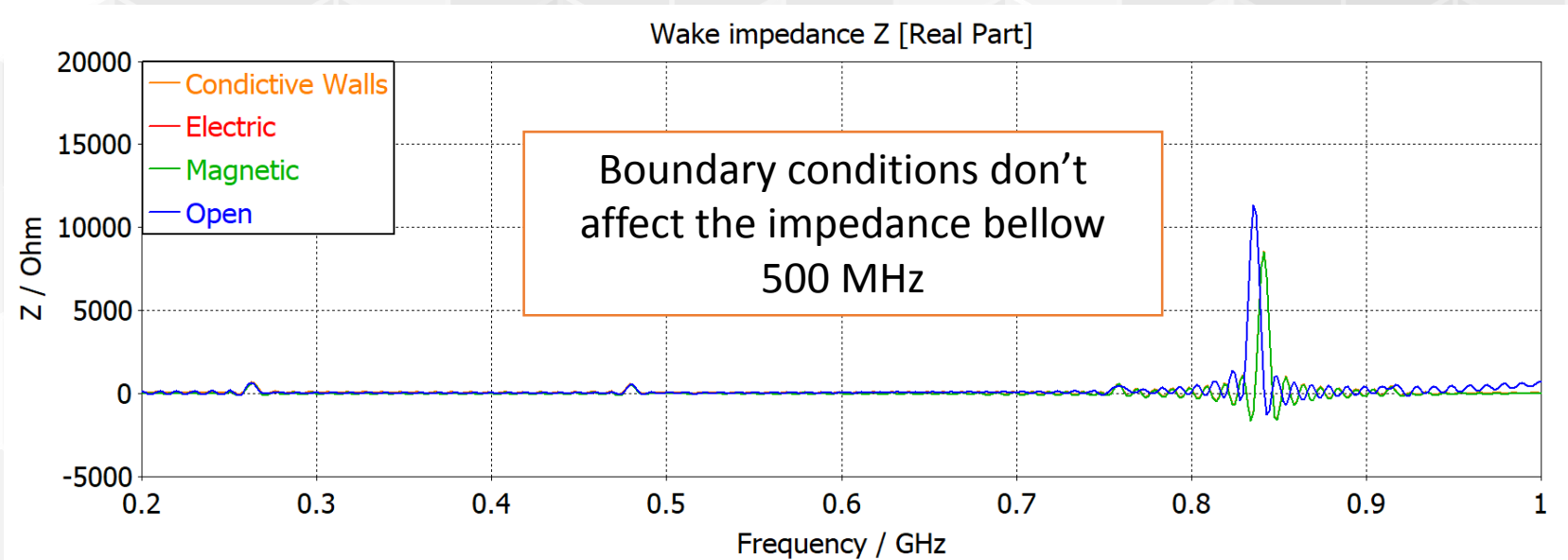
Backup – influence of mesh parameters on Wakefield solver





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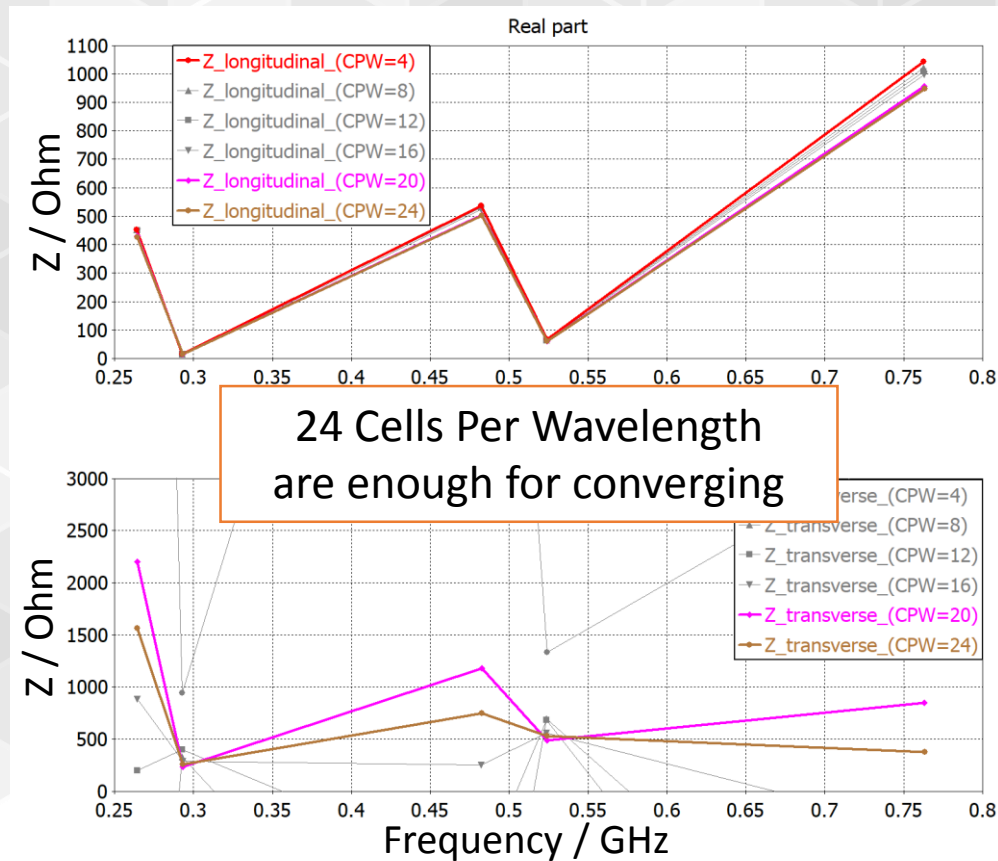
Backup – influence of boundary conditions on Wakefield solver





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Backup – influence of mesh parameters on Eigenmode solver



Backup – insulating the screen holder and the shaft

