

HOM Coupler Studies for the SRF Gun



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DESY – TEMF Meeting
Darmstadt
October 20, 2022

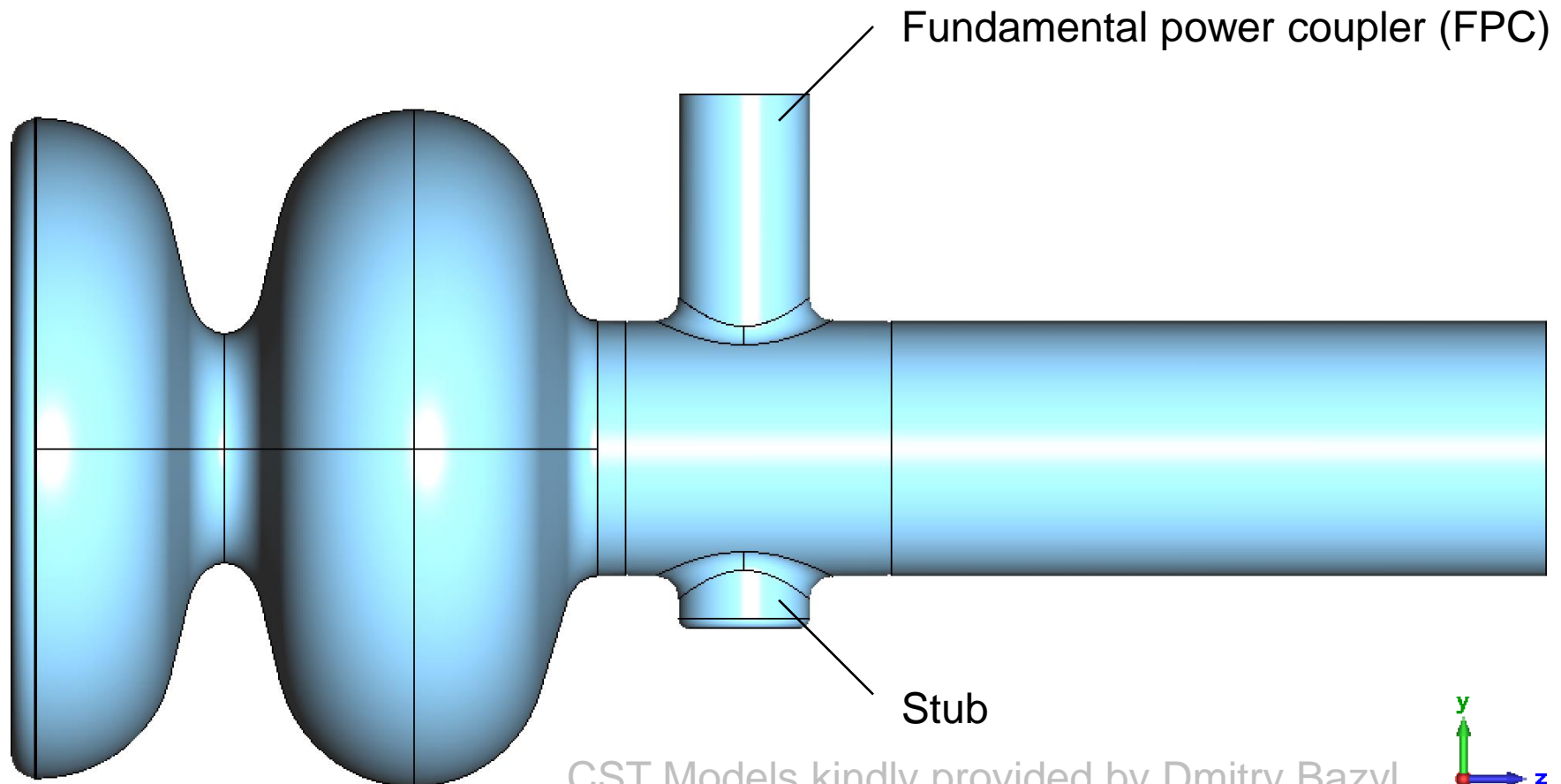


- Motivation
- Numerical Modeling
 - Cavity, Stub, HOM Coupler
- Numerical Results
 - Cavity + FPC
 - Cavity + FPC + Stub
 - Cavity + FPC + HOM Coupler (single)
 - Cavity + FPC + HOM Coupler (double)
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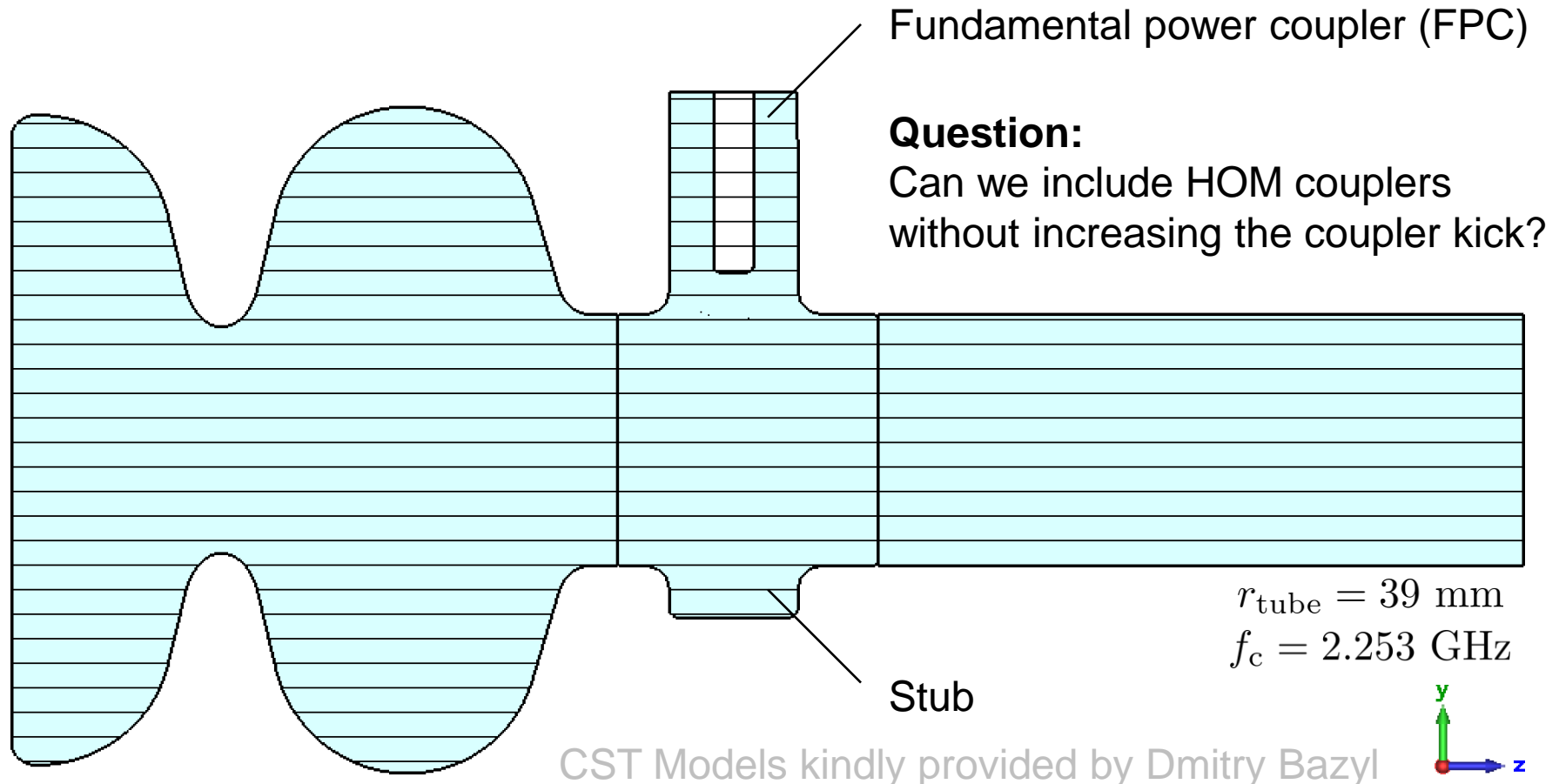
- DESY SRF Gun



