

Eigenvalue Calculations of a TESLA Cavity including the Fundamental Power Coupler



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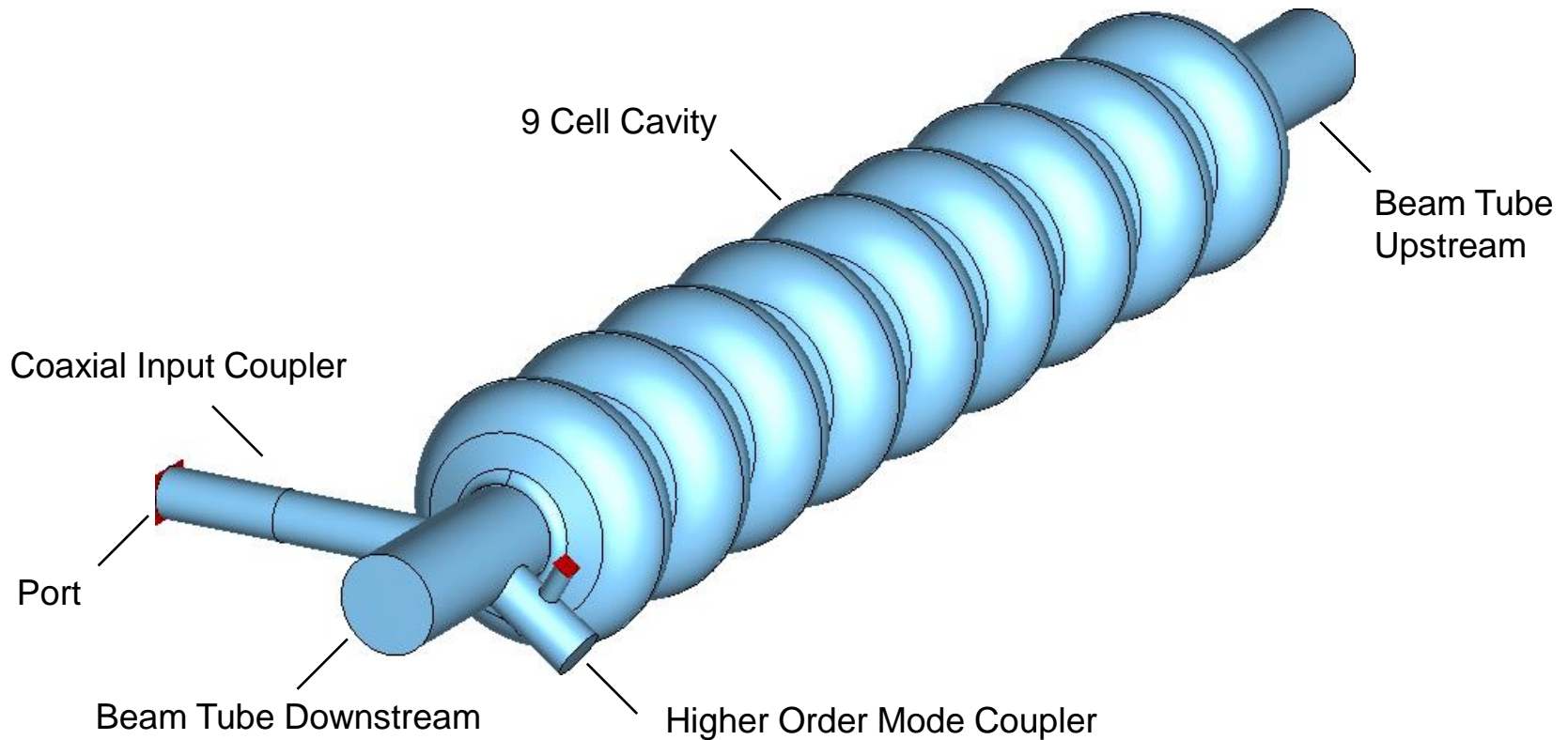


- Motivation
- Numerical Results based on 3D Eigenmode Analysis
 - TESLA 1.3 GHz Cavity with Antenna
 - Extraction of 2D Waveguide Modes
 - External Quality Factor
 - TESLA 1.3 GHz Cavity with FPC
 - Extraction of 2D Waveguide Modes
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 - TESLA 1.3 GHz Cavity with FPC and additional Scatterer
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- Summary / Conclusion

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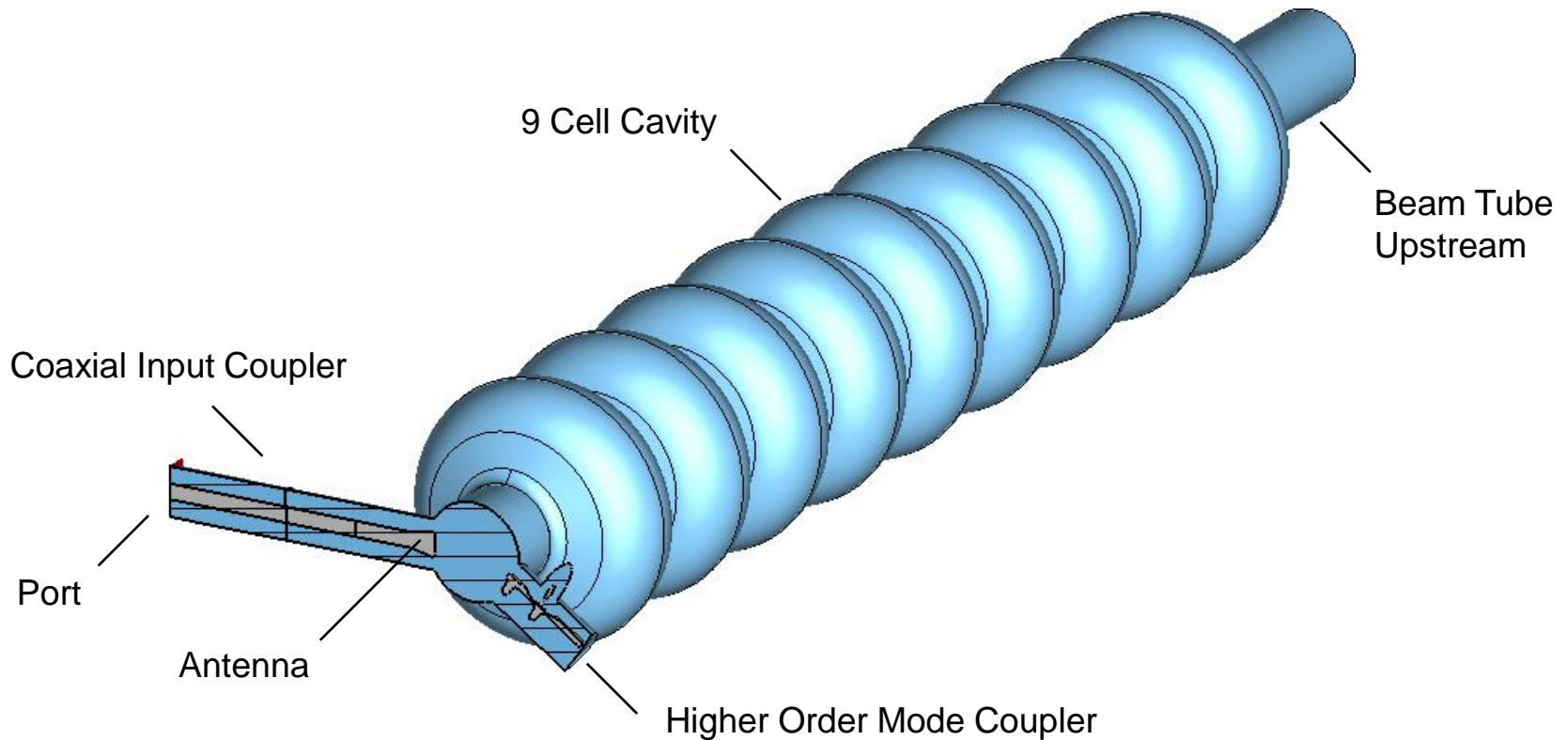
Motivation

