



# Automatic 3D Modeling for Waveguide Filters



# 3D Modeling Waveguide Package

The new 3D modelling waveguide package is a design workflow that uses automation to help build 3D waveguide filters. The new function supports rectangular and cylinder waveguides and guides the user through single resonator modelling and analysis, coupling schemes modelling and analysis, and finally a fully customized 3D modeling GUI interface.

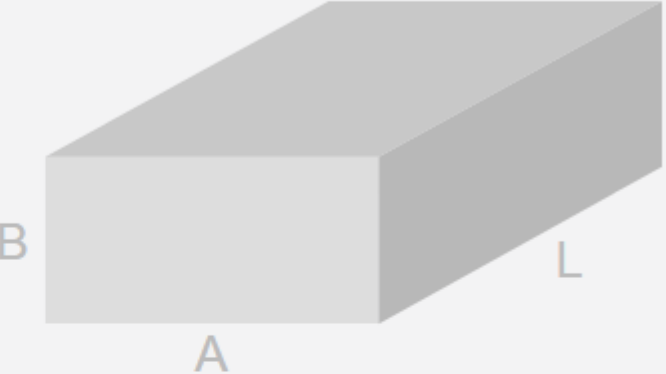
Unit: cm

Mode Index: m: 1, n: 0, l: 1

**Select Waveguide (WR-62)**

A (Width)	1.58	cm	A Range	1.264	1.896
Ratio B/A	0.5		B (Height)	0.79	cm

Frequency	17.5	GHz		
Frequency Range	11.9	GHz	18	GHz
Surface Material	Silver			
Conductivity	6.1	$\times 10^7$ S/m		
Fill-in Material	Air			
Dielectric Constant	1			
Loss Tangent Angle	0	<b>Apply</b>		
L (Length)	To be calculated	cm		
Unloaded Q	To be calculated			
Cavity Material	Brass			
Fill-in Material CTE	0.0000184			
Temperature	25	$^{\circ}\text{C}$		
From 0	$^{\circ}\text{C}$	To 0	$^{\circ}\text{C}$	<b>Apply</b>
Low Shift	To be calculated	MHz		
High Shift	To be calculated	MHz		



**Air Fill-in**  
Waveguide housing

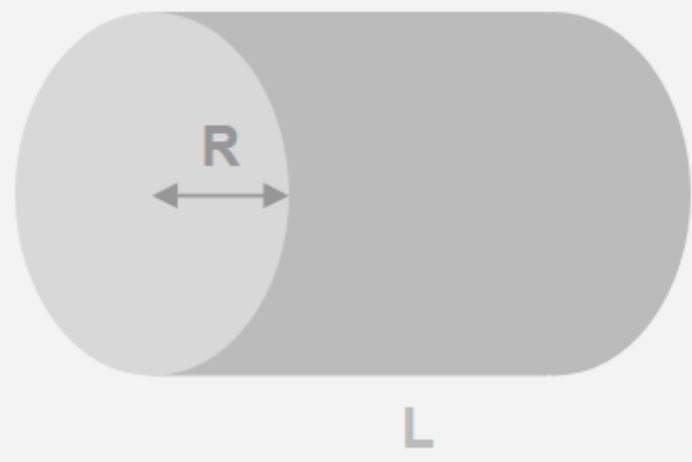
**Fill-in Materials (apply for ceramic waveguide structure)**  
Only surface plating

Unit: cm, Resonator Type: TE

Mode Index: m: 1, n: 1, l: 1

Frequency	17.5	GHz	Frequency Range	17.25	GHz	17.75	GHz	<b>Apply</b>
Radius	0.7	cm	Radius Range	0.56	cm	0.84	cm	

Surface Material	Silver			
Conductivity	6.1	$\times 10^7$ S/m		
Fill-in Material	Air			
Dielectric Constant	1			
Loss Tangent Angle	0			
L (Length)	To be calculated	cm		
Unloaded Q	To be calculated			
Cavity Material	Brass			
Fill-in Material CTE	0.0000184			
Temperature	25	$^{\circ}\text{C}$		
From 0	$^{\circ}\text{C}$	To 0	$^{\circ}\text{C}$	<b>Apply</b>
Low Shift	To be calculated	MHz		
High Shift	To be calculated	MHz		



# 3D Modeling Function Overview

## Filter Type Selection

Support different filter applications:

- Coaxial cavity
- Rectangular waveguide
- Cylinder waveguide

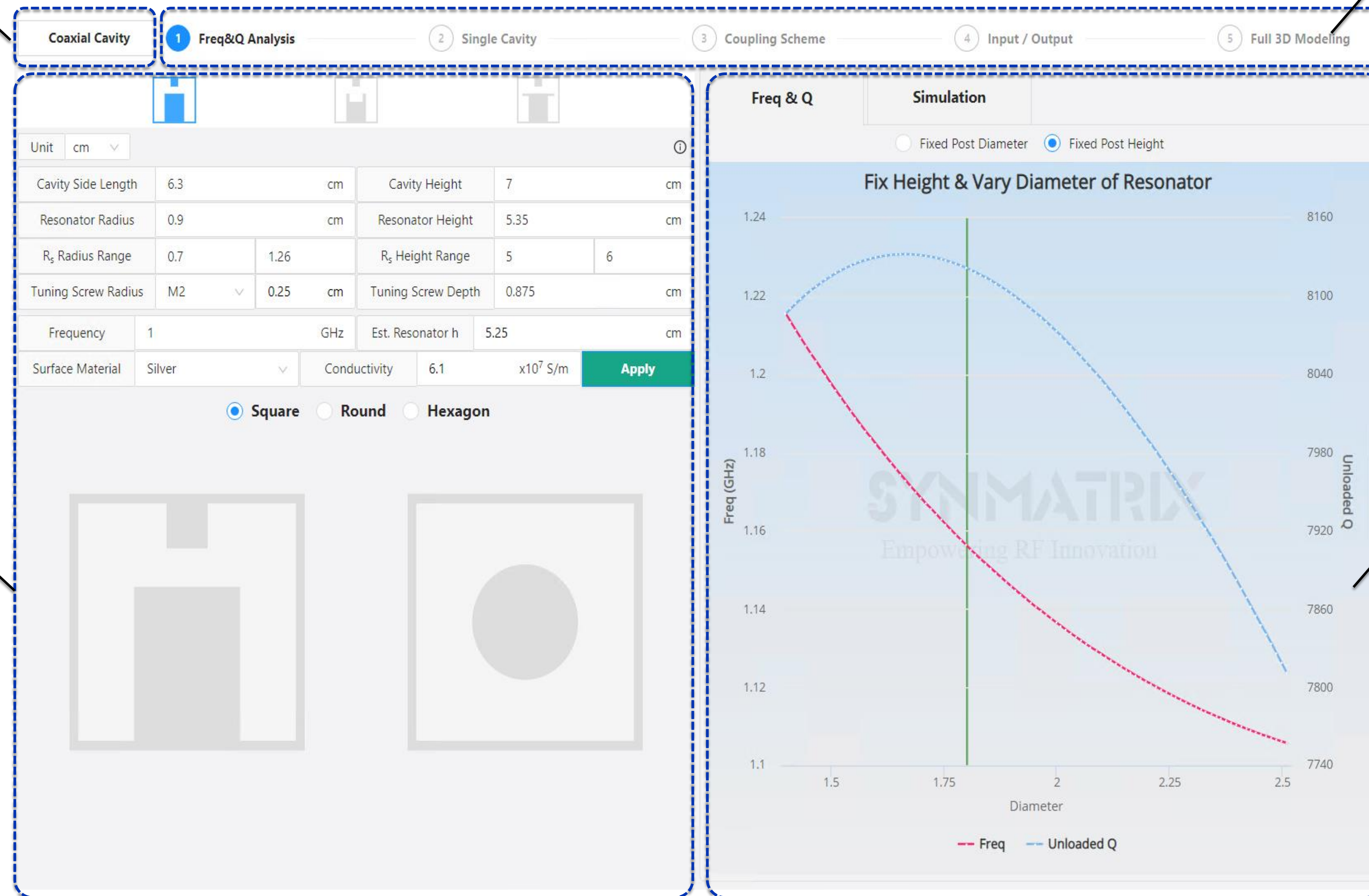
## Design Workflow Selection

Standard design workflow

- Single cavity modelling & Simulation
- Adjacent coupling modelling & Simulation
- Input/output coupling schemes
- Customized full 3D modelling

## Resonator Analysis & Synthesis

- Support different resonator shapes
- Frequency & Unloaded Q analysis
- Mode chart analysis
- Dimension synthesis