CST Models kindly provided by Dmitry Bazyl

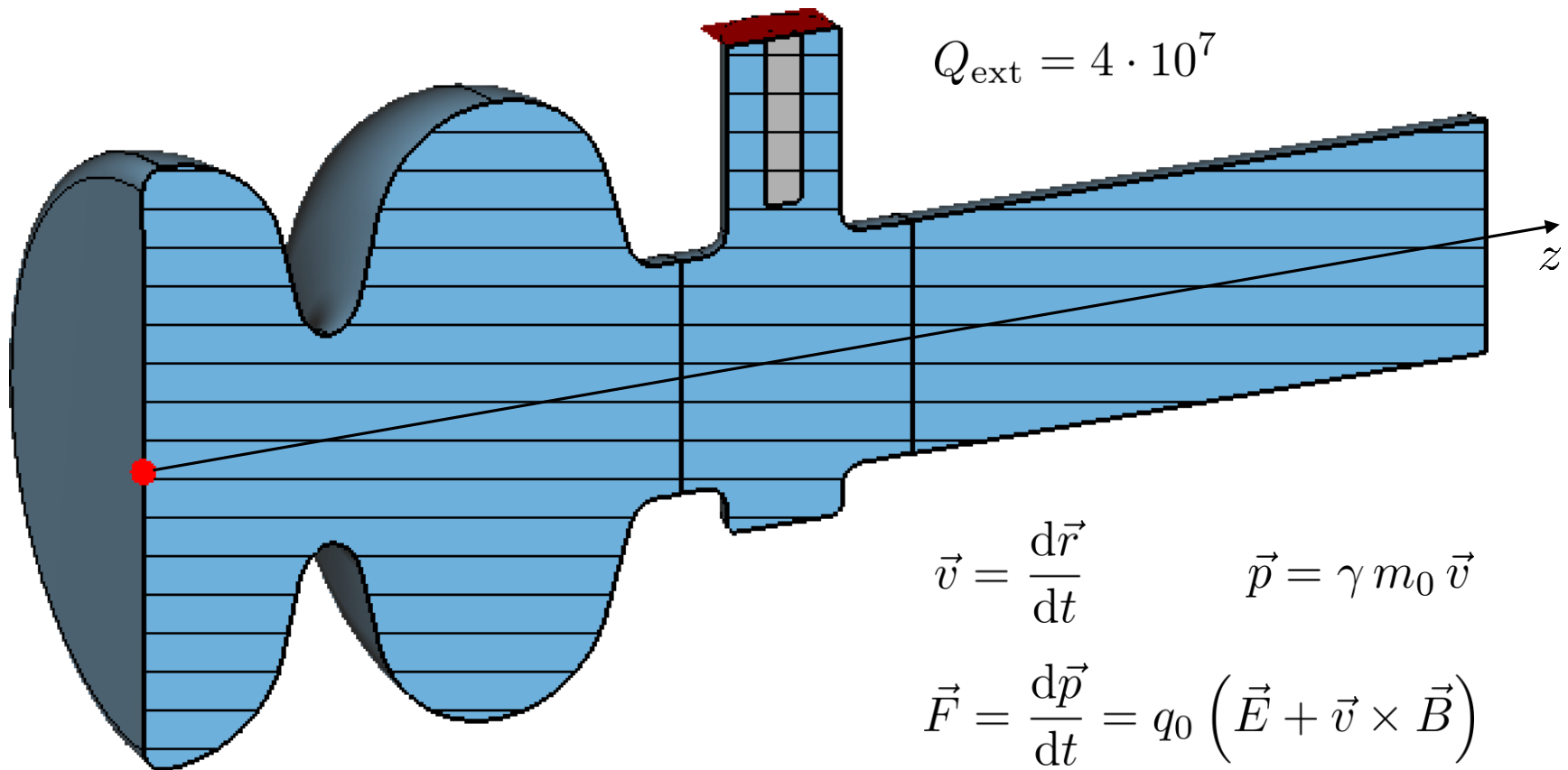
Motivation

▪ DESY SRF Gun

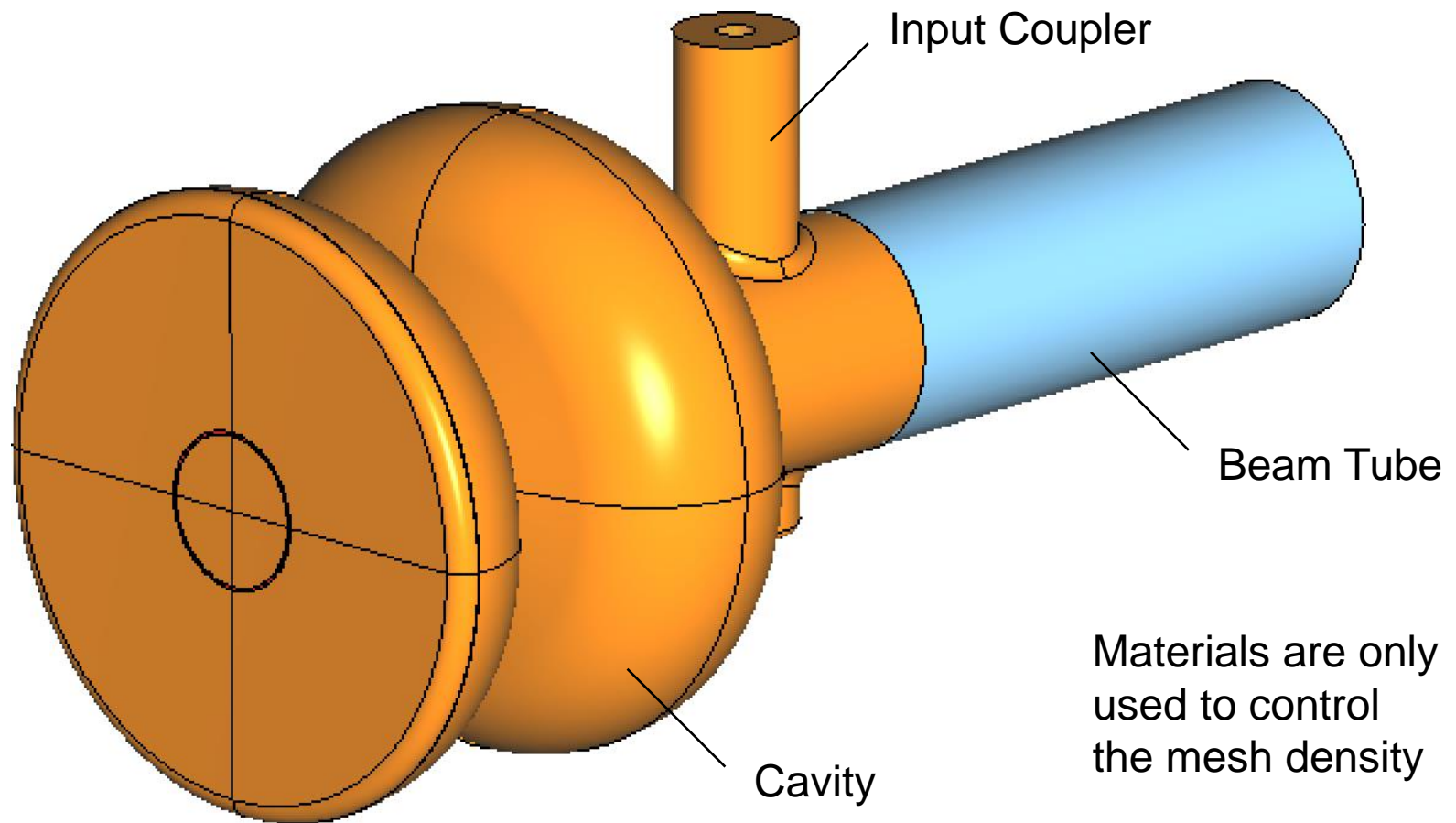


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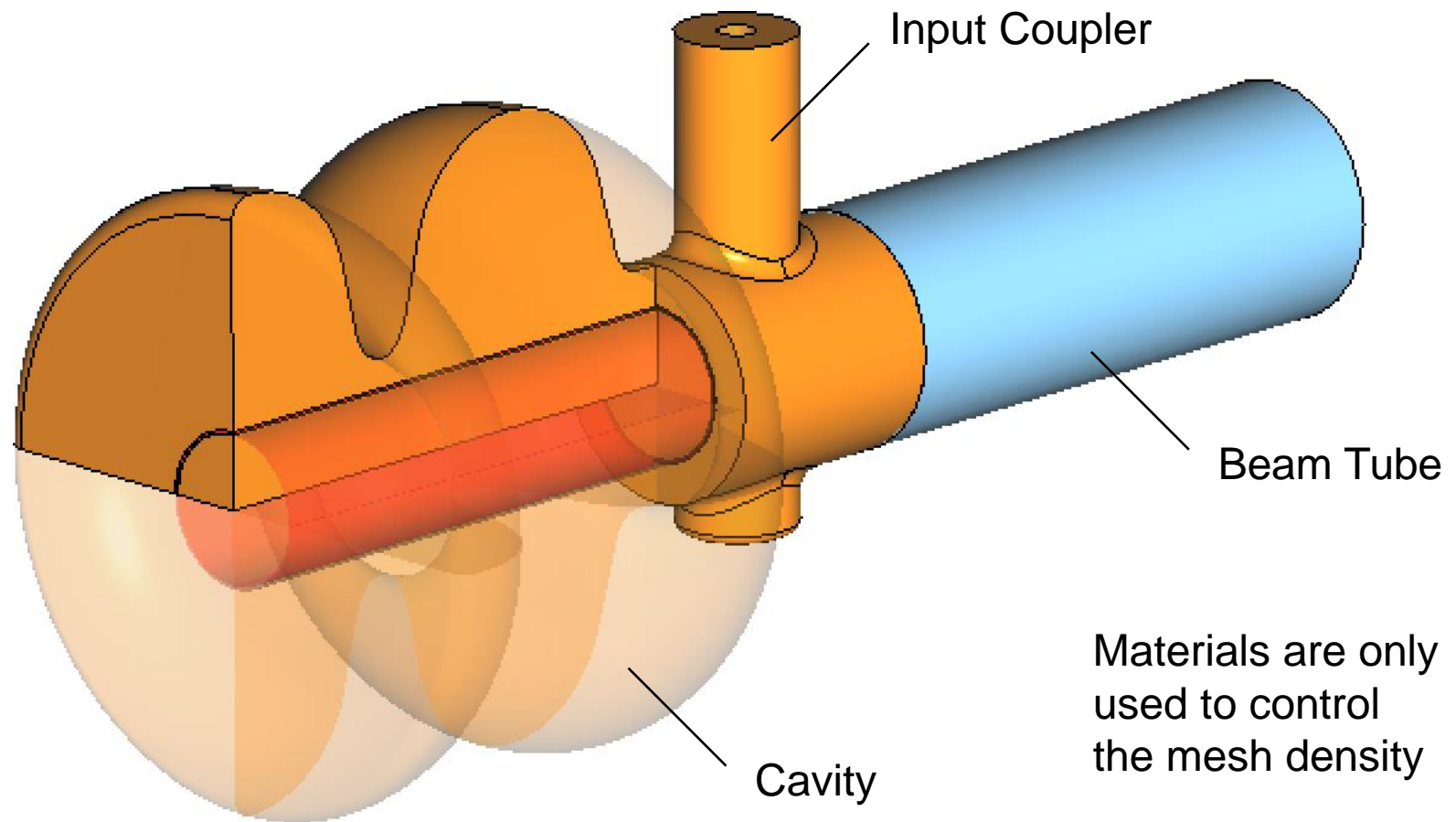
- Eigenmode Analysis + Point-Charge Particle Tracking