- TESLA 1.3 GHz Cavity
 - Cavity with FPC Antenna and two HOM couplers



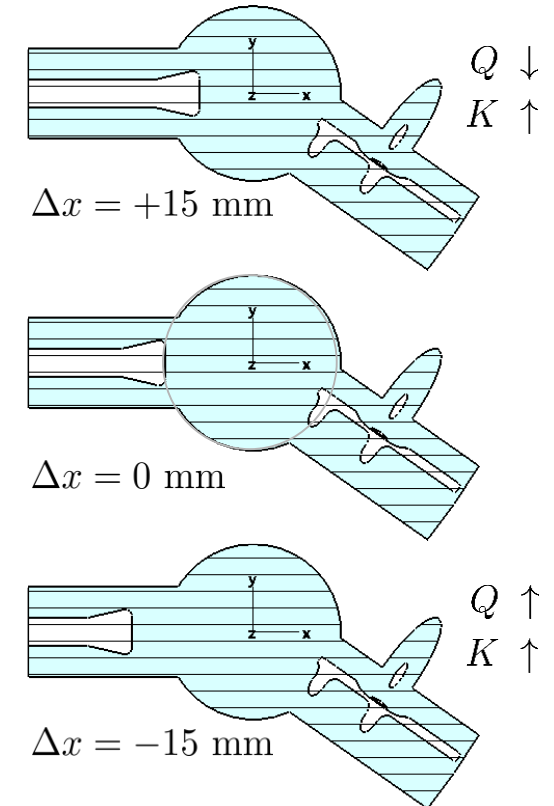
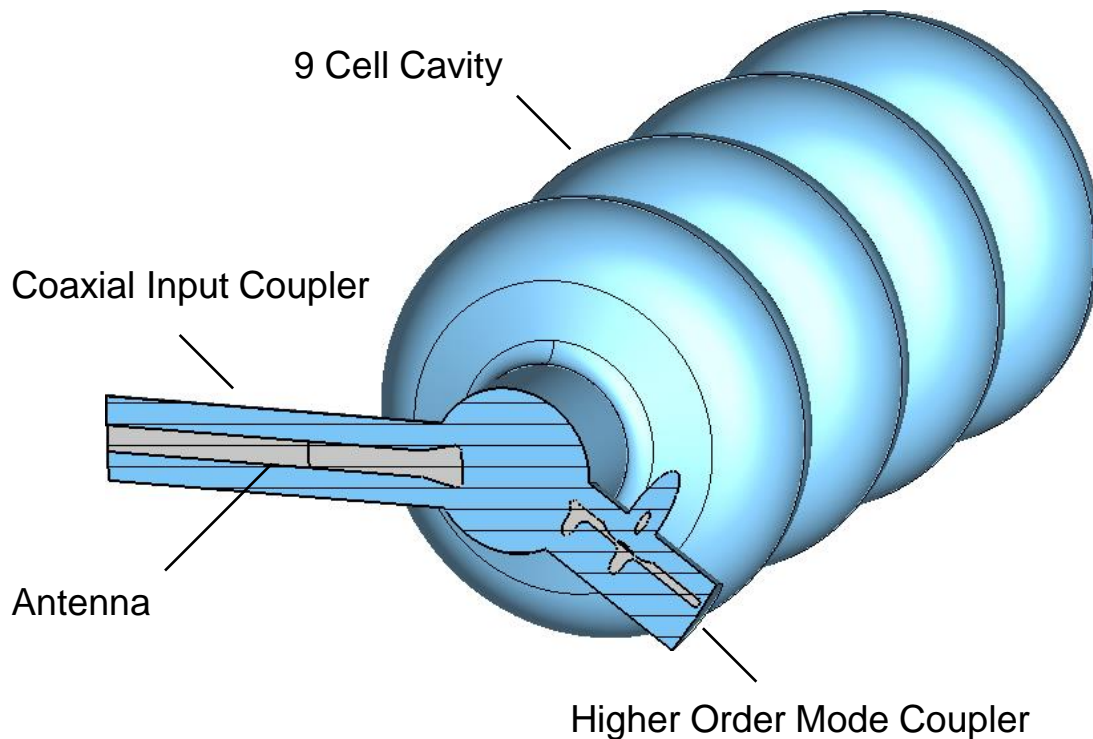
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Motivation

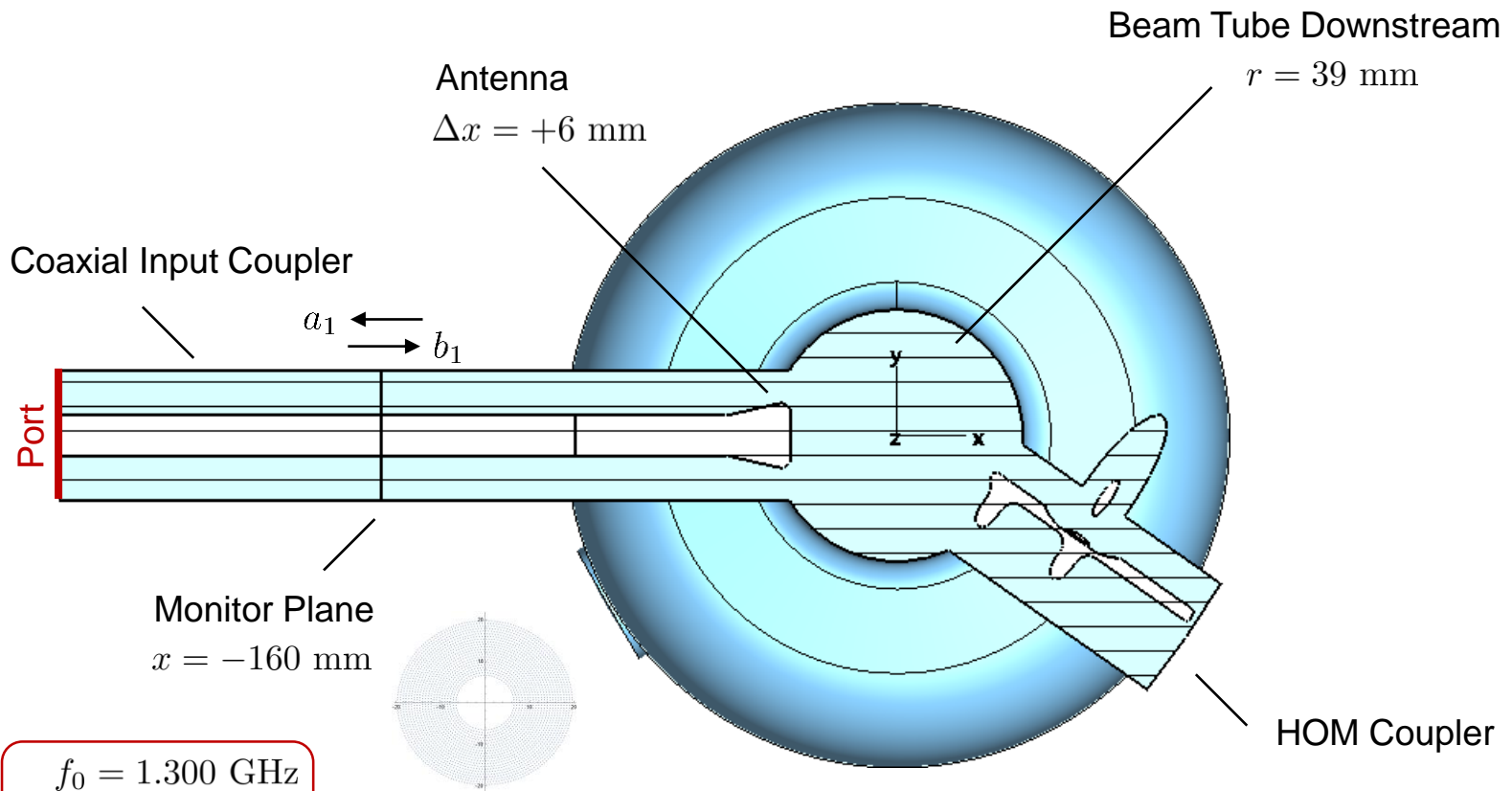
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Numerical Results