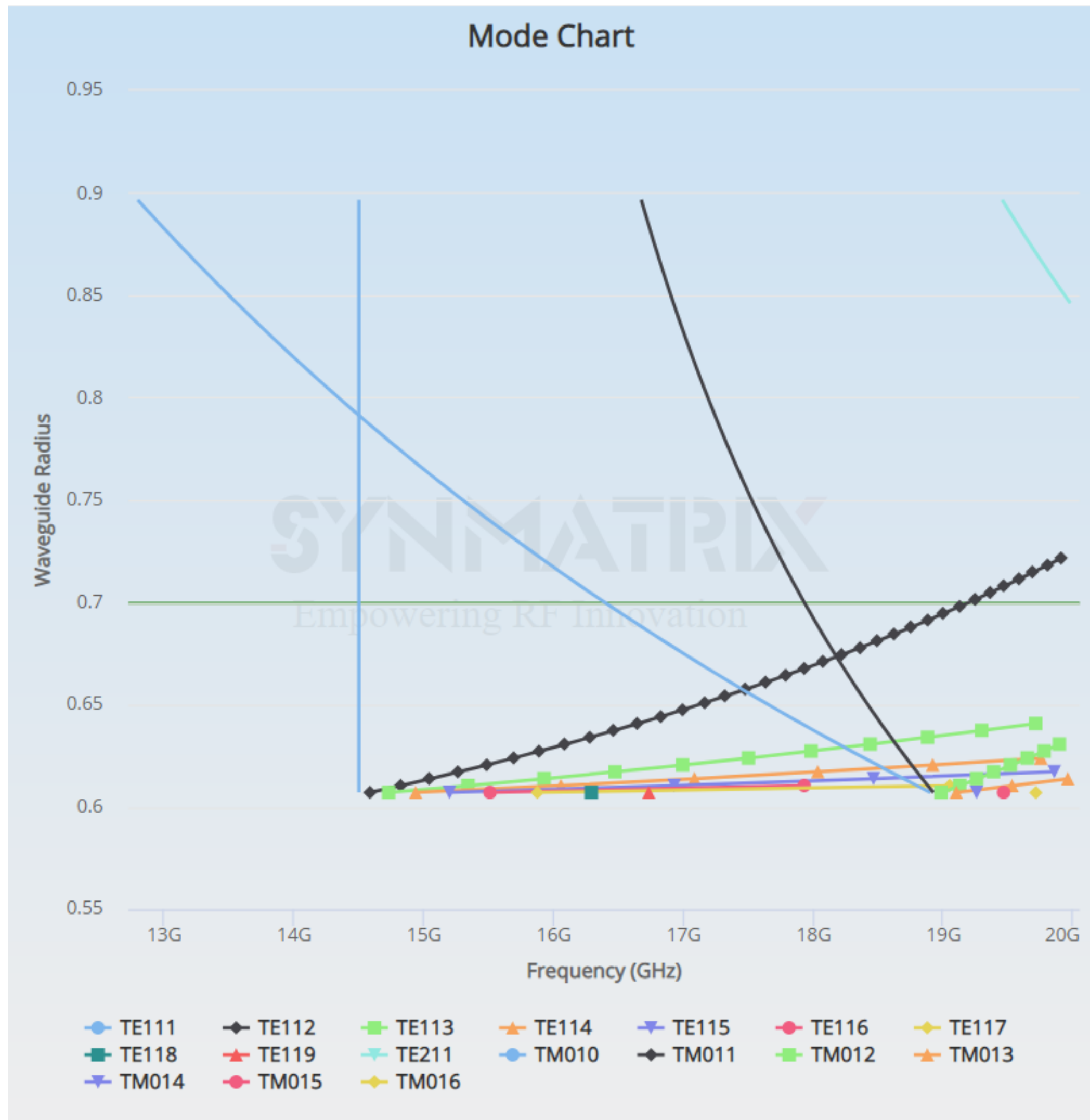


## Analysis & Simulation Plot

Analysis and simulation results plotting:

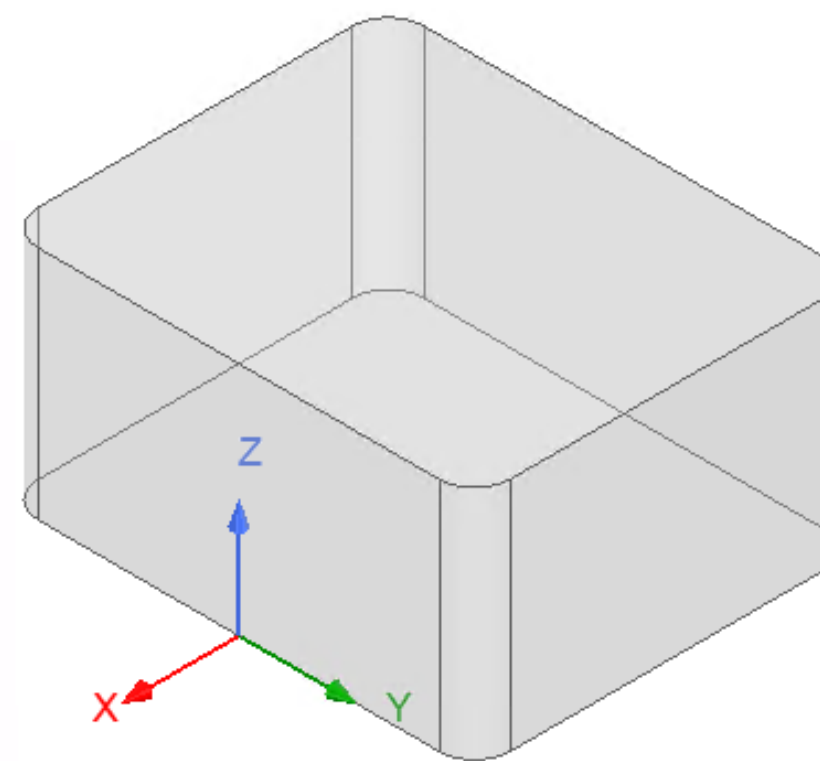
- Sync up with HFSS result;
- Parametric study curve;
- Curve fitting—regression analysis
- Frequency, unloaded Q, coupling coefficient, group delay