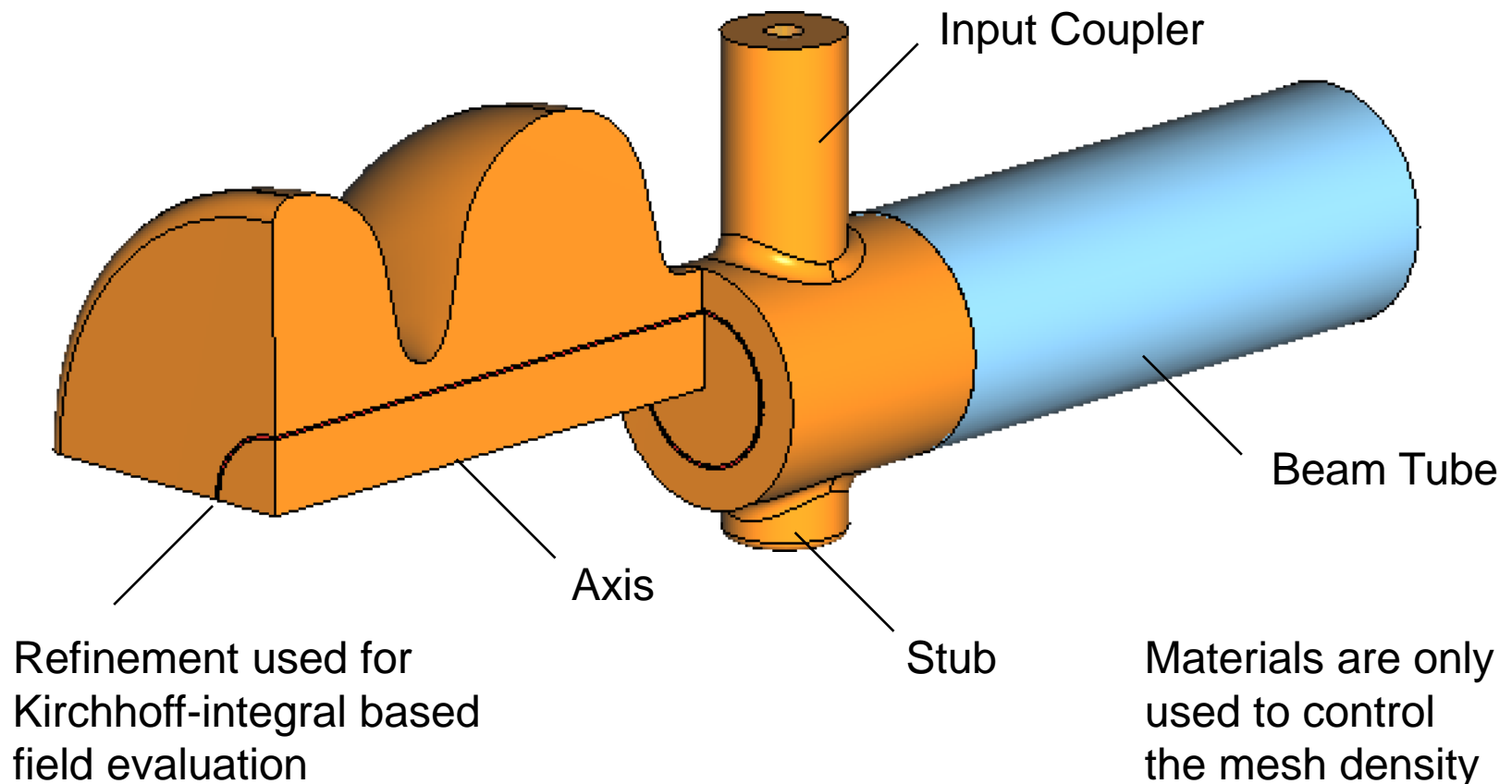
- Electromagnetic Field Calculation



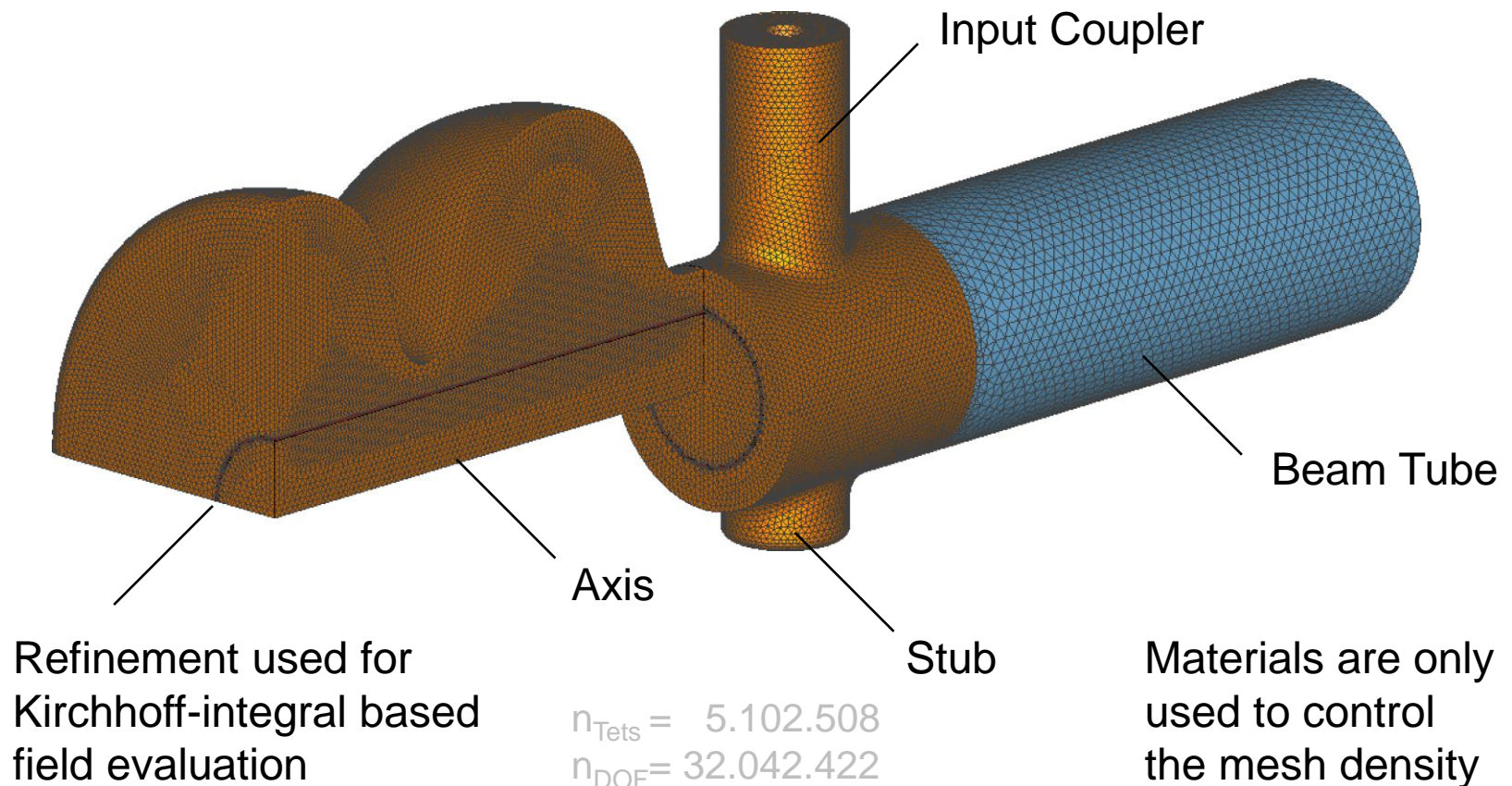
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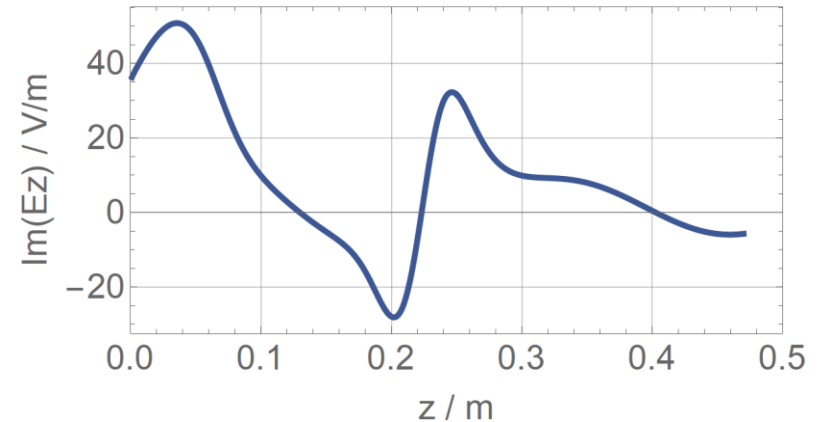
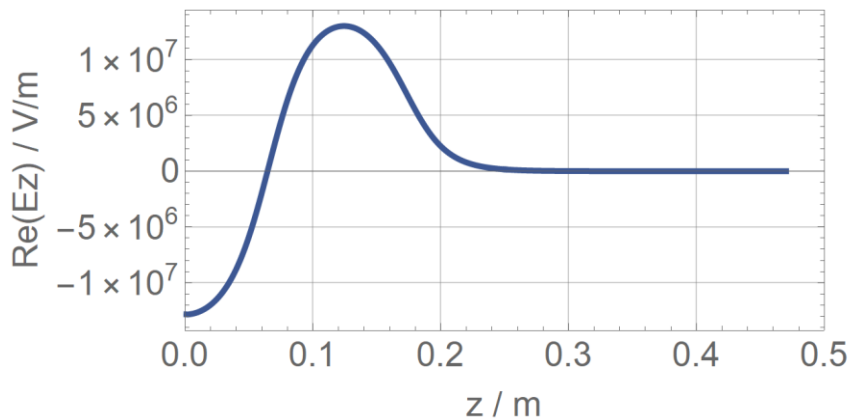
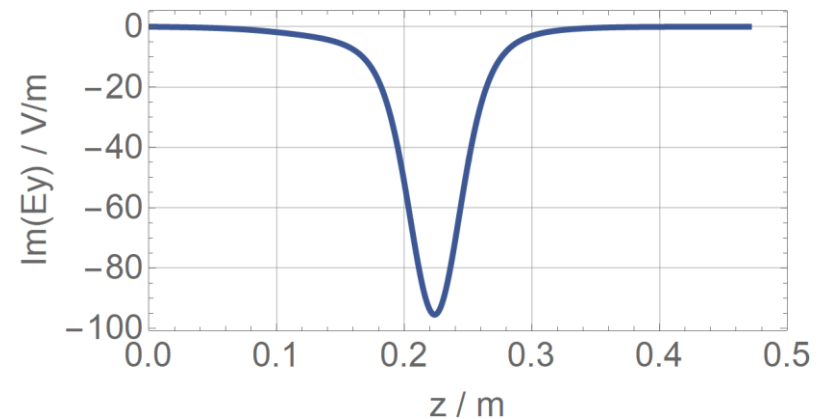
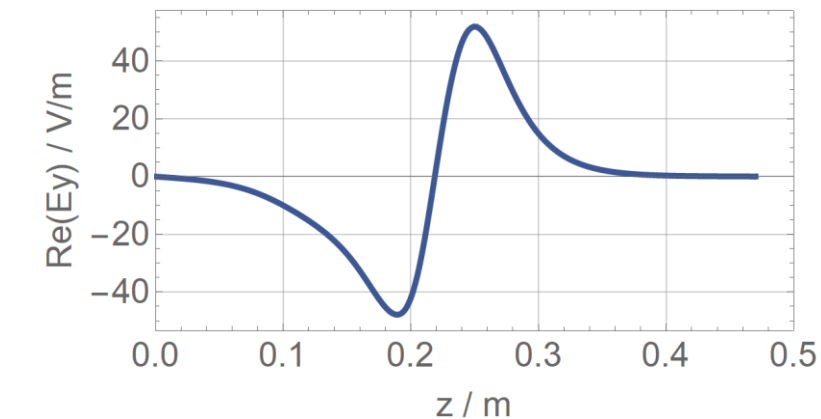
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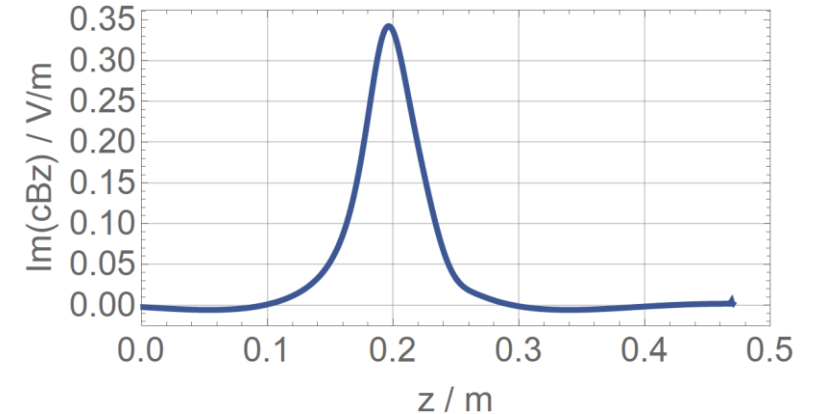
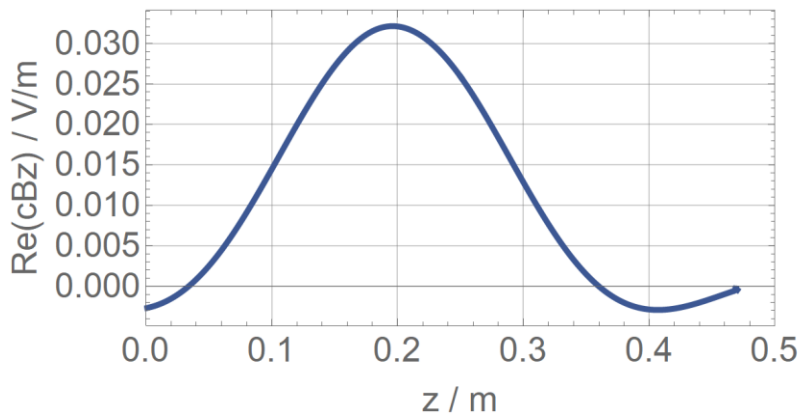
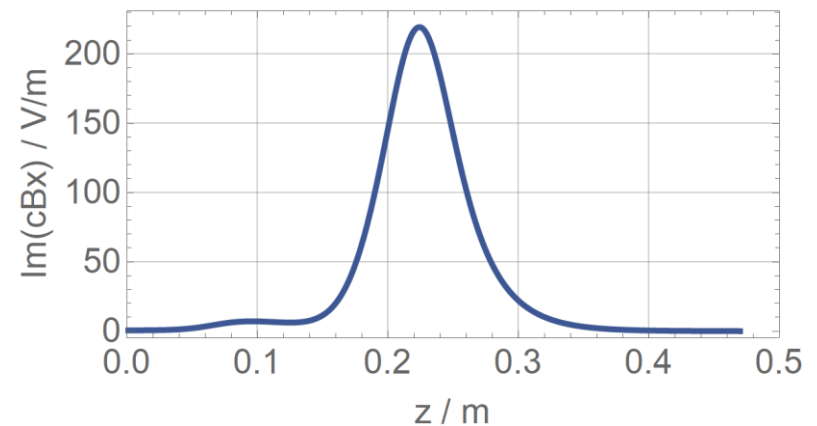
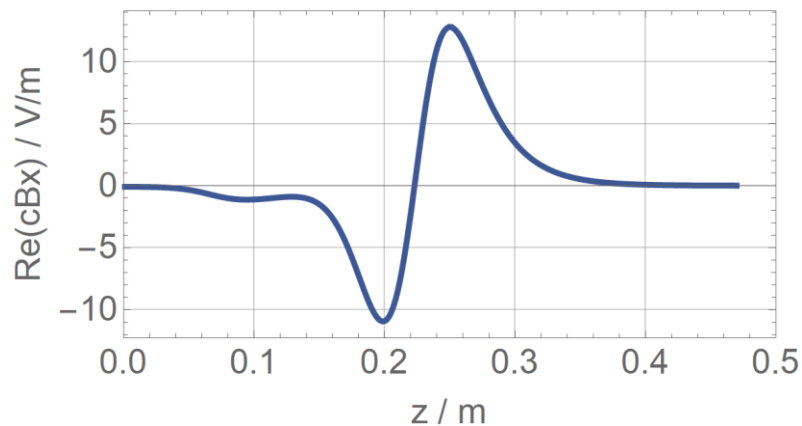
Numerical Results