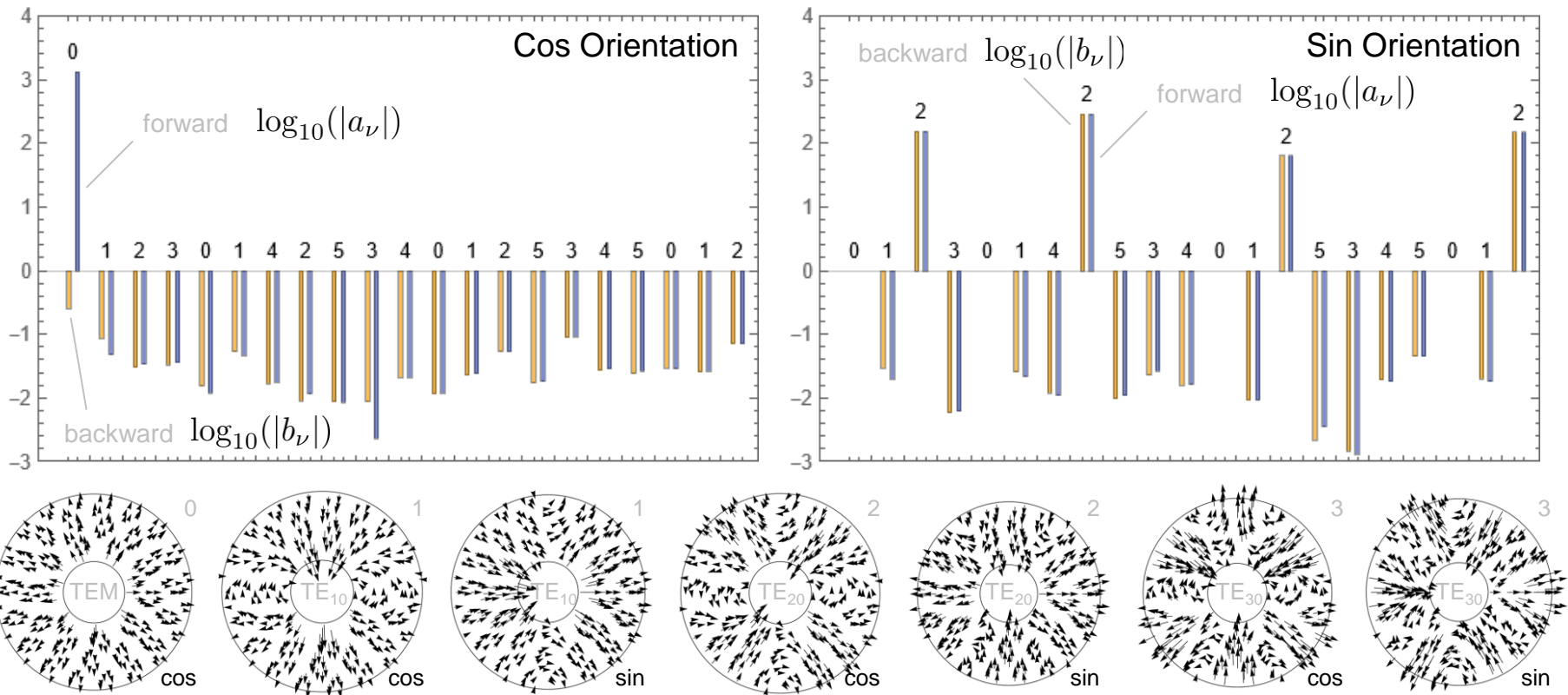
▪ TESLA 1.3 GHz Cavity



$$f_0 = 1.300 \text{ GHz}$$
$$Q_{\text{ext}} = 3.456 \cdot 10^6$$

Numerical Results

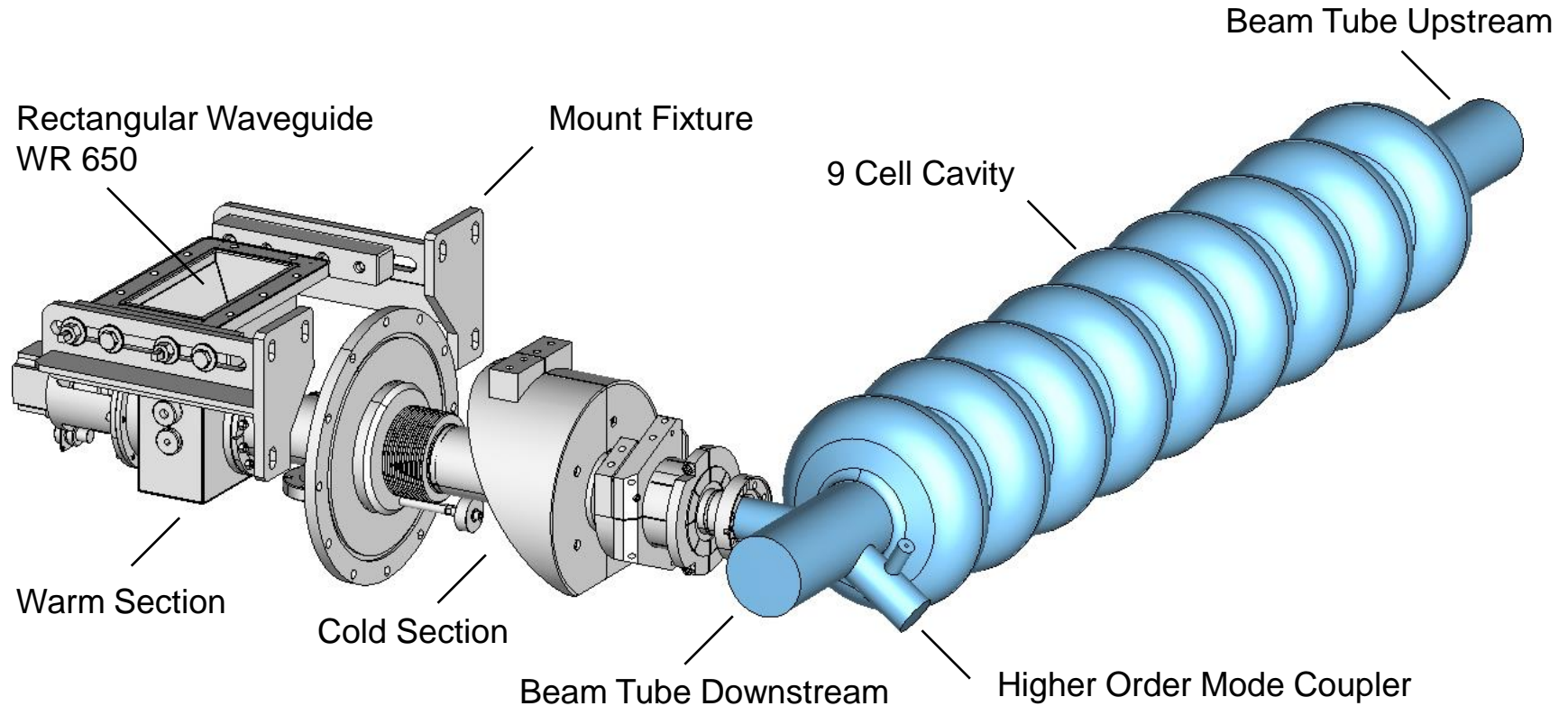
- TESLA 1.3 GHz Cavity
 - Magnitude of the Waveguide Modes in the Monitor Plane



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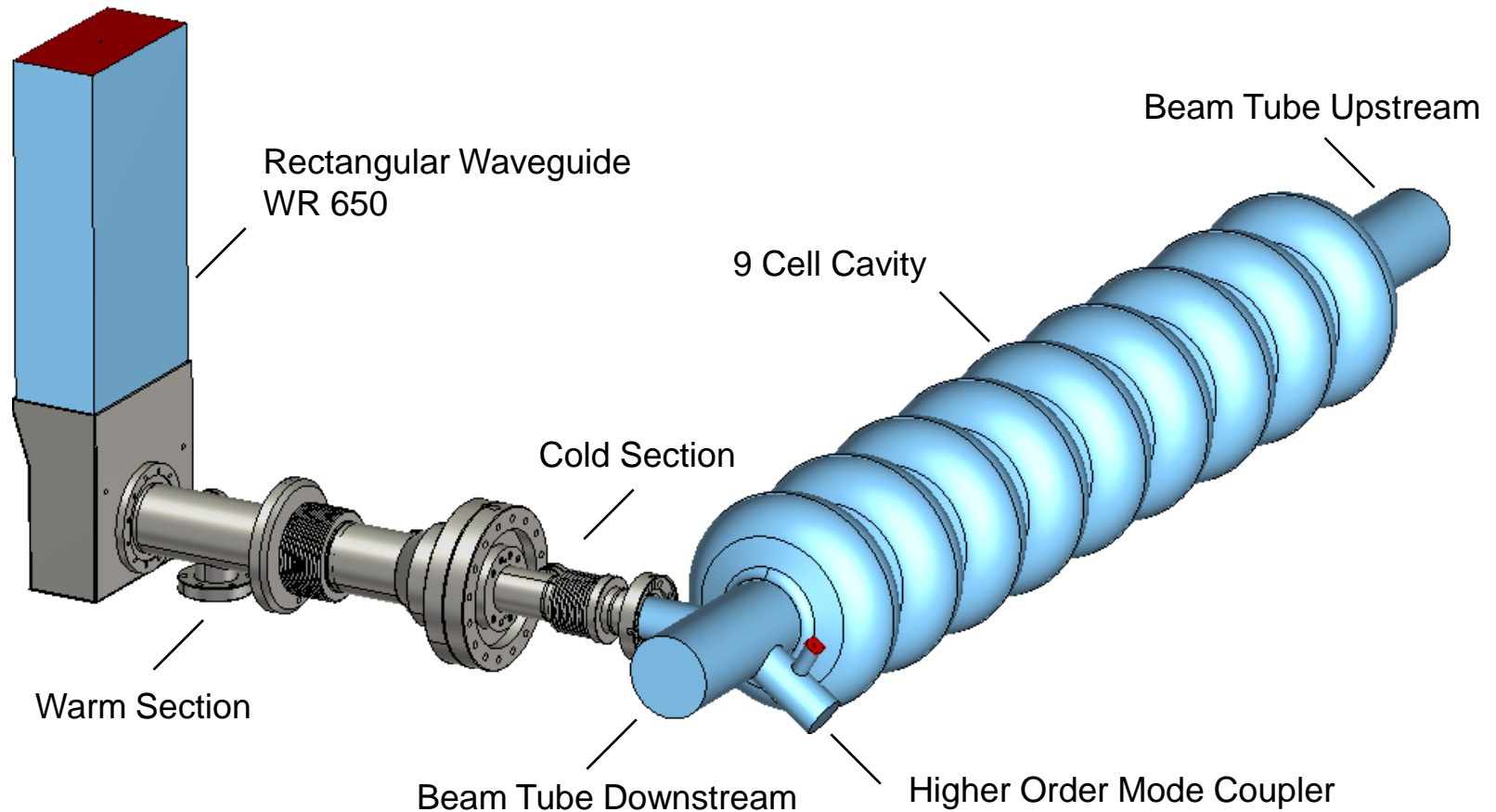
Numerical Results