# 3D Modeling Function—Model Chart

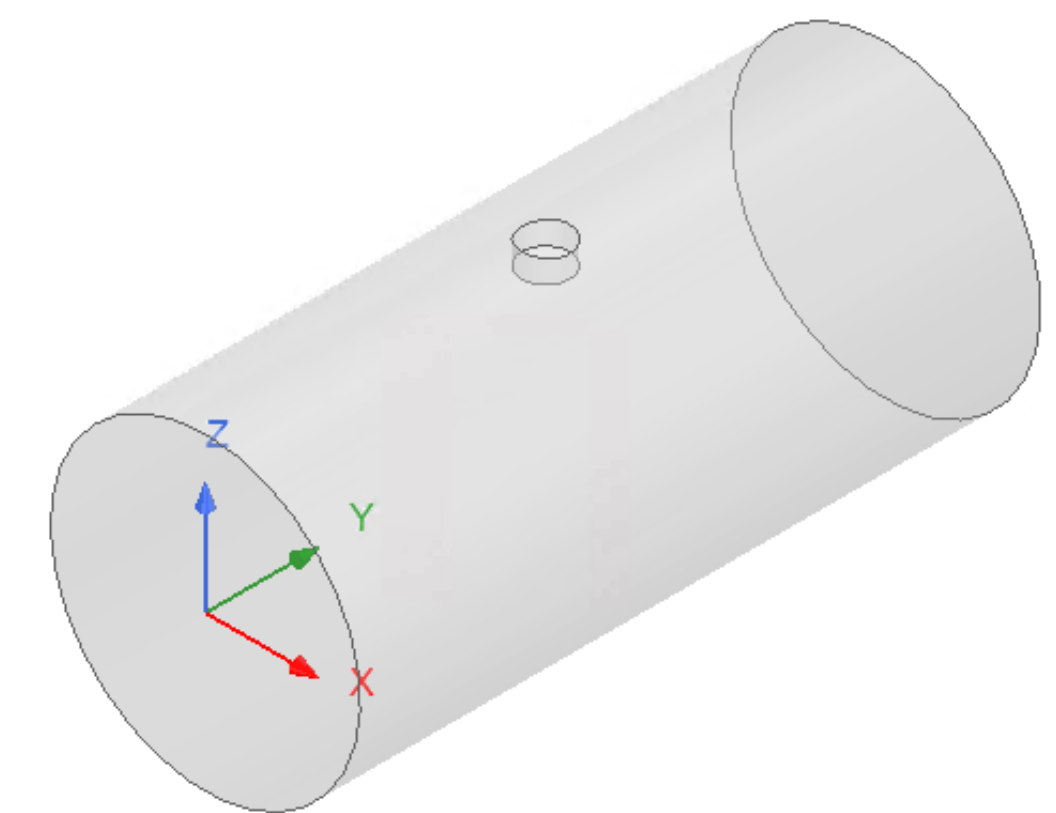


## Mode Chart

Waveguide modes describe the field pattern characteristic under the particular waveguide structure. It analyzes the transverse hybrid modes, either TE or TM, to determine the widest range of dimensions that meets the user's desired operating bands. Through the mode chart analysis, users will quickly retrieve the correct waveguide dimension to obtain the widest "clean" frequency window.