▪ Electric Field Components

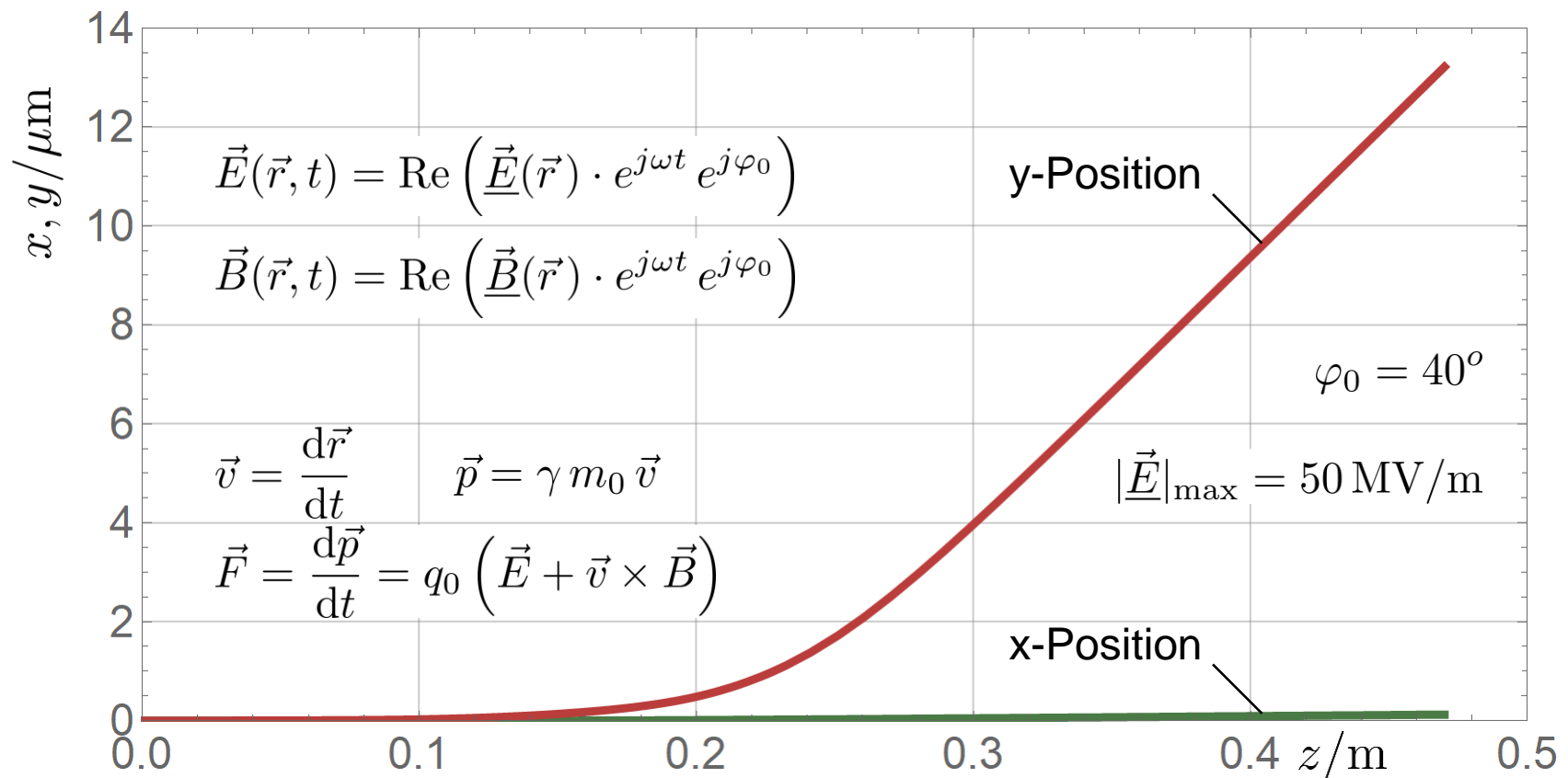


Numerical Results

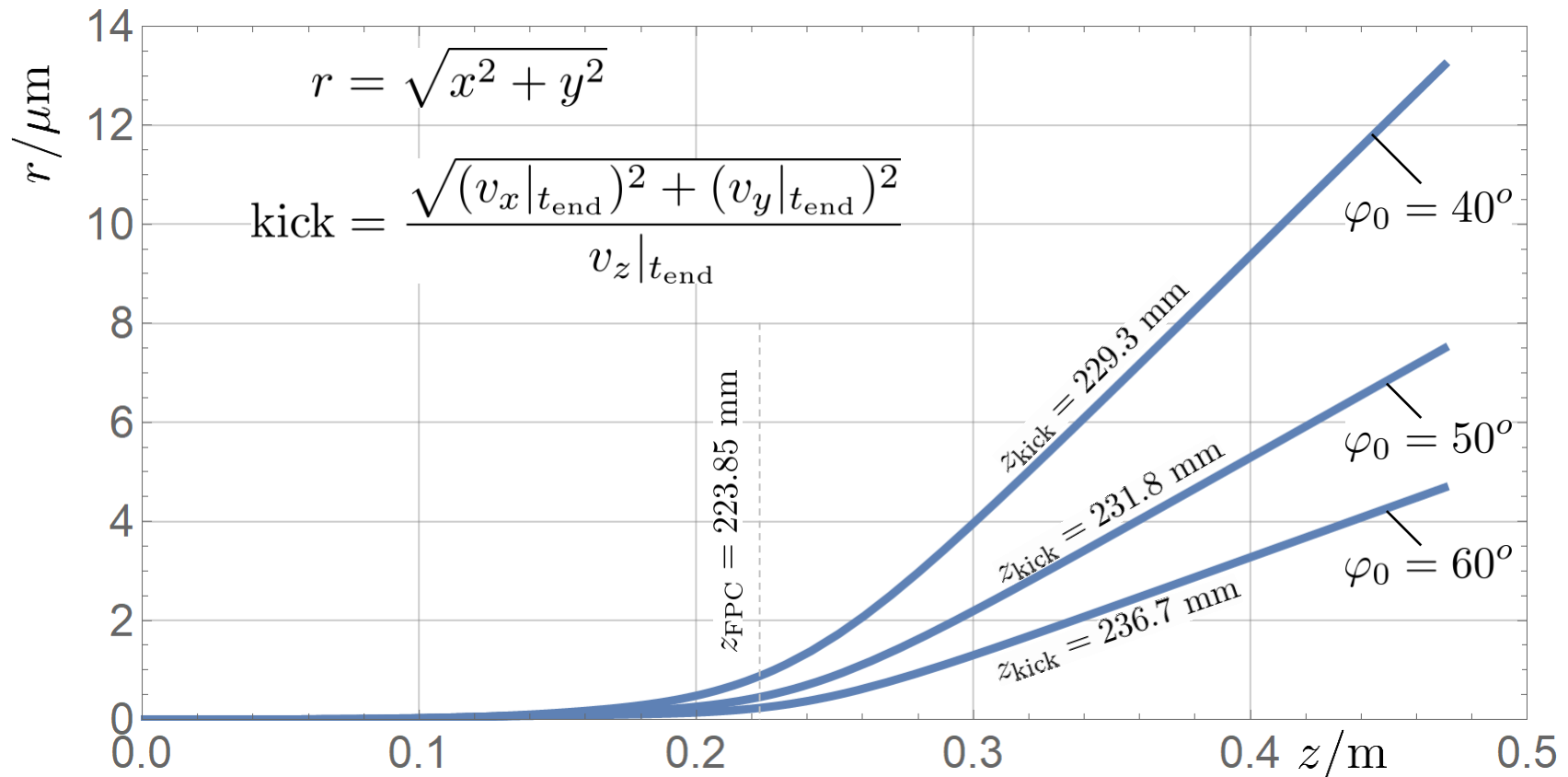
▪ Magnetic Field Components



Time-Domain Fields and Single-Particle Dynamics

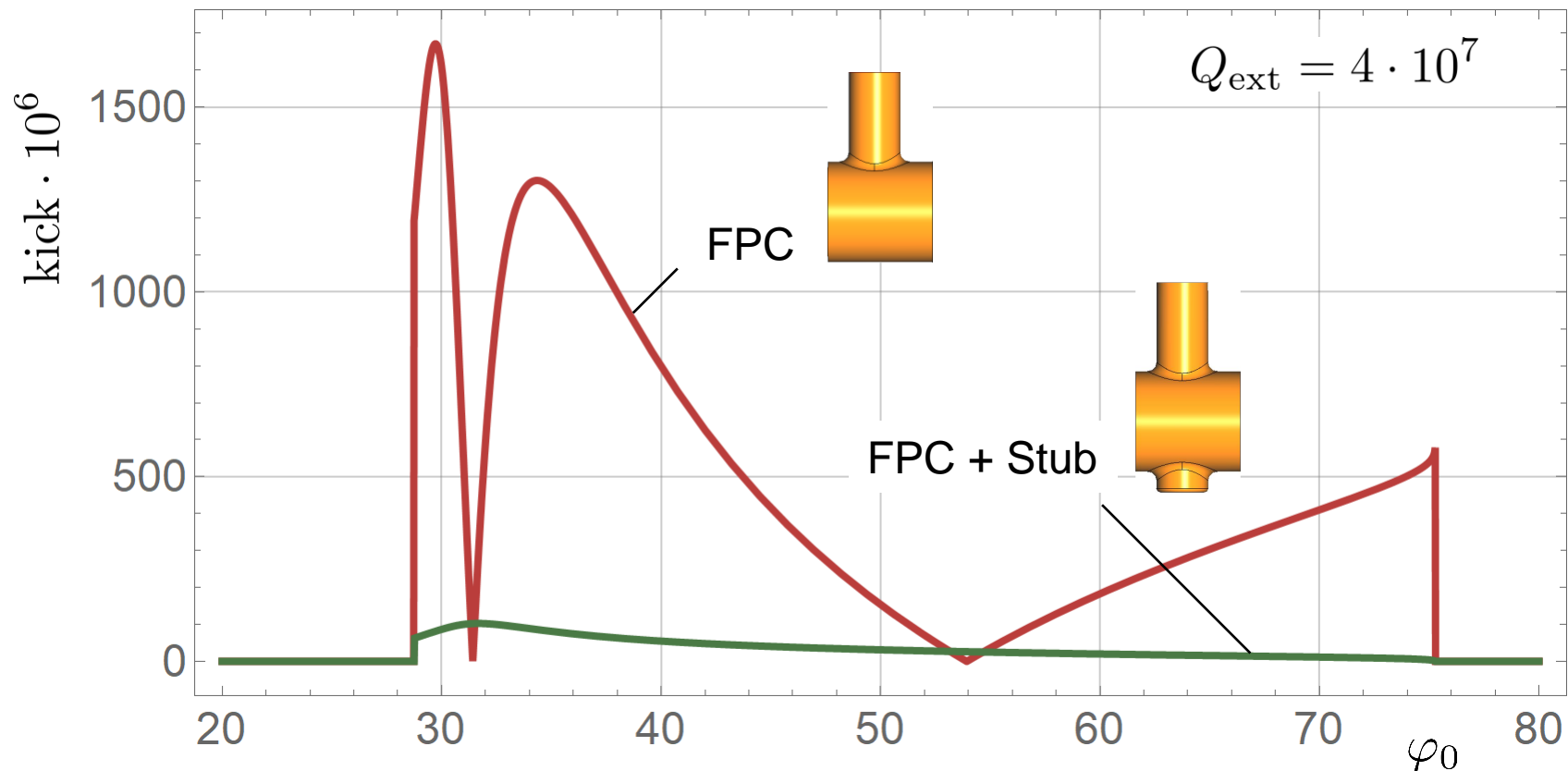