- TESLA 1.3 GHz Cavity
 - Attachment of the Fundamental Power Coupler



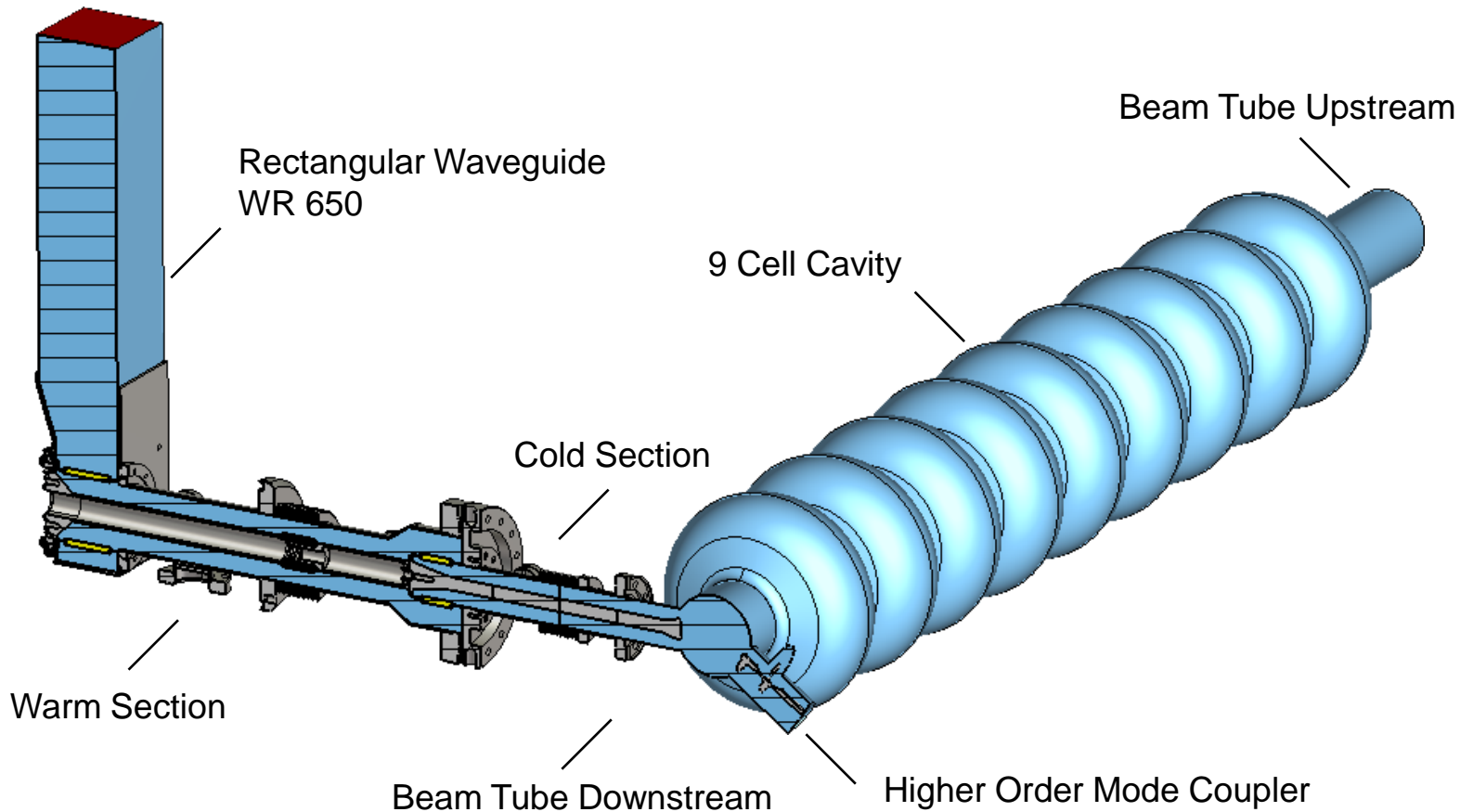
Numerical Results

▪ TESLA 1.3 GHz Cavity



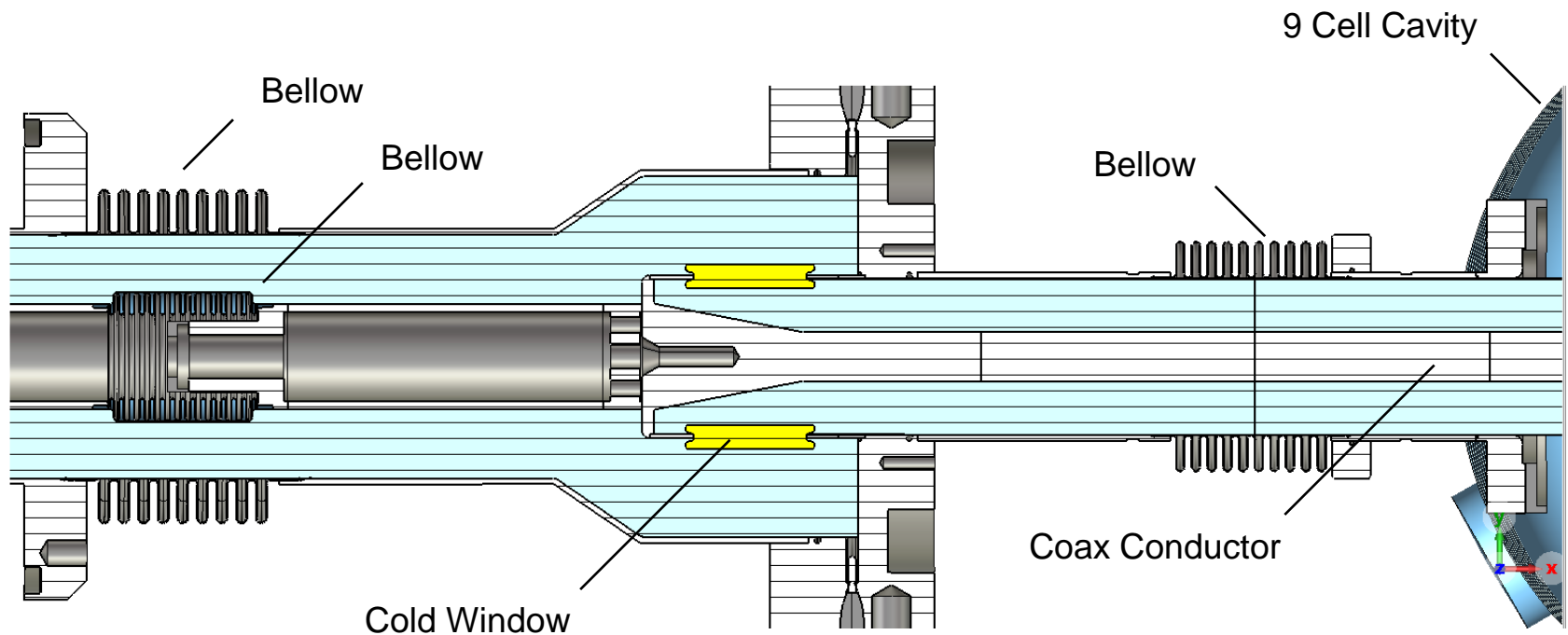
Numerical Results

▪ TESLA 1.3 GHz Cavity



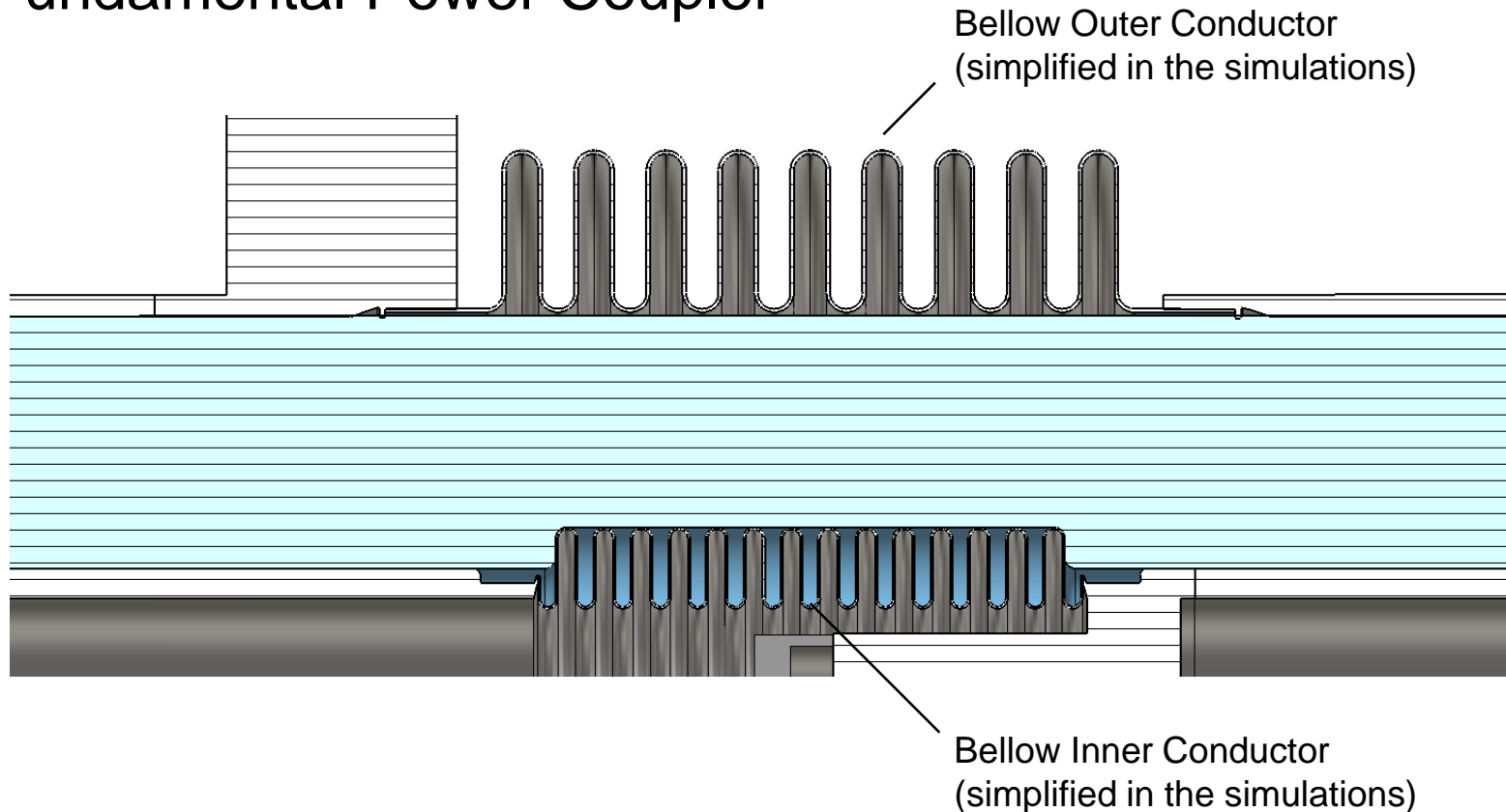
Numerical Results