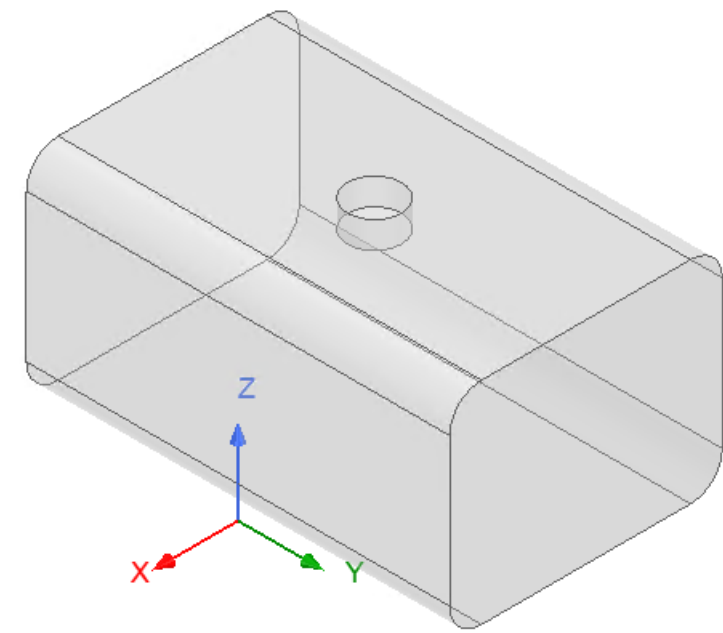


Rectangular Waveguide

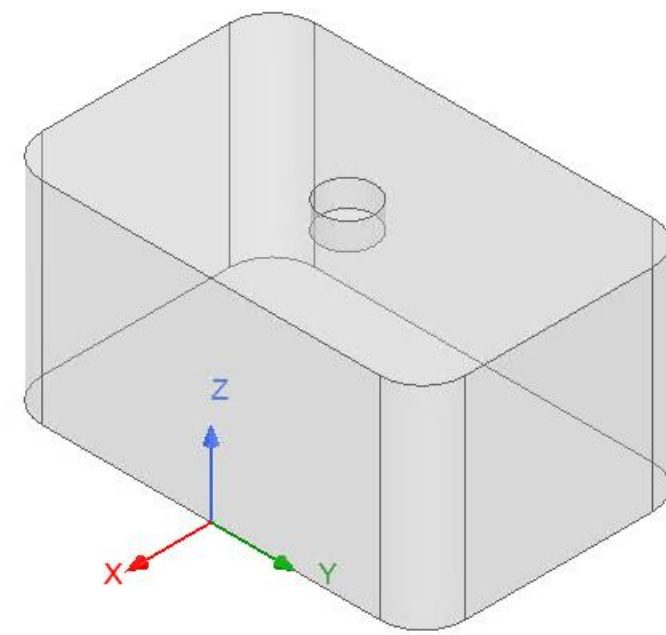


Cylinder Waveguide

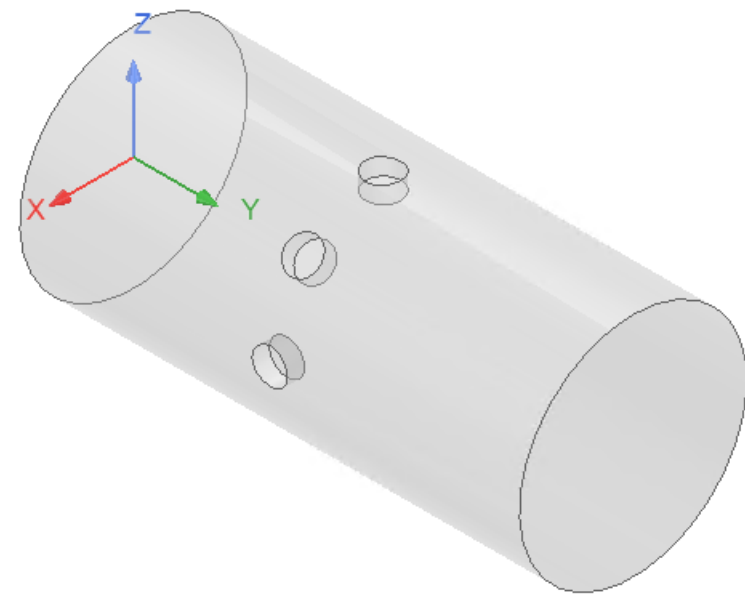
# 3D Modeling Function—Single Cavity Analysis