▪ Trajectories and Kick Definition



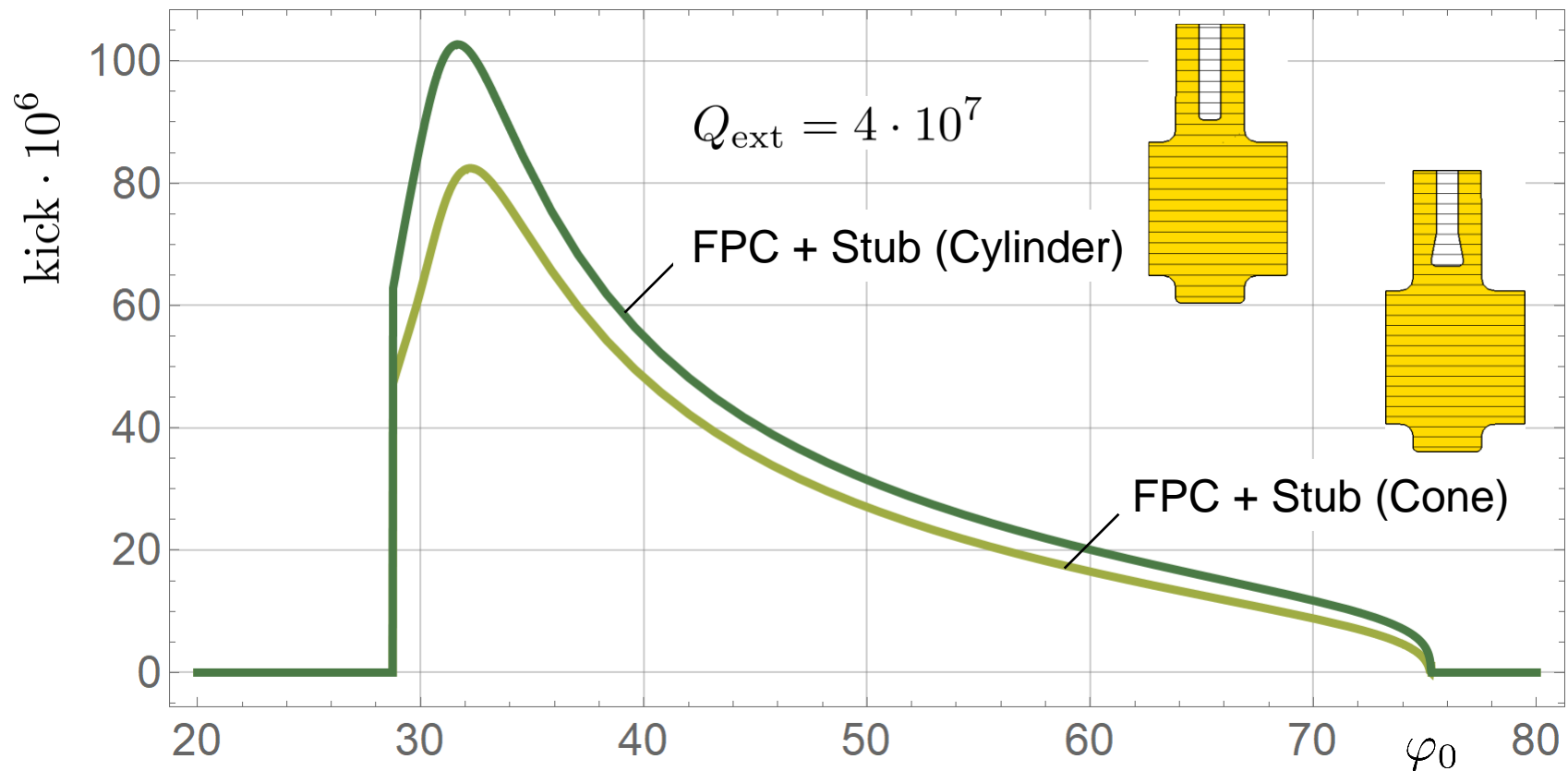
Numerical Results

▪ Transverse Kick



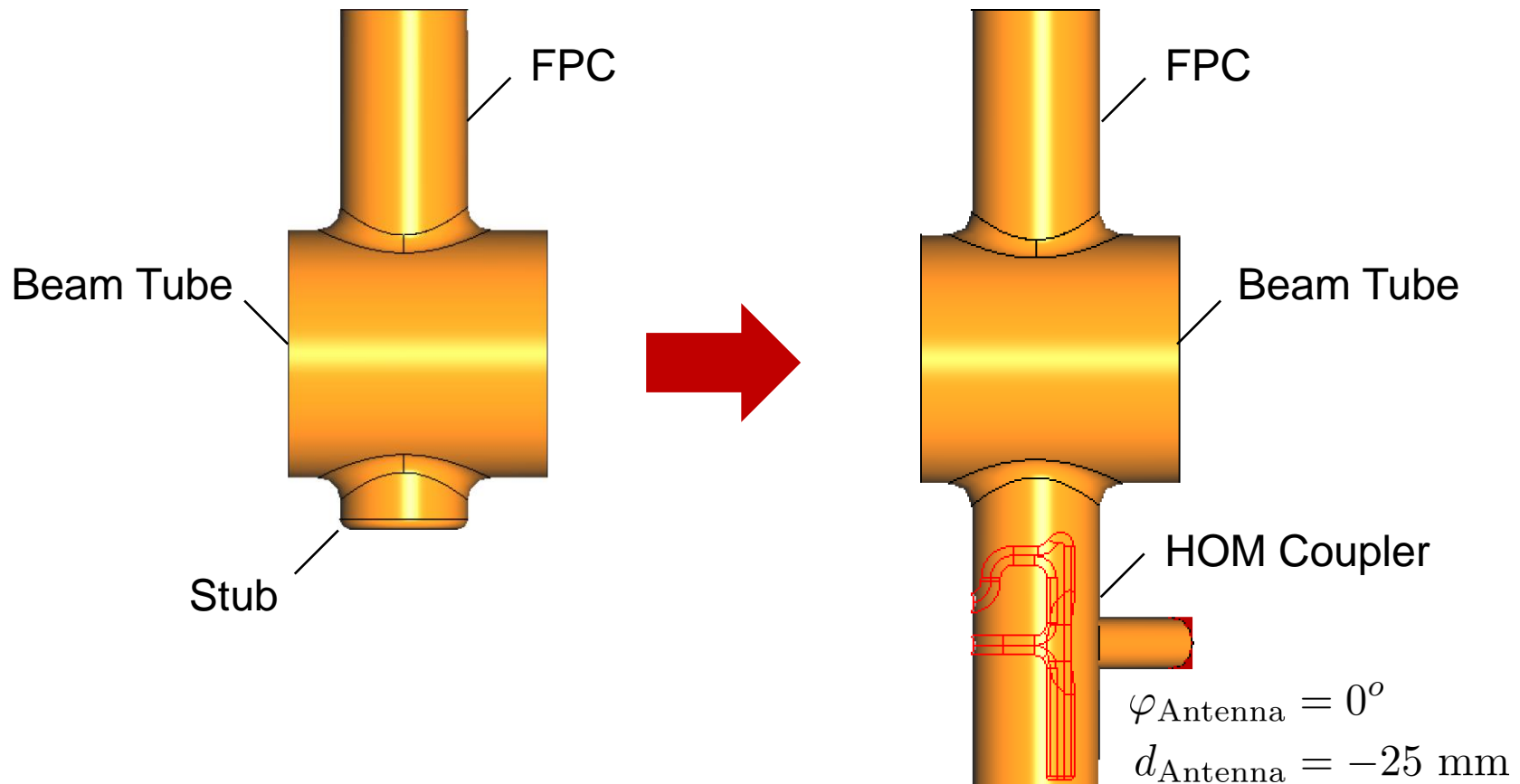
Numerical Results

▪ Transverse Kick



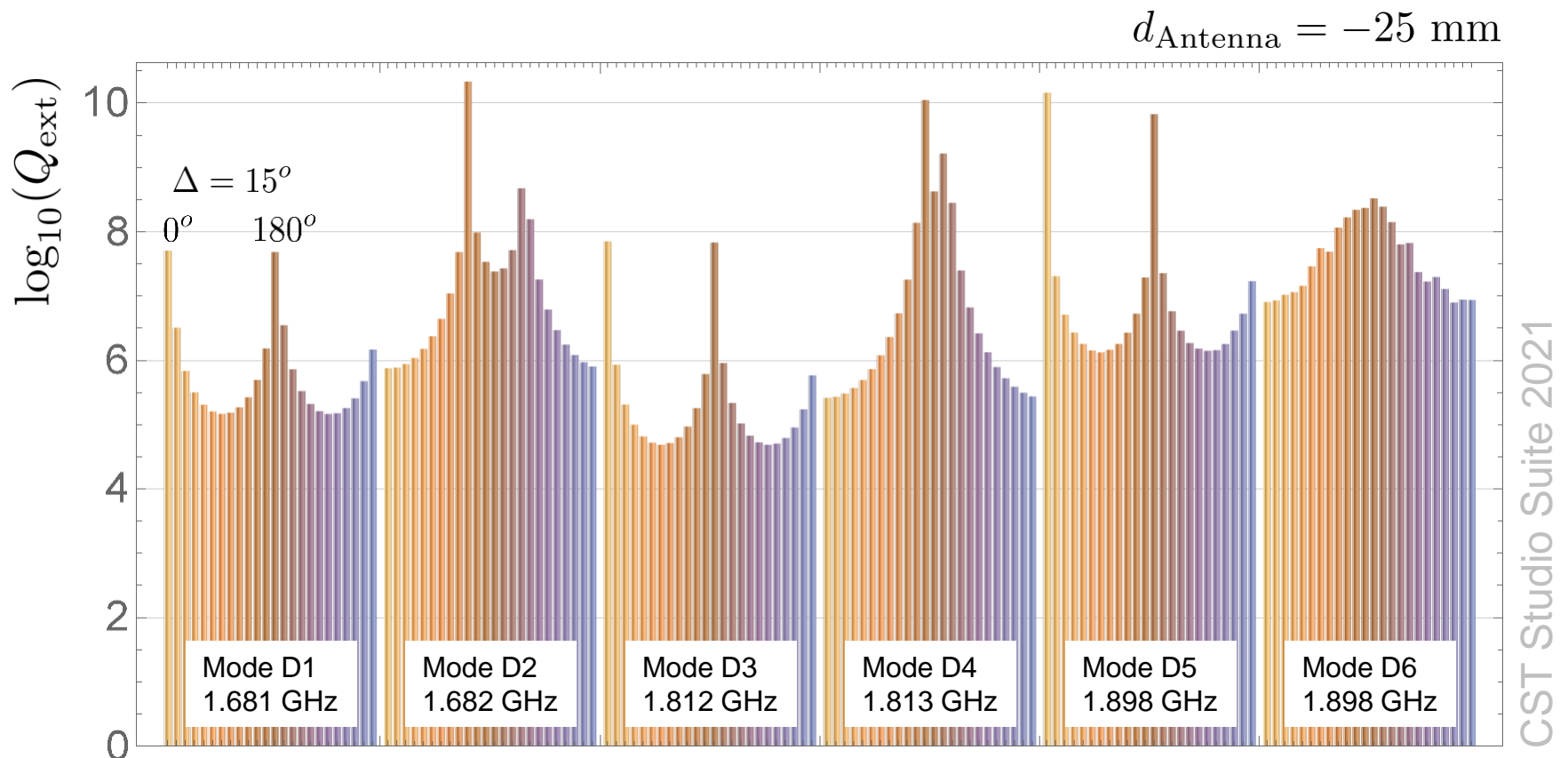
Numerical Results

- Exchange Stub with HOM Coupler