- TESLA 1.3 GHz Cavity
 - Fundamental Power Coupler



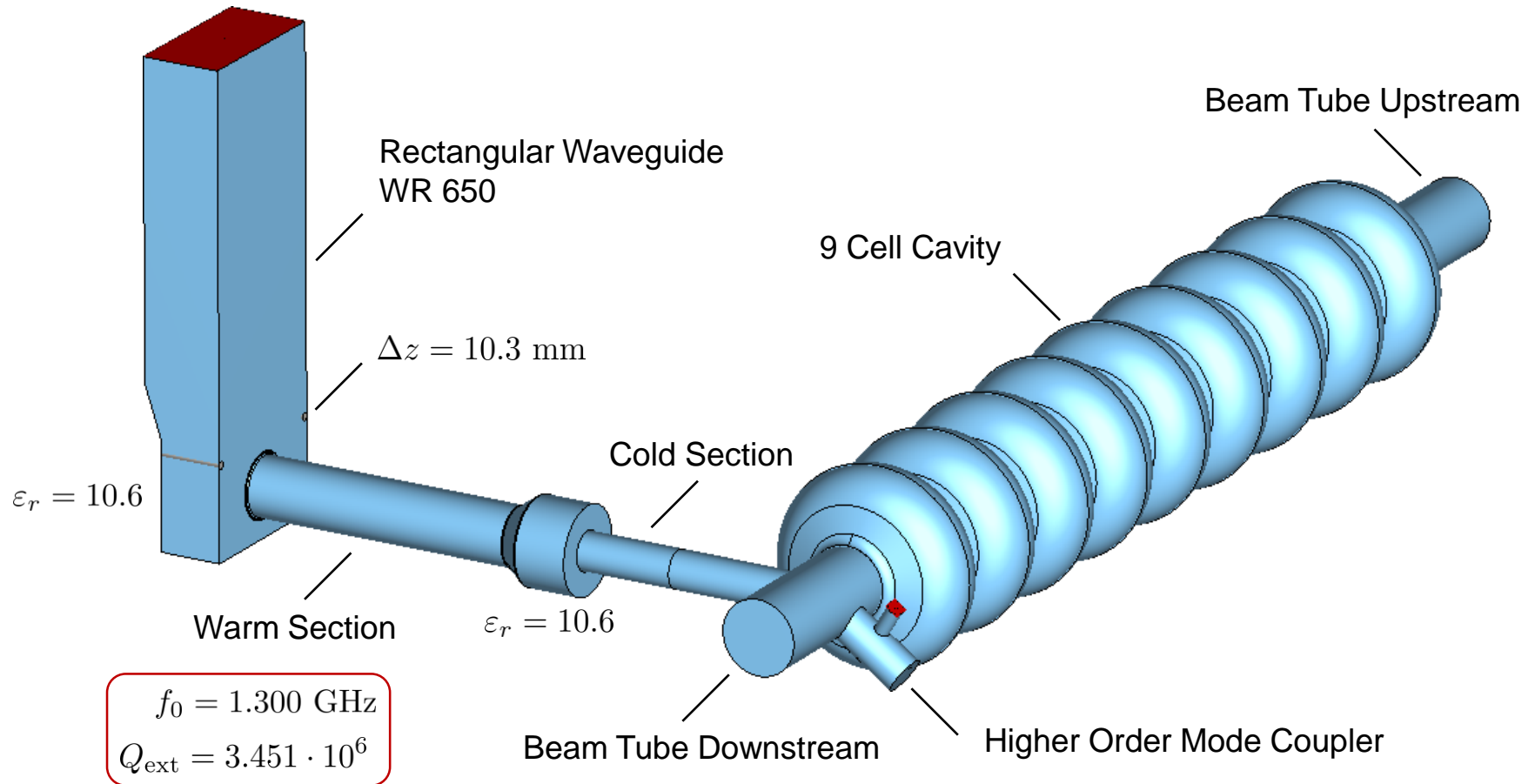
Numerical Results

- TESLA 1.3 GHz Cavity
 - Fundamental Power Coupler



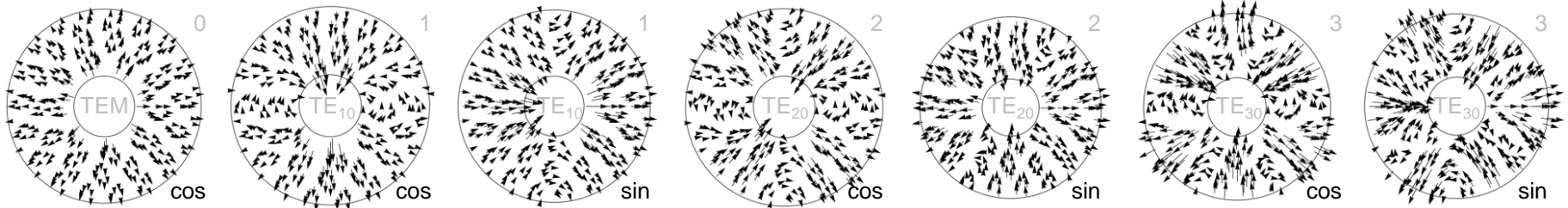
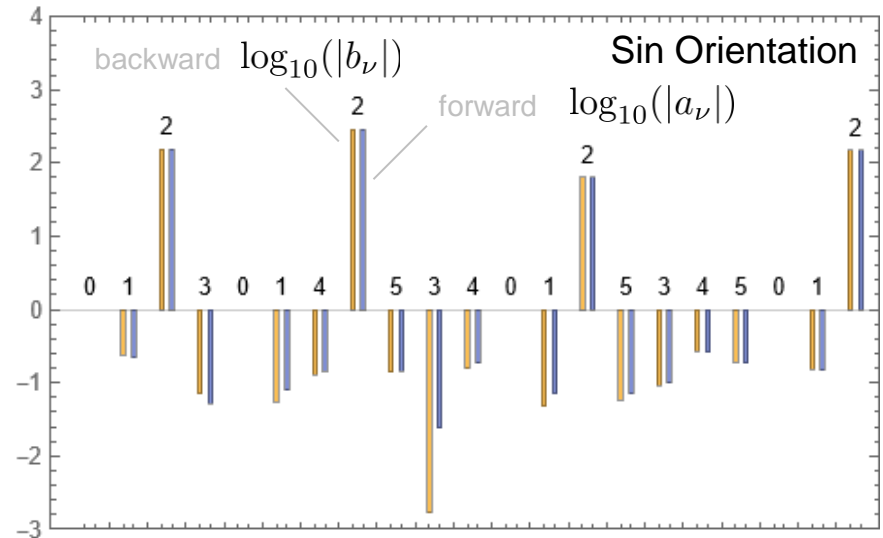
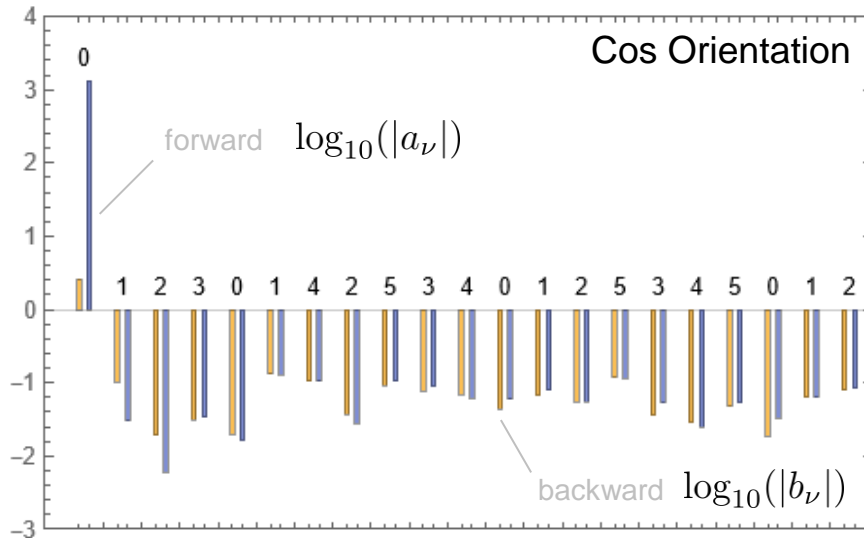
Numerical Results