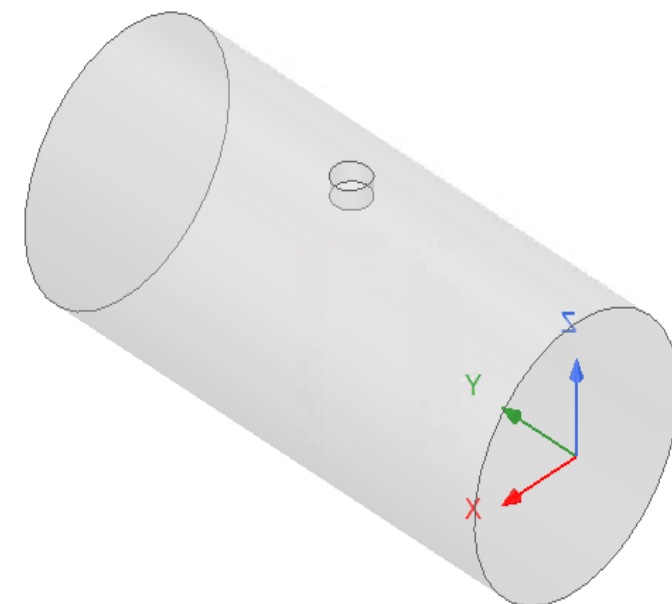
Rectangular WG—Type1



Rectangular WG—Type2



Cylinder WG



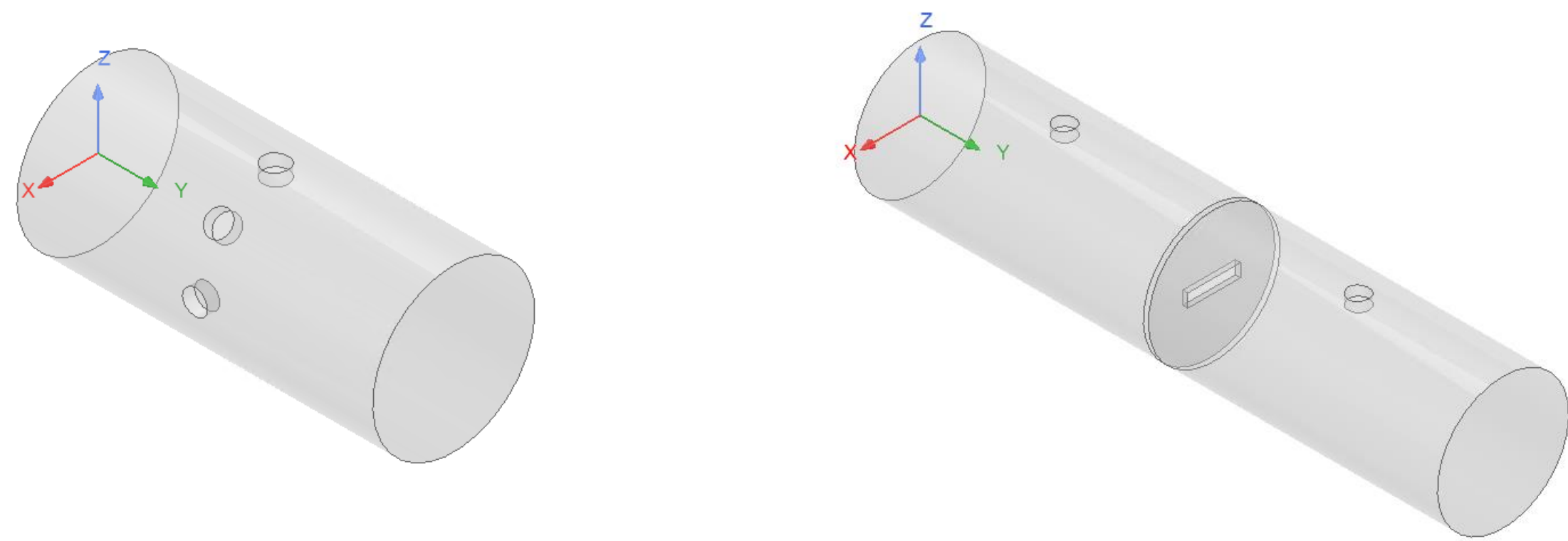
## Key Features

- ✓ Different resonator types are available used for rectangular and cylindrical waveguides
- ✓ Mode chart analysis and system-aided 'best dimension' recommendation
- ✓ Thermal drift analysis based on user-defined parameters
- ✓ Easy HFSS simulation setup including mesh refinement
- ✓ Parametric study using key variables