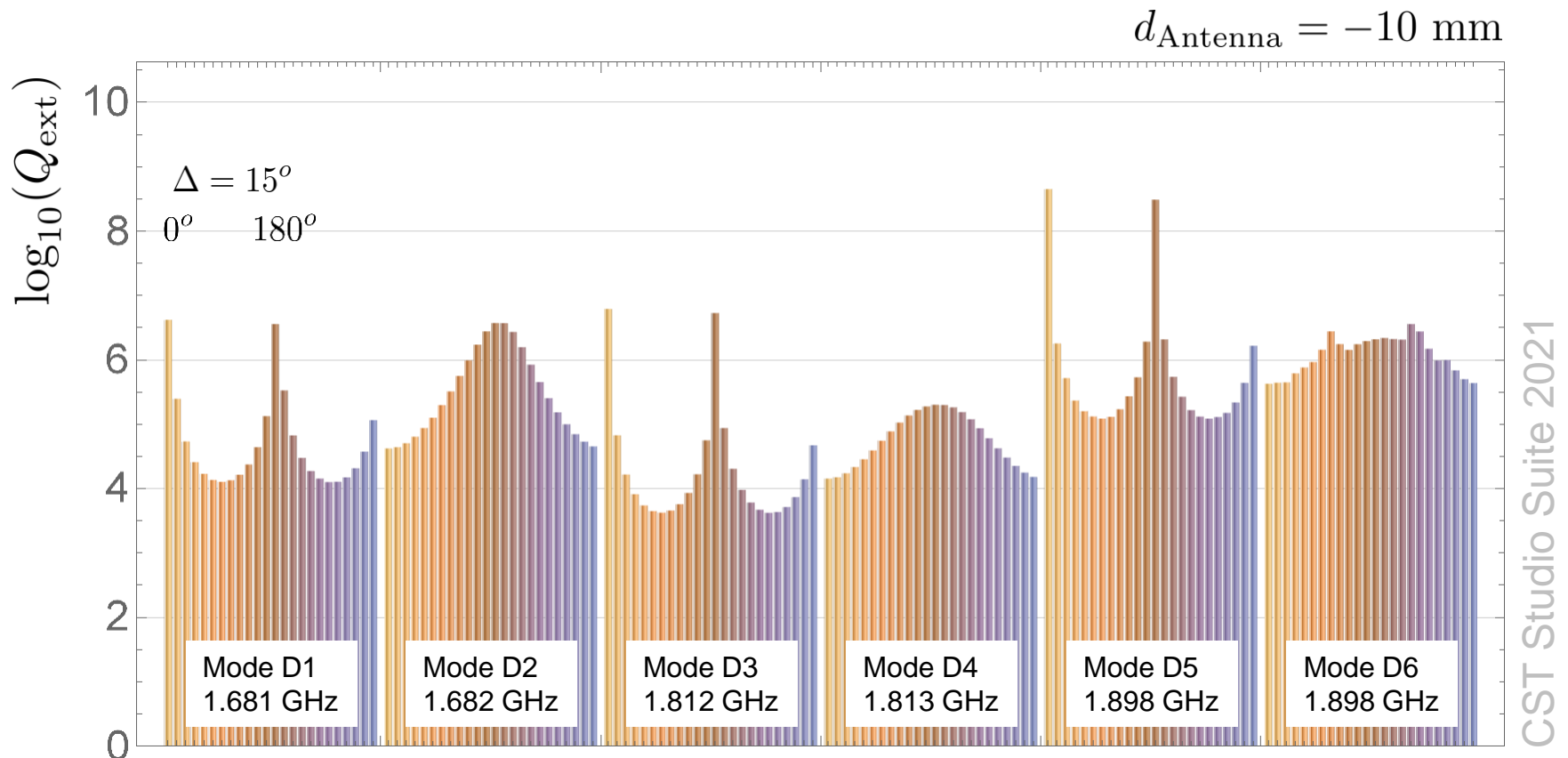
Numerical Results

- External Quality Factor



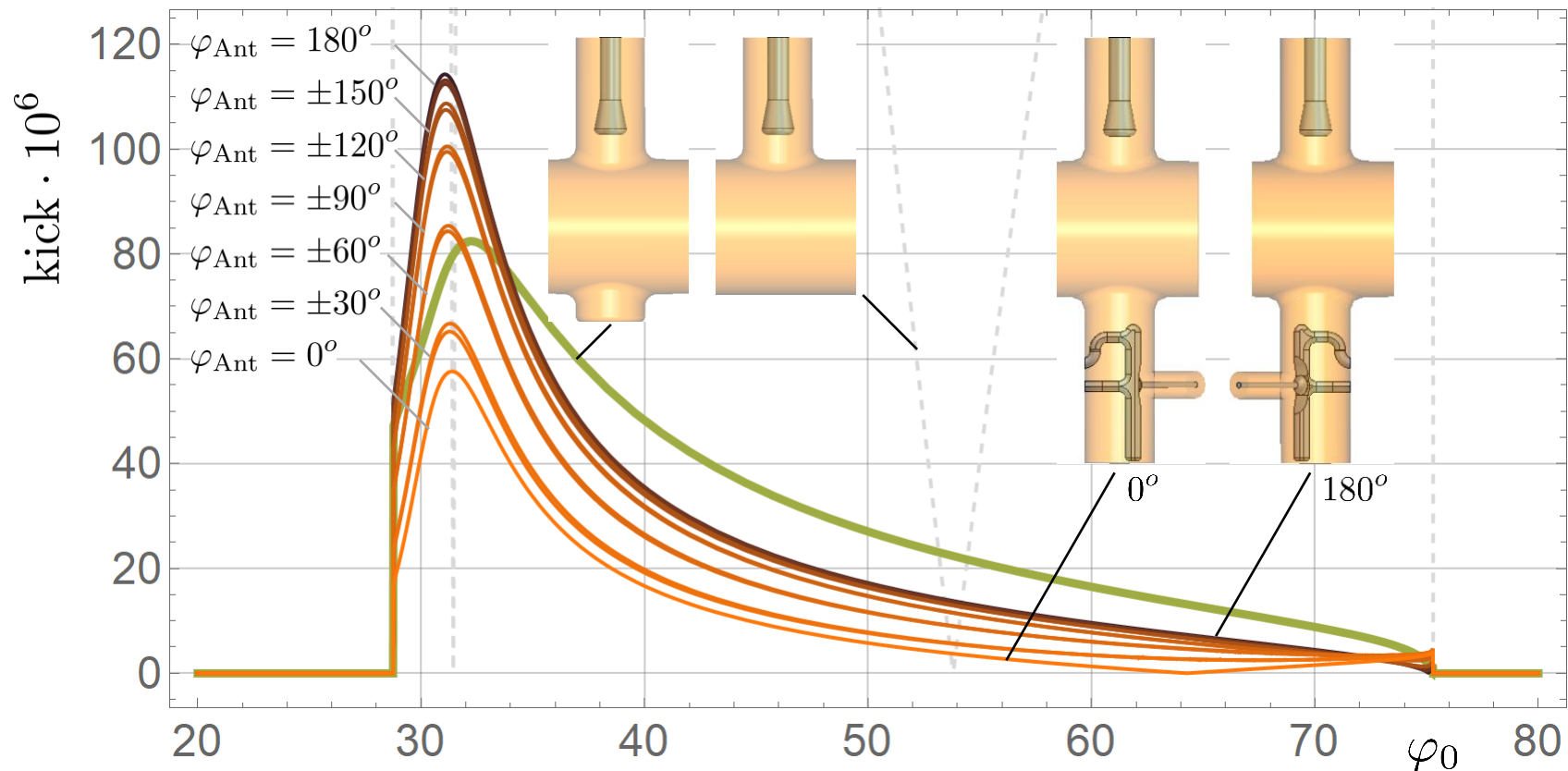
Numerical Results

External Quality Factor

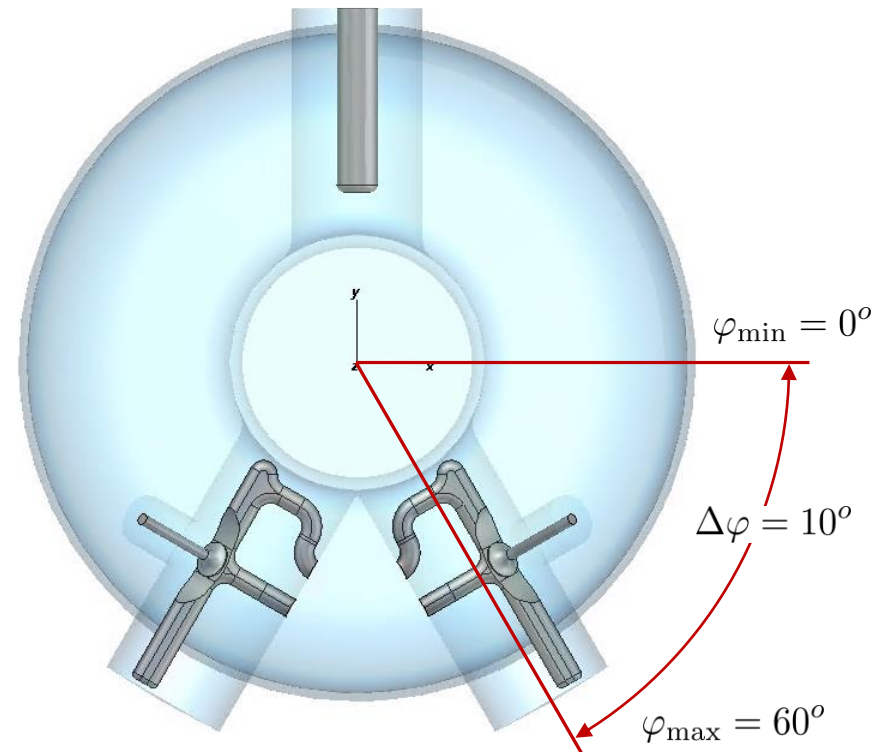
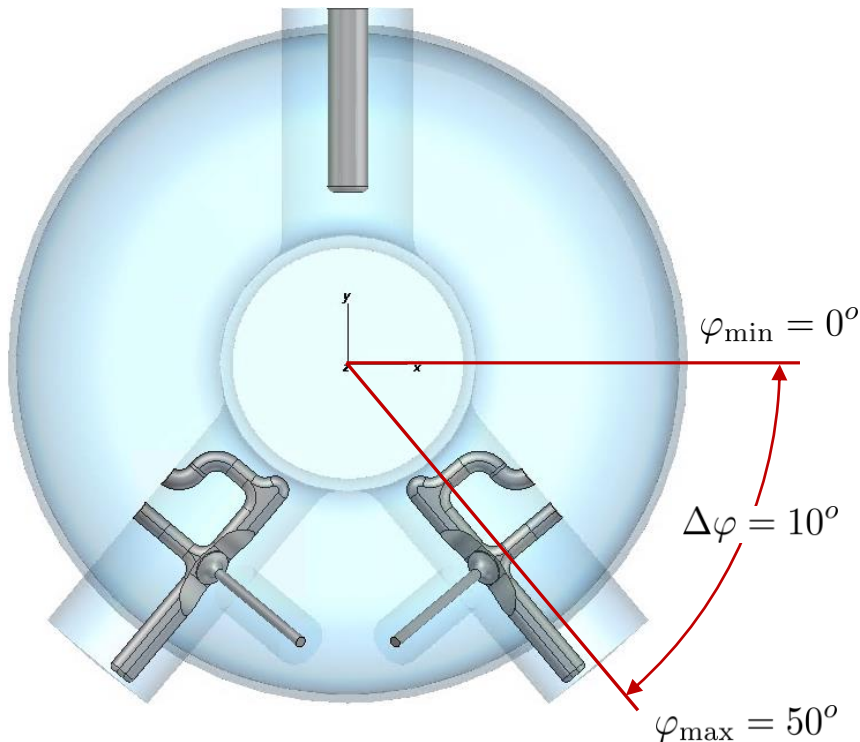