▪ TESLA 1.3 GHz Cavity



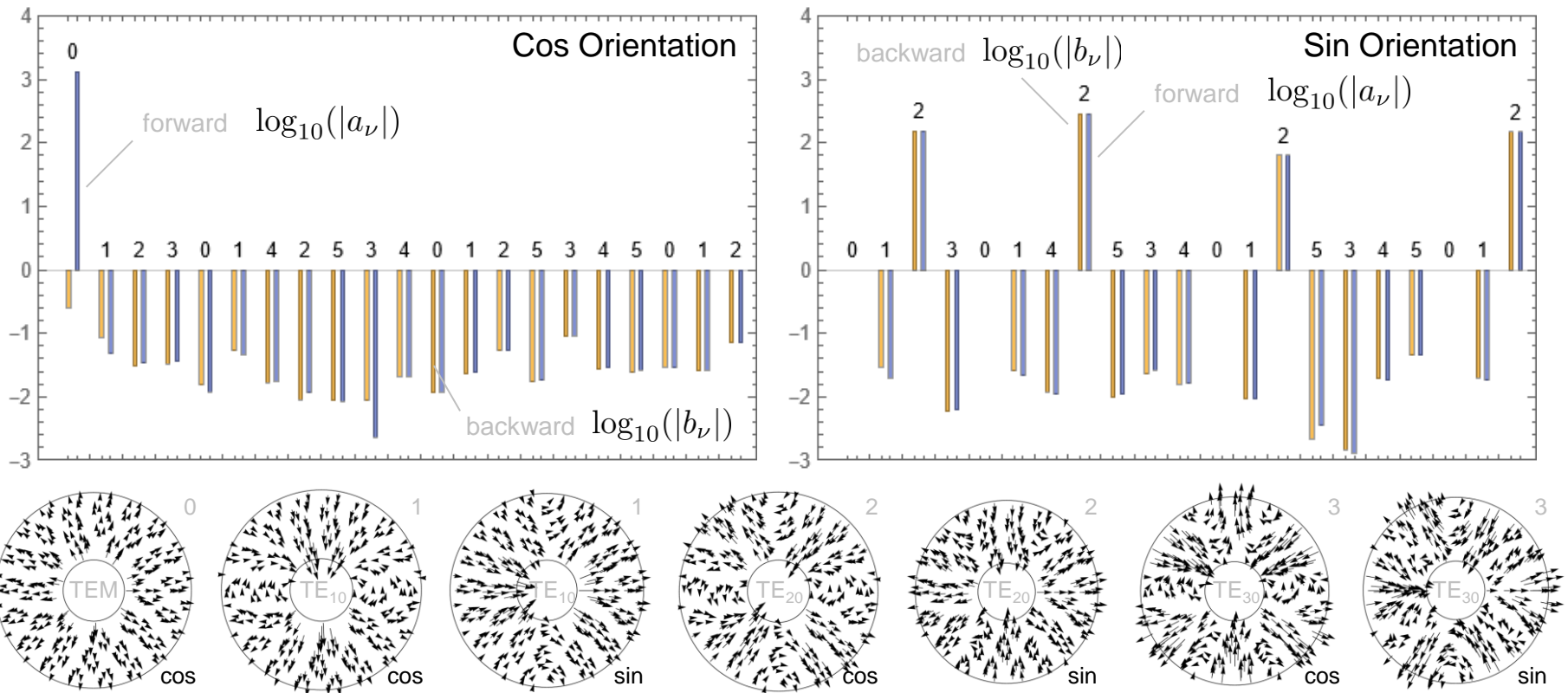
Numerical Results

- TESLA 1.3 GHz Cavity
 - 2D Modal Field Strength in the Monitor Plane



Numerical Results

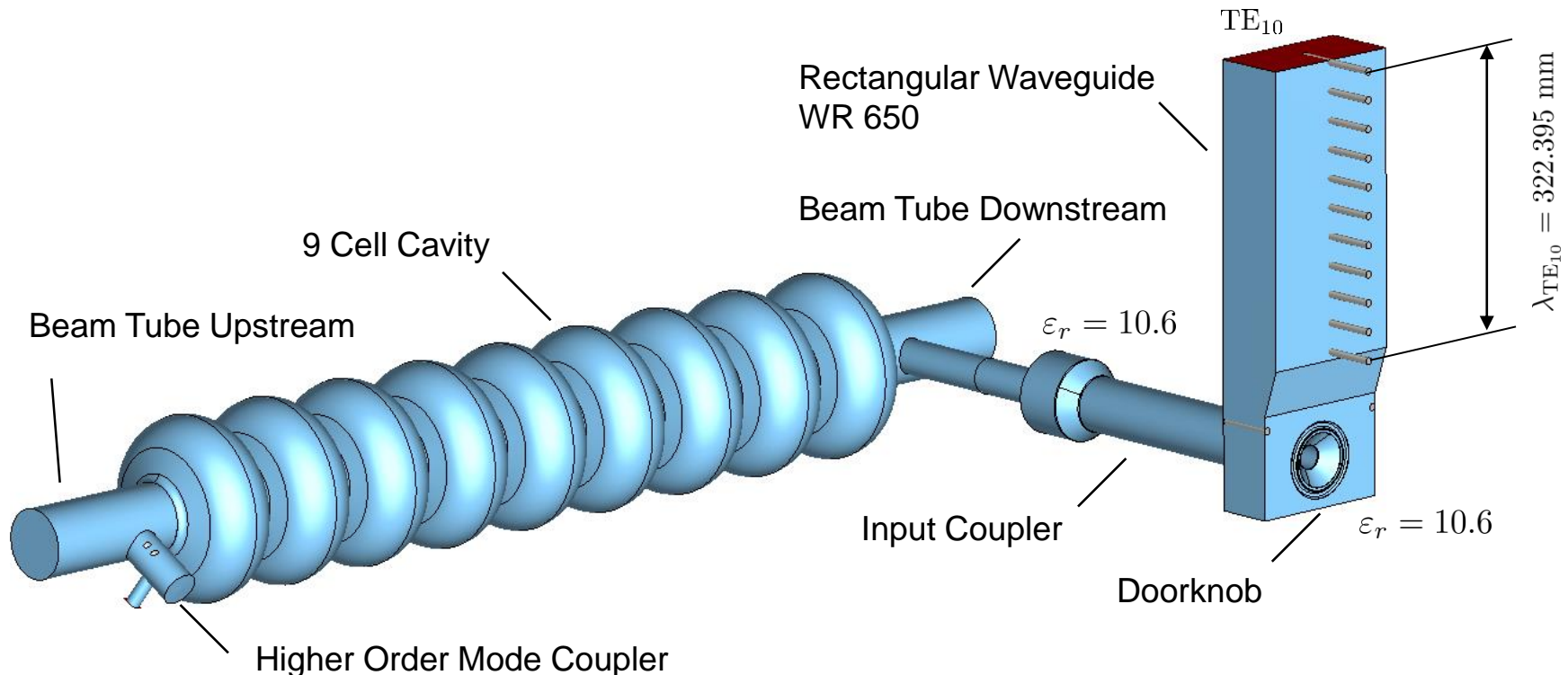
- TESLA 1.3 GHz Cavity
 - 2D Modal Field Strength in the Monitor Plane (no FPC)