# 3D Modeling Function—Adjacent Coupling Analysis

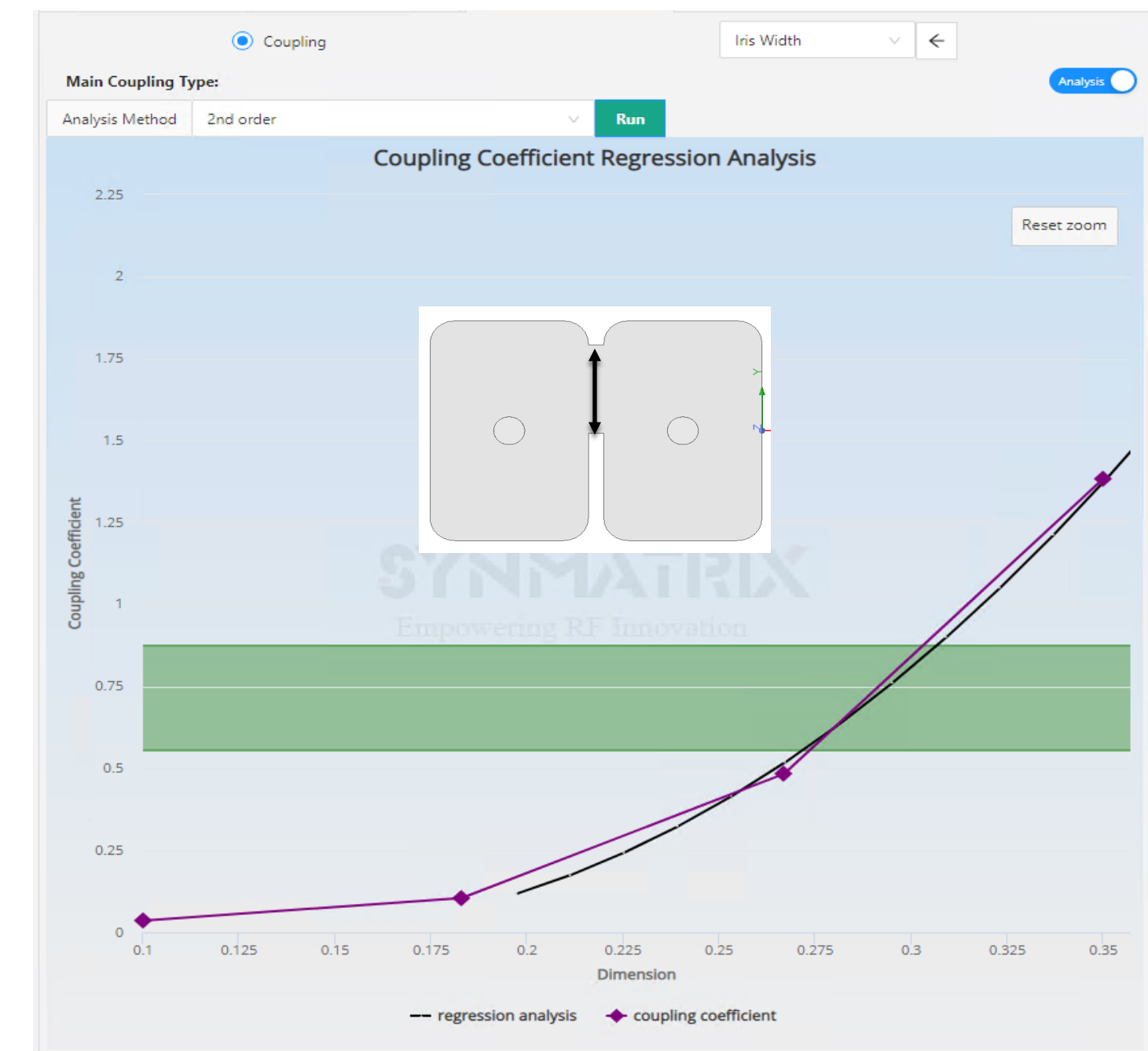


Rectangular waveguide coupling schemes

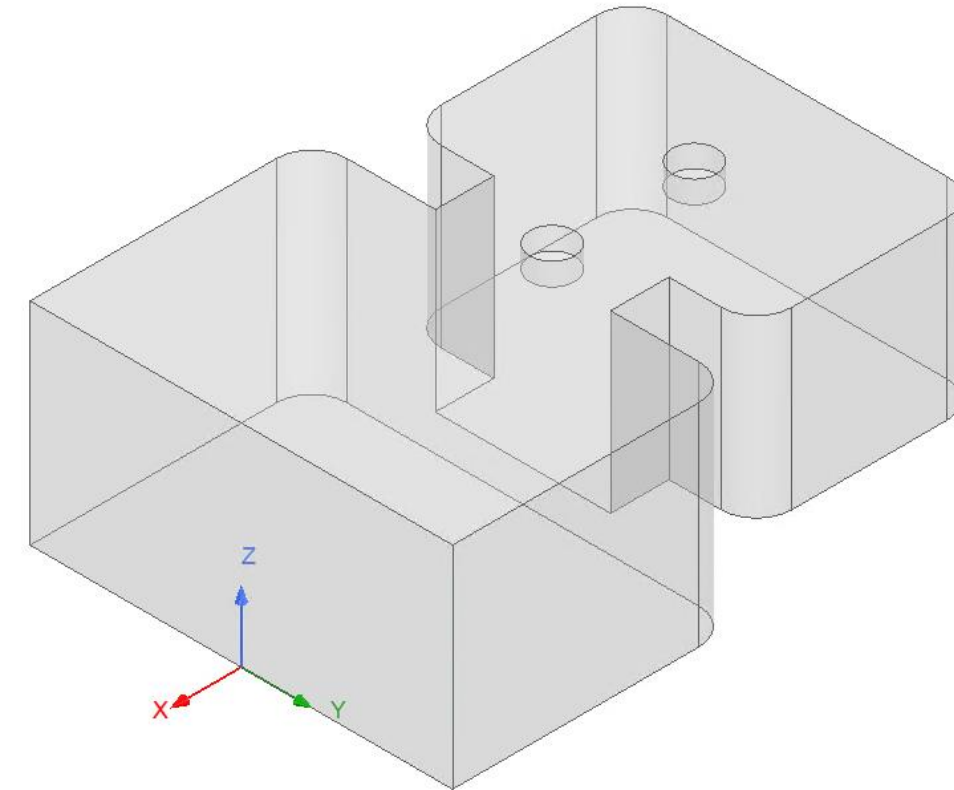
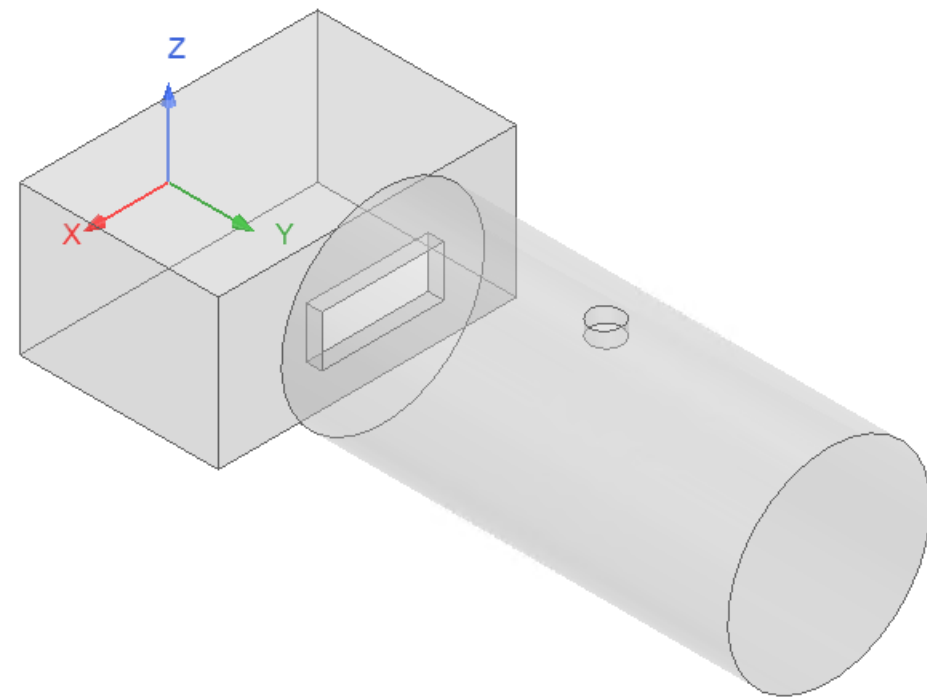


Cylinder waveguide coupling schemes

- ✓ Flexible coupling schemes definition allow users to customize the coupling structure
- ✓ Parametric study to analyze the coupling coefficient
- ✓ Regression analysis to obtain the coupling dimension value



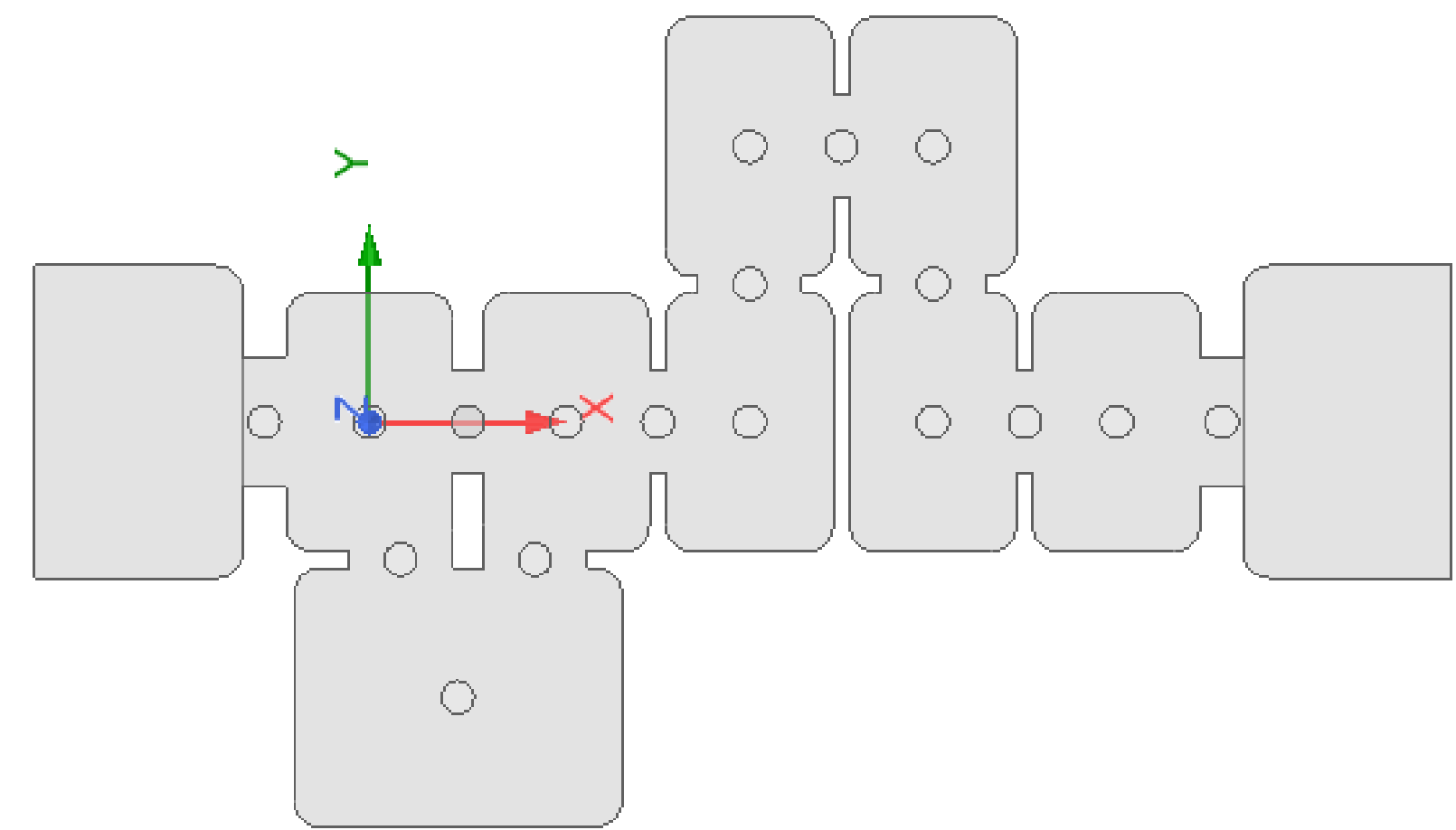