Numerical Results

▪ Transverse Kick wrt. HOM Antenna Rotation

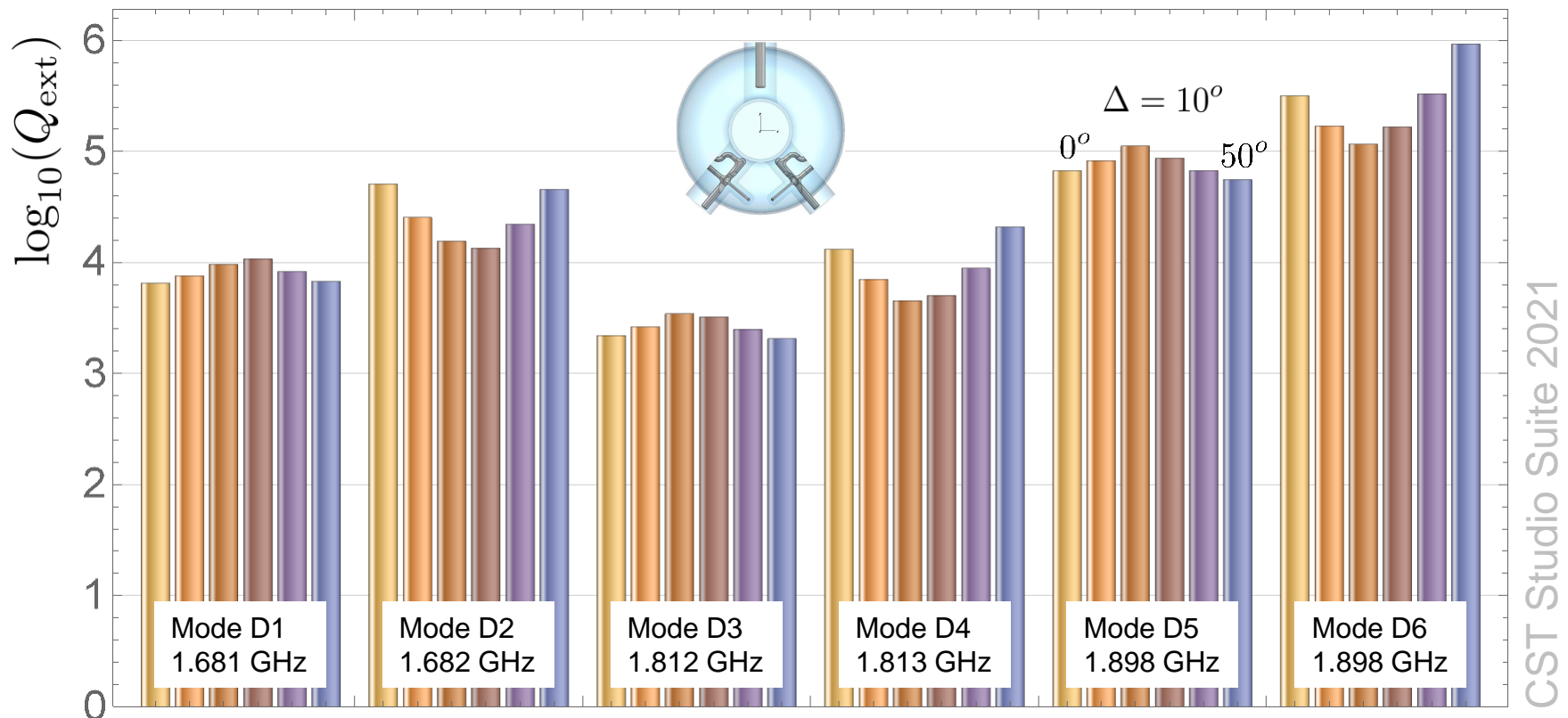


▪ Coupler Rotation in the Transverse Plane



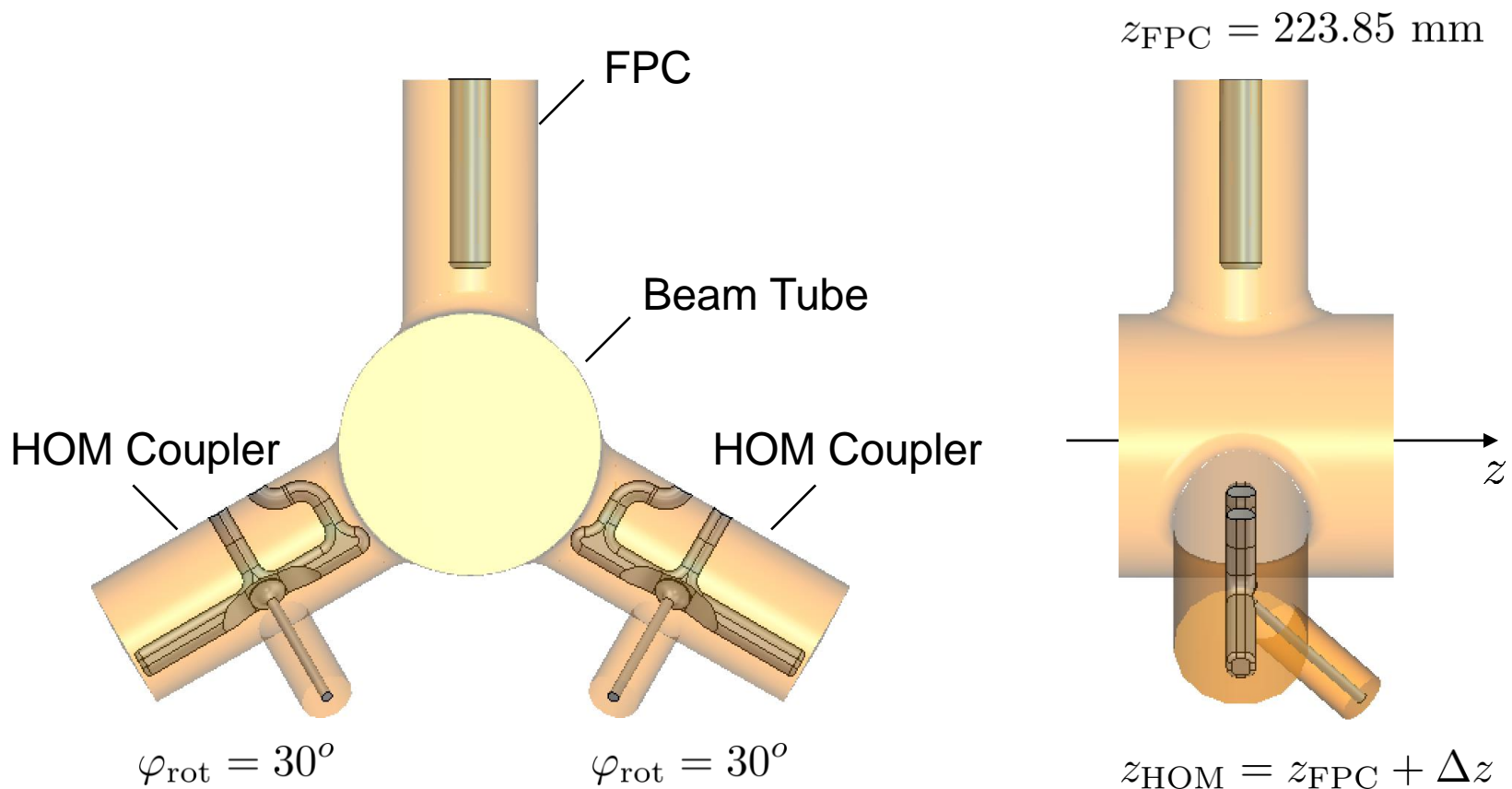
Numerical Results

▪ External Quality Factor



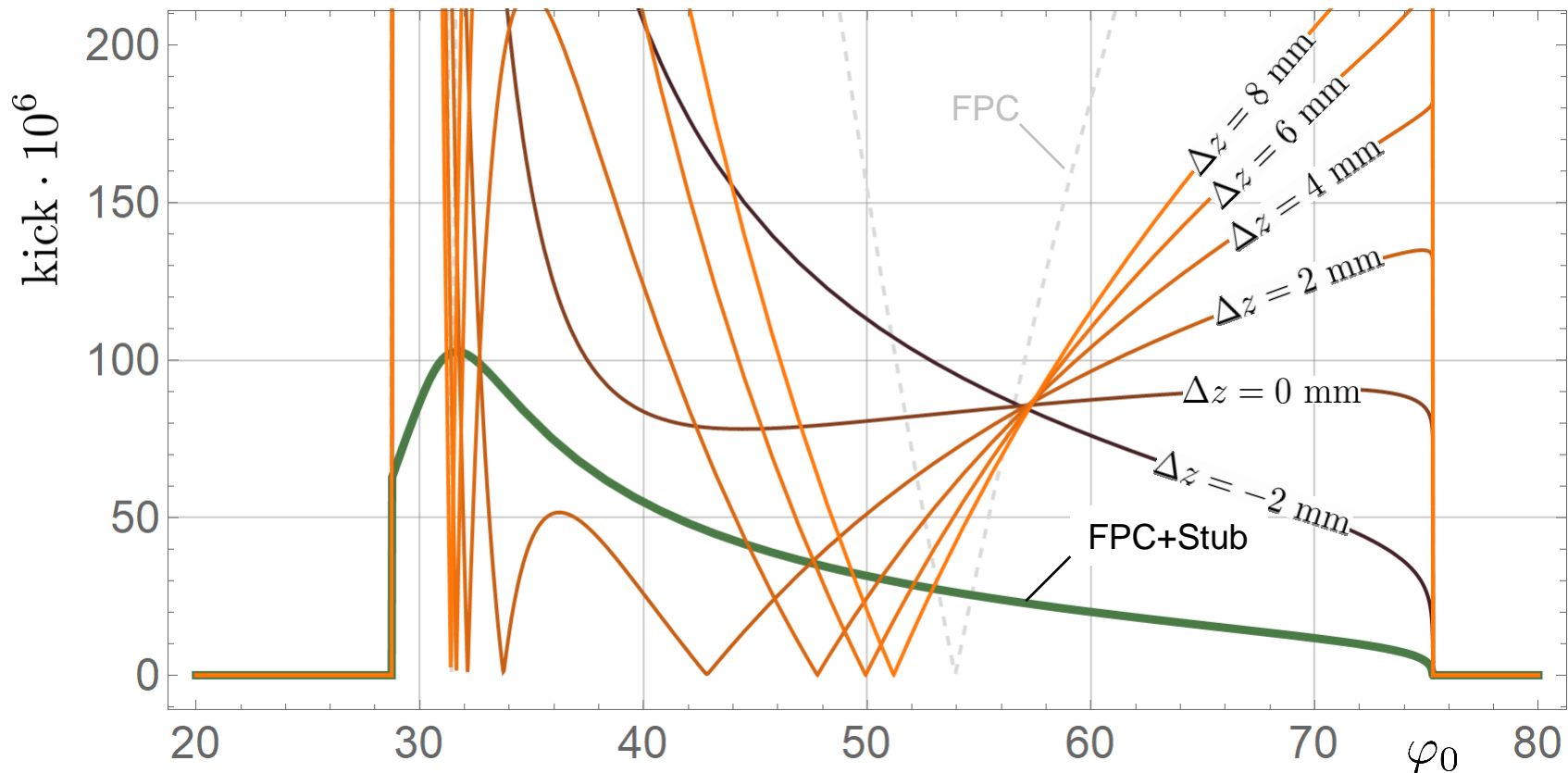
Numerical Results

- Setup with Two HOM Couplers (Nose Down)