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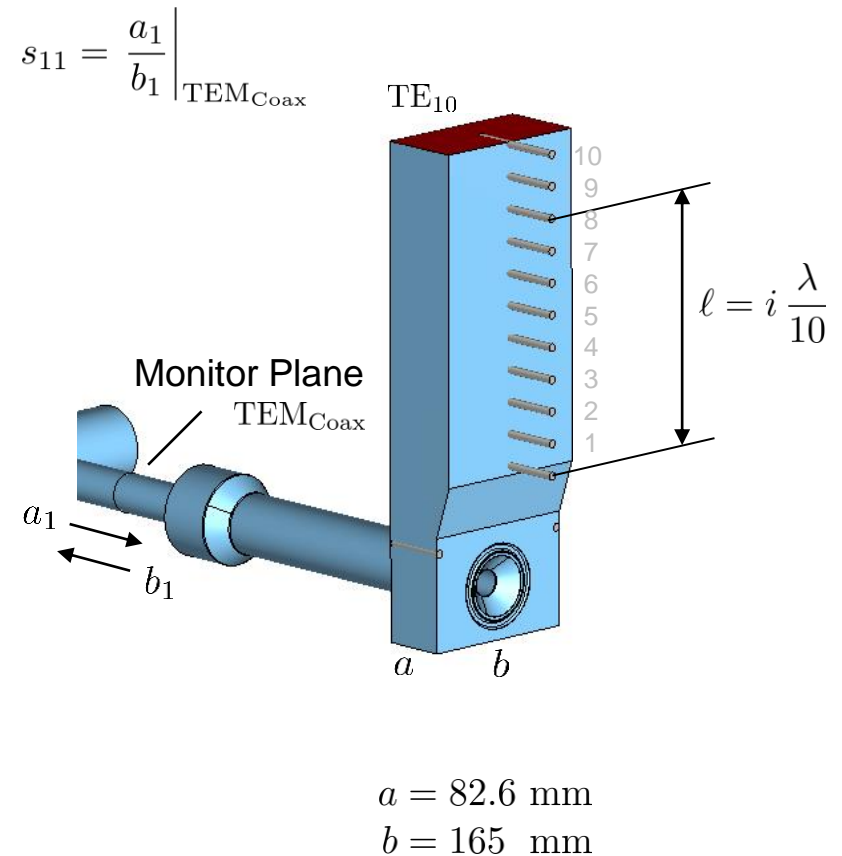
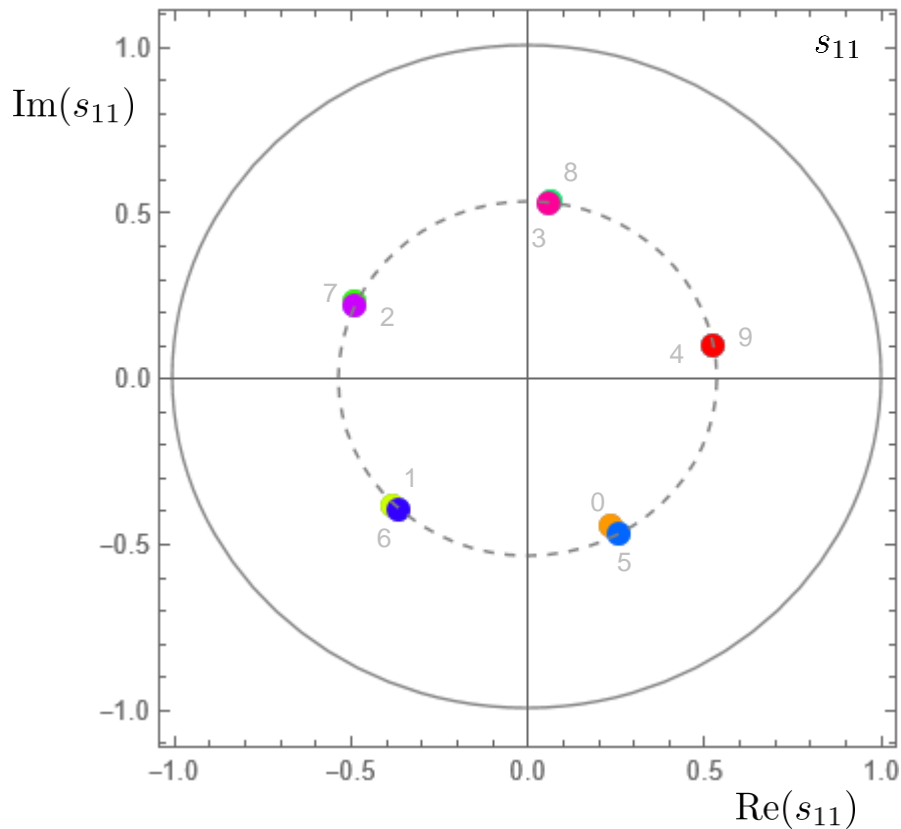
Numerical Results

- TESLA 1.3 GHz Cavity
 - Artificial Scatterer within the Rectangular Waveguide



Numerical Results

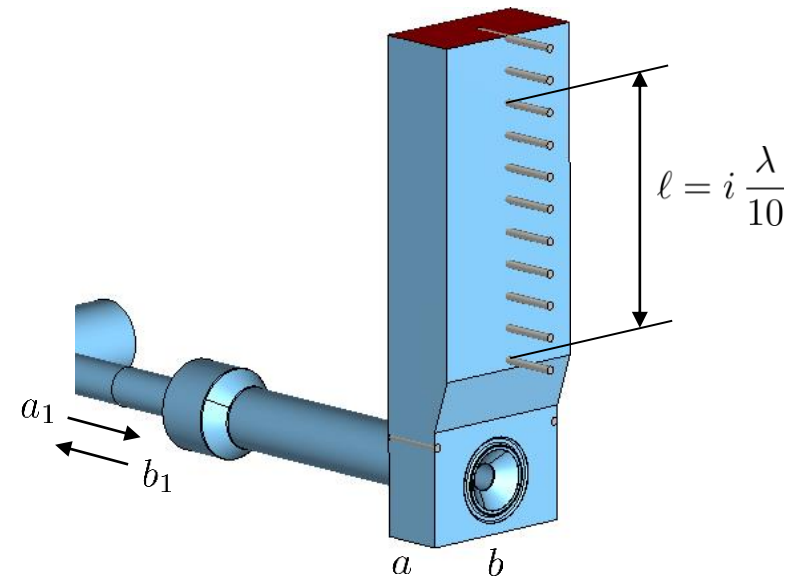
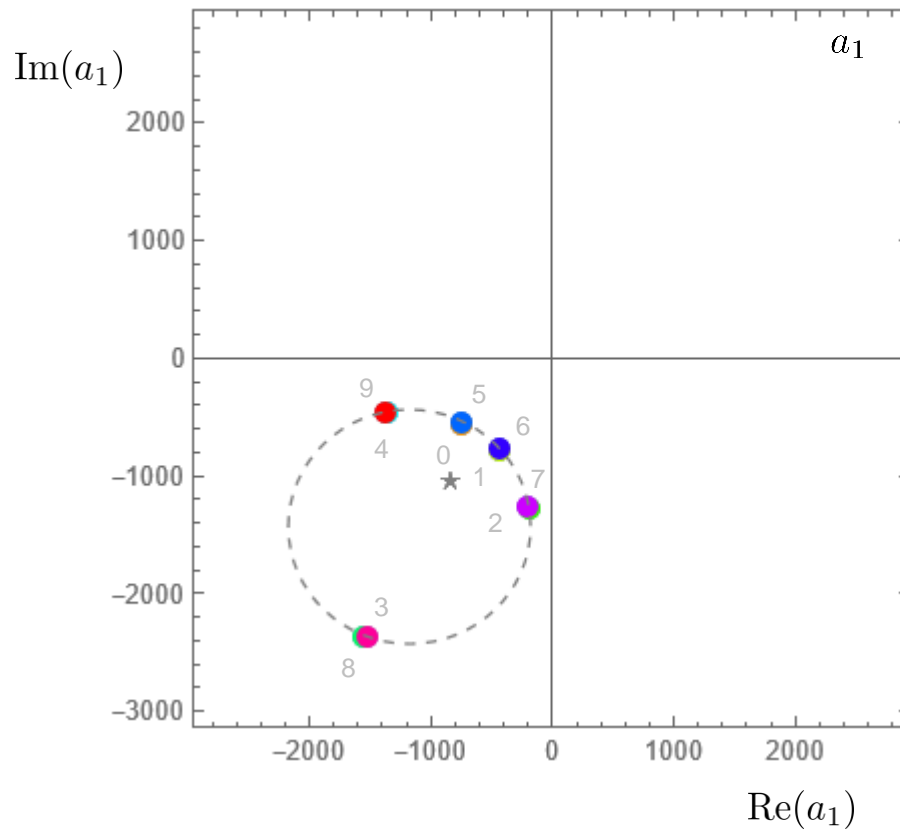
TESLA 1.3 GHz Cavity



Numerical Results

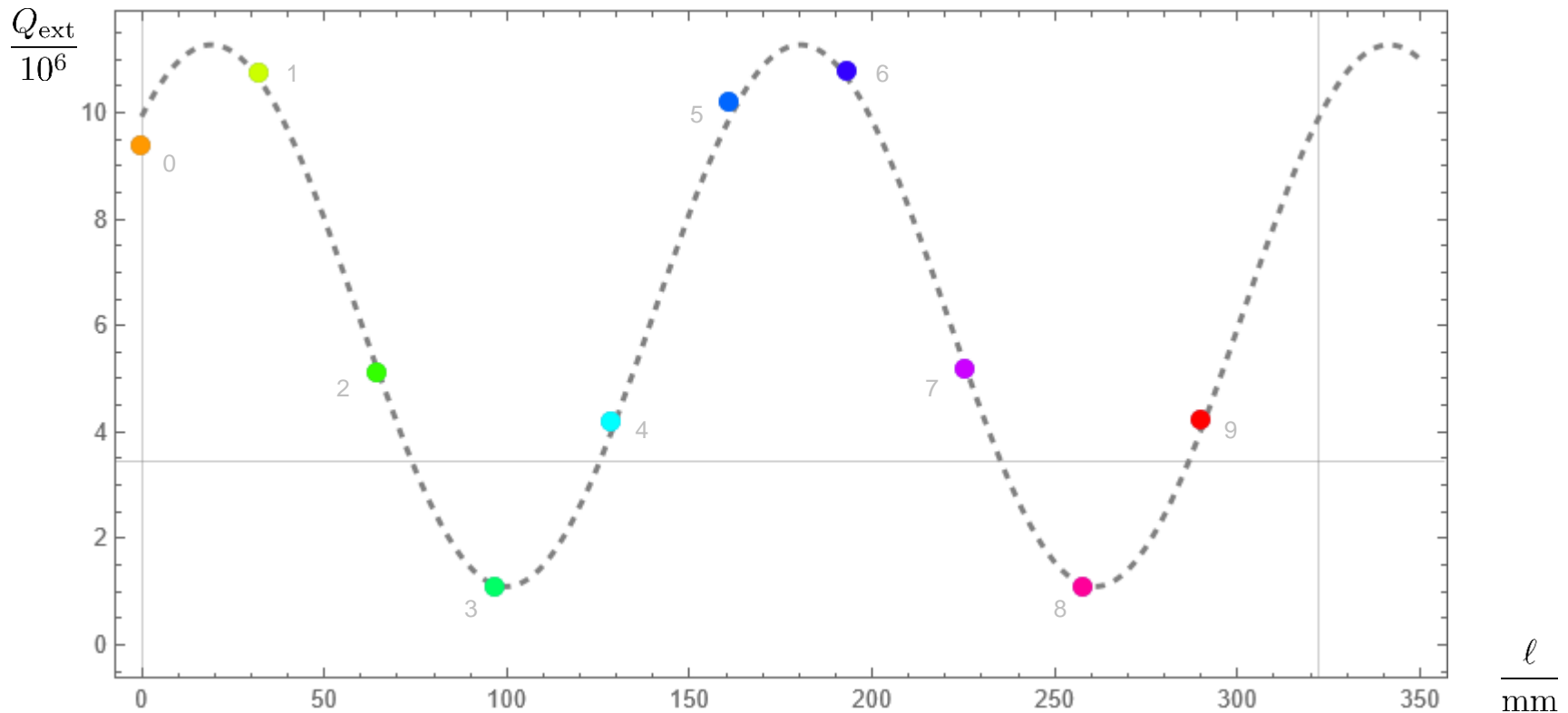
TESLA 1.3 GHz Cavity

$$s_{11} = \frac{a_1}{b_1} \Big|_{\text{Mode 1}}$$



Numerical Results

- TESLA 1.3 GHz Cavity
- External Quality Factor

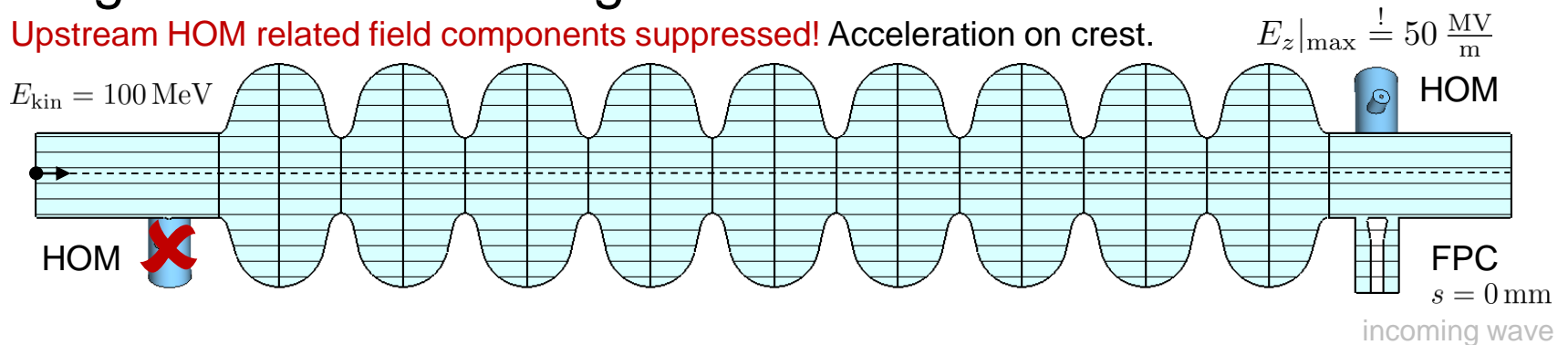


Numerical Results

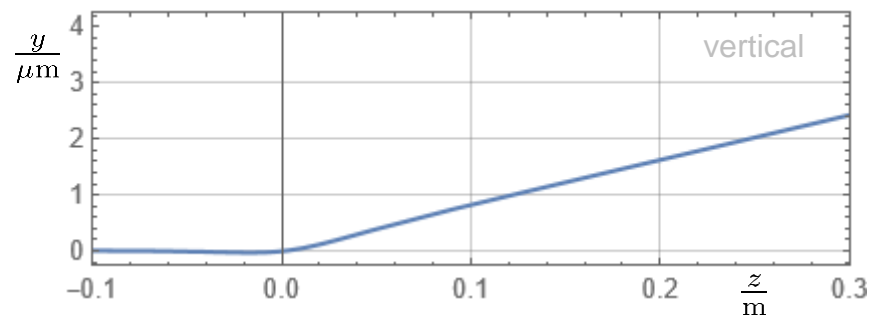
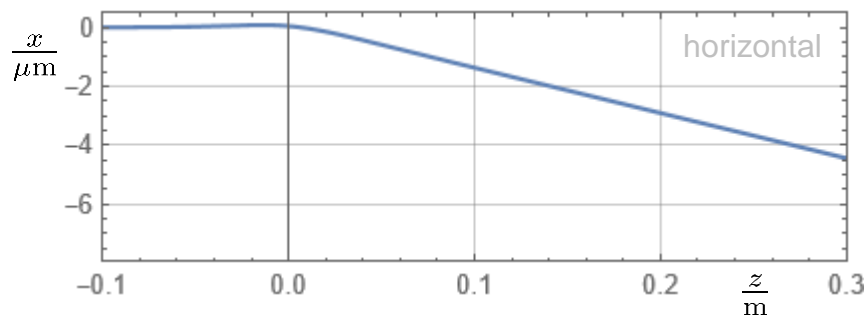
▪ 9-Cell TESLA 1.3 GHz Cavity

- Single-Particle Tracking

Upstream HOM related field components suppressed! Acceleration on crest.

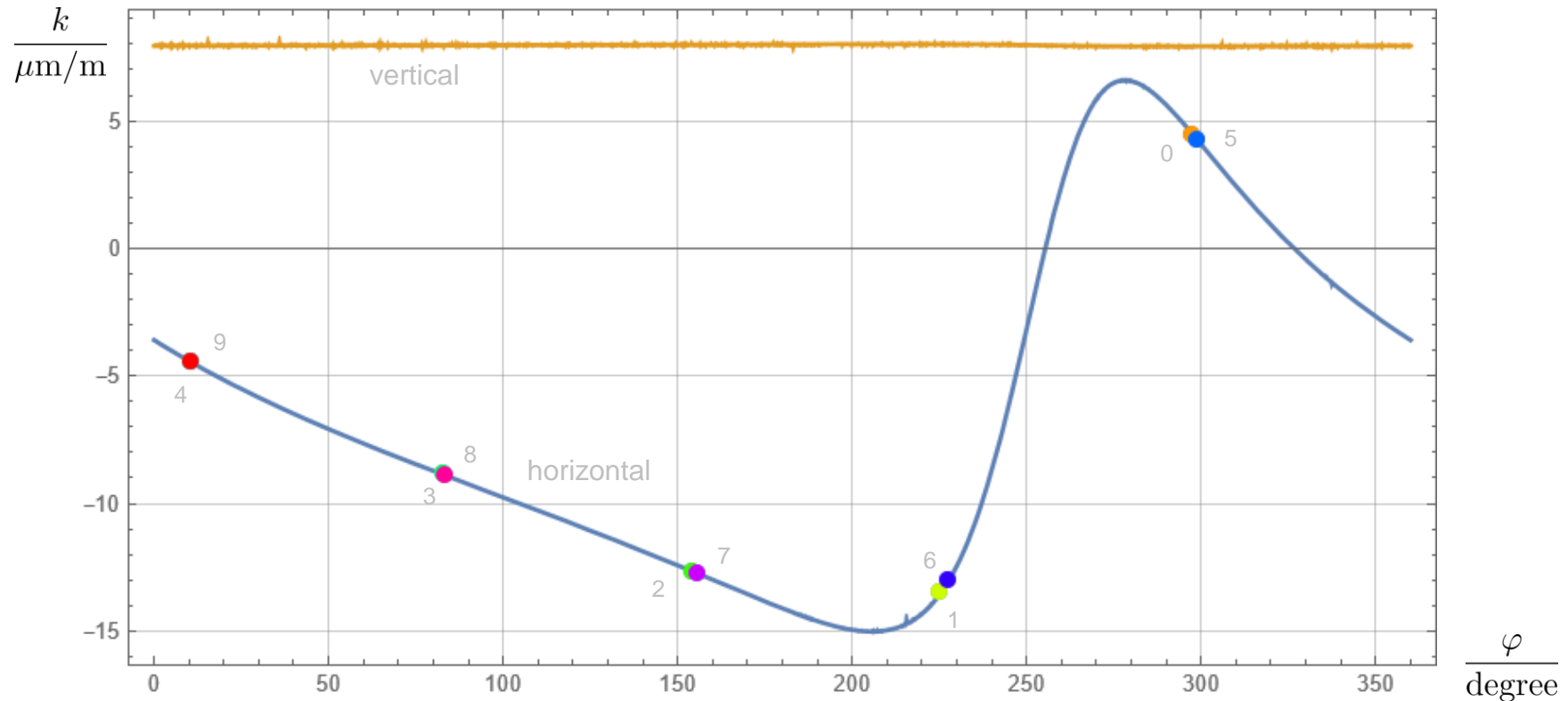


- Trajectory in the Horizontal and Vertical Planes



Numerical Results

- TESLA 1.3 GHz Cavity
 - Horizontal and Vertical Coupler Kicks



Summary / Conclusion

- Summary
- Numerical Results based on 3D Eigenmode Analysis
 - Modeling of a TESLA 1.3 GHz Cavity with
 - Simple Antenna Tip and a short Coaxial Waveguide
 - Fundamental Power Coupler (FPC)
 - Fundamental Power Coupler and an additional Scatterer
 - Observations of
 - 2D Waveguide Mode Amplitudes and Reflection Coefficients
 - External Quality Factors
 - Horizontal and Vertical Kick Factors
- Conclusion
 - ➔ Magnitude and Phase of the additional scatterer should be adjustable to modify the Quality Factor and Coupler Kick