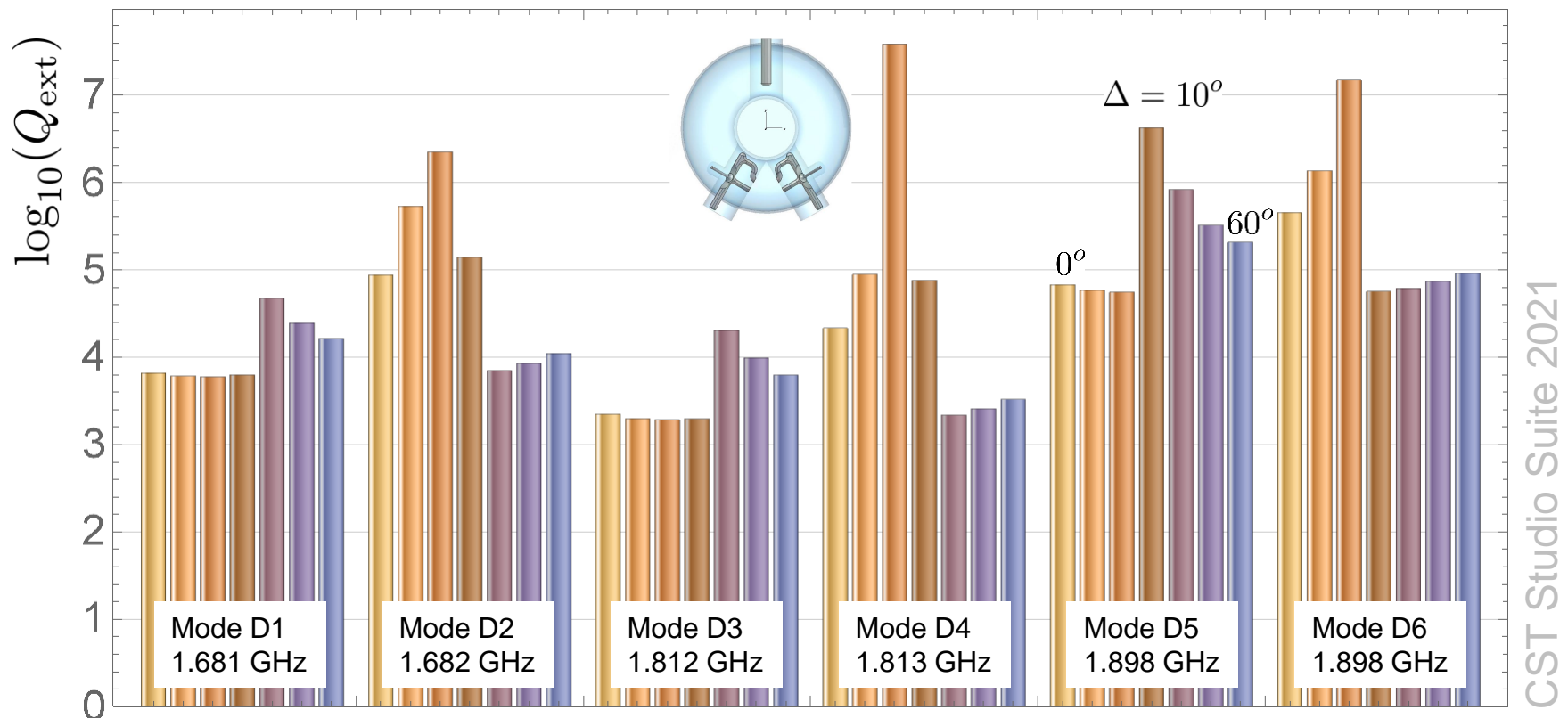
Numerical Results

▪ Transverse Kick wrt. Longitudinal Position



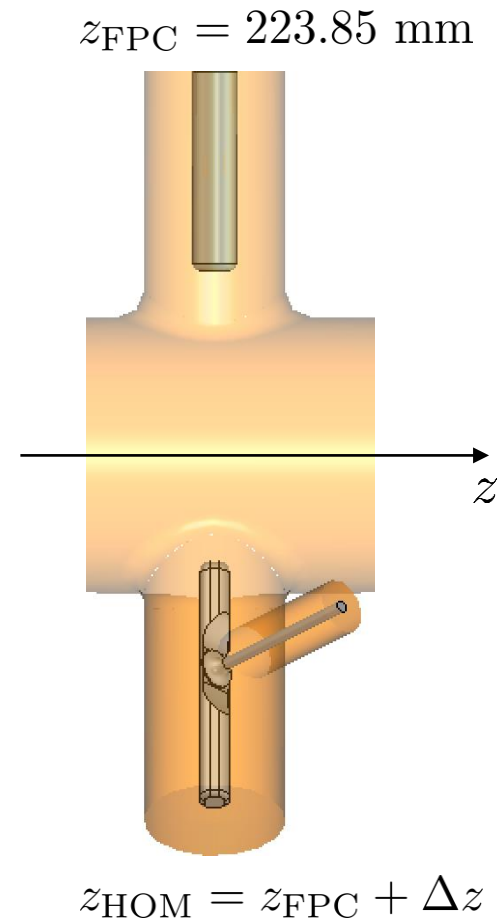
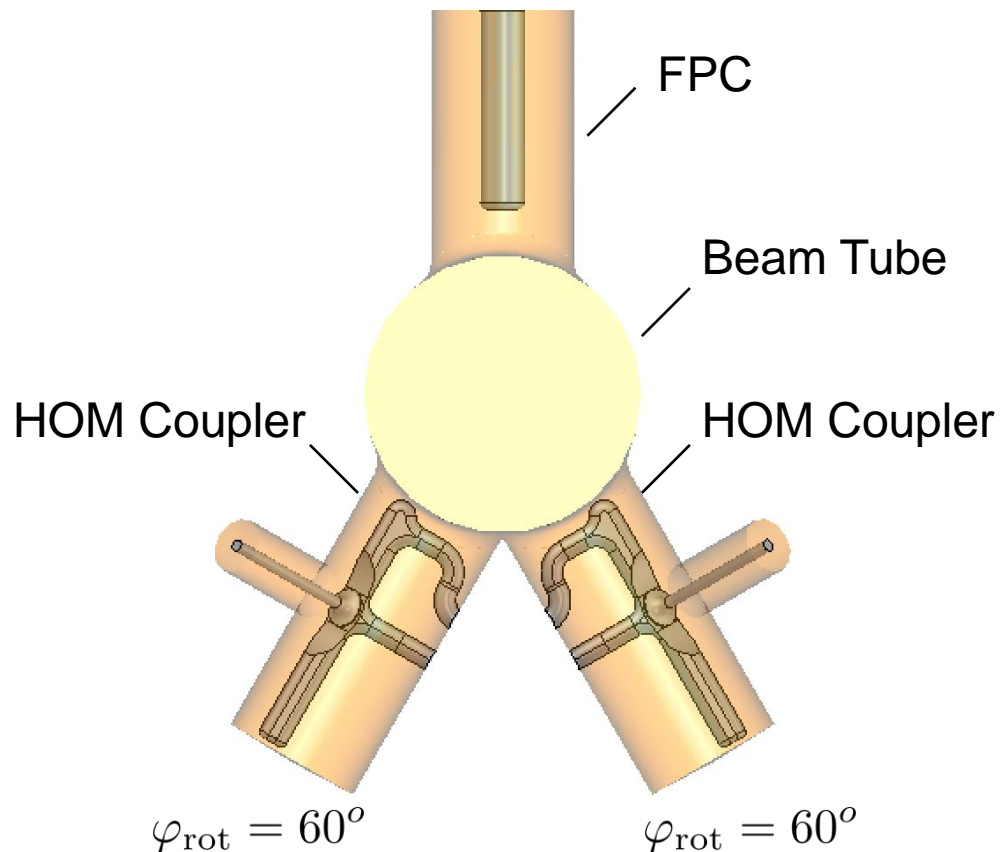
Numerical Results

- External Quality Factor (Antennas: Nose Up)



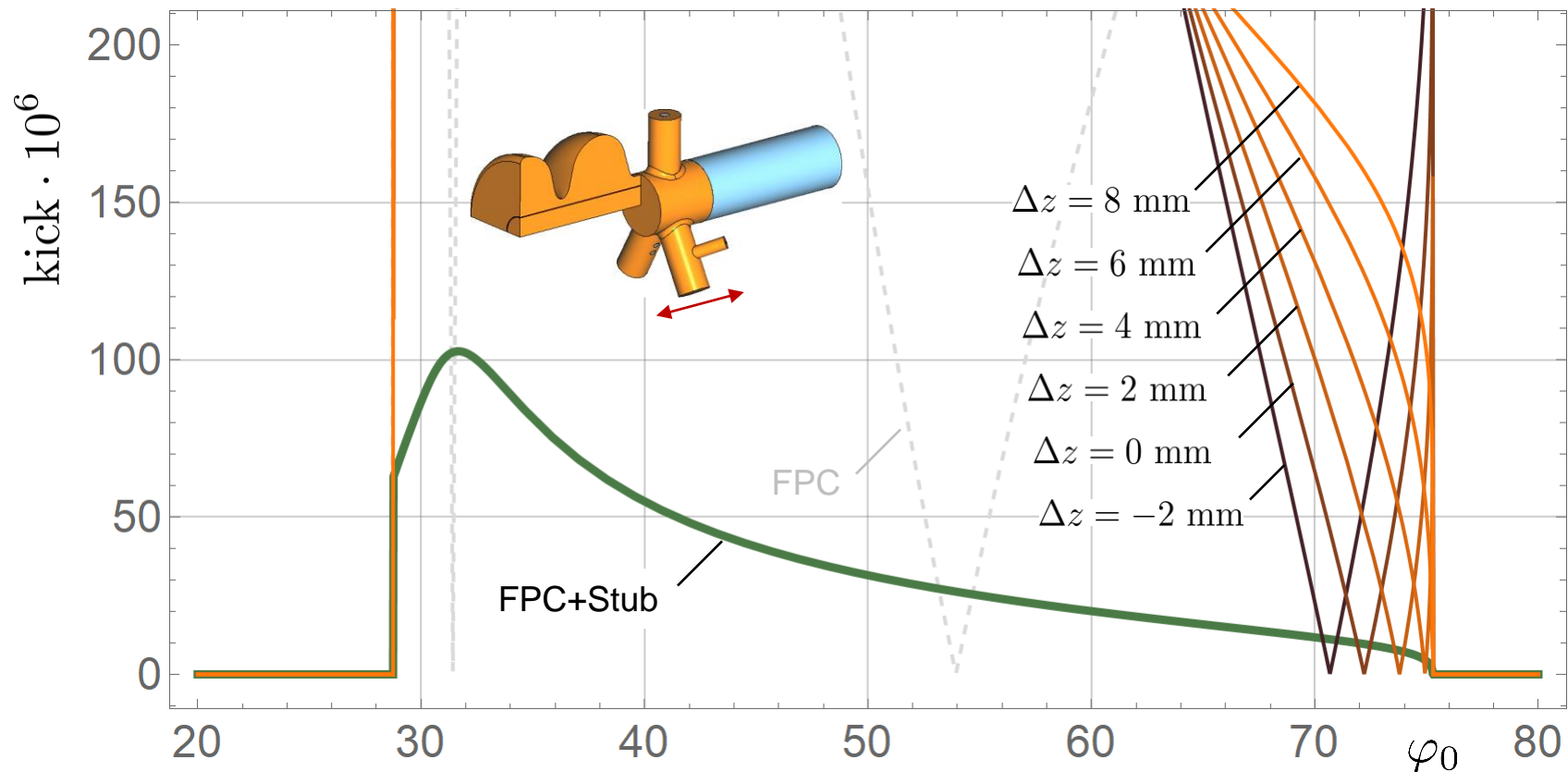
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▪ Setup with Two HOM Couplers



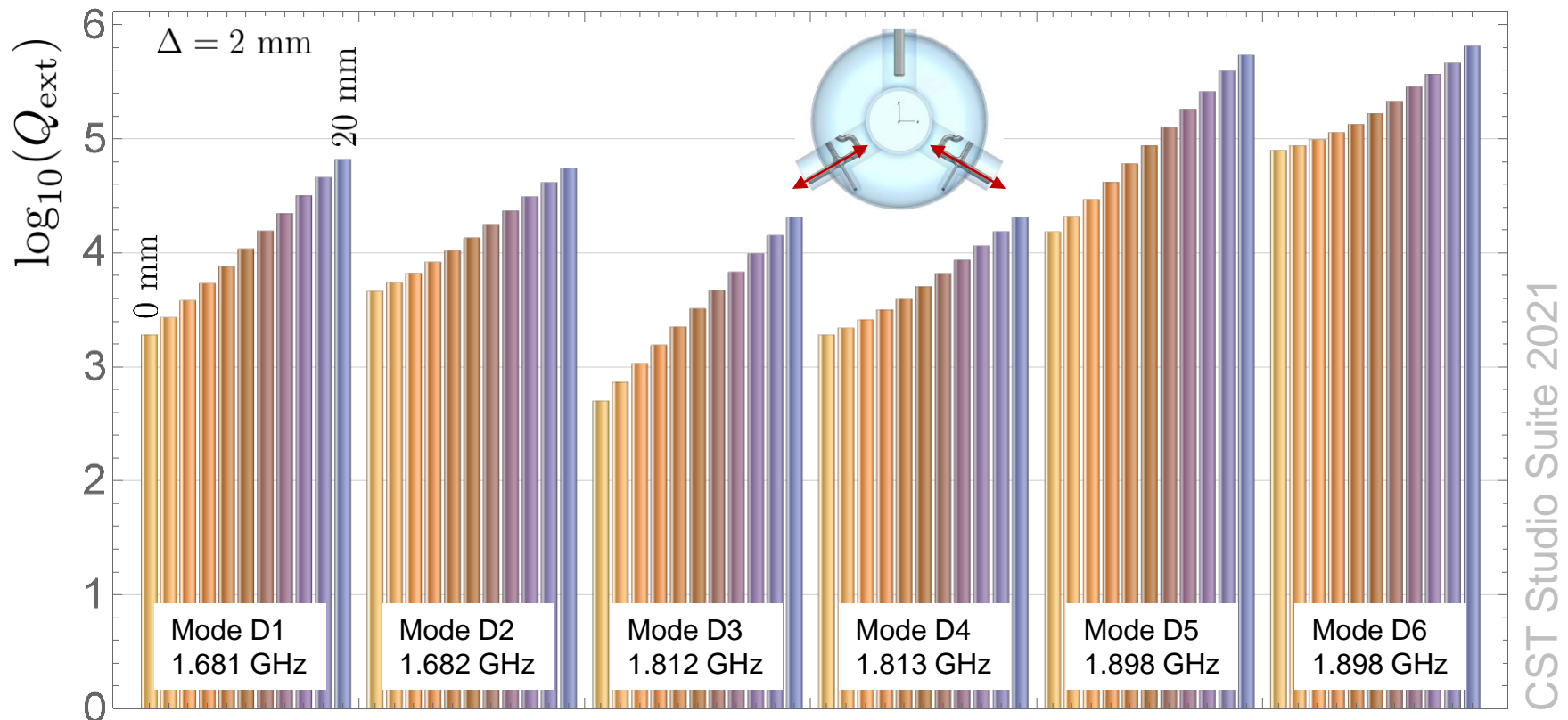
Numerical Results

▪ Transverse Kick wrt. Longitudinal Position



Numerical Results

▪ Variation of the Antenna Penetration Depth



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Summary

- Geometric model provided by DESY (Dmitry Bazyl)
- Numerical modeling based on FEM
 - Complex-valued eigenmode analysis
 - Kirchhoff integral field smoothing
 - Single particle used for kick calculations
- Various HOM coupler configurations examined
 - Double HOM coupler setup represents promising candidate if higher-order modes need to be extracted explicitly



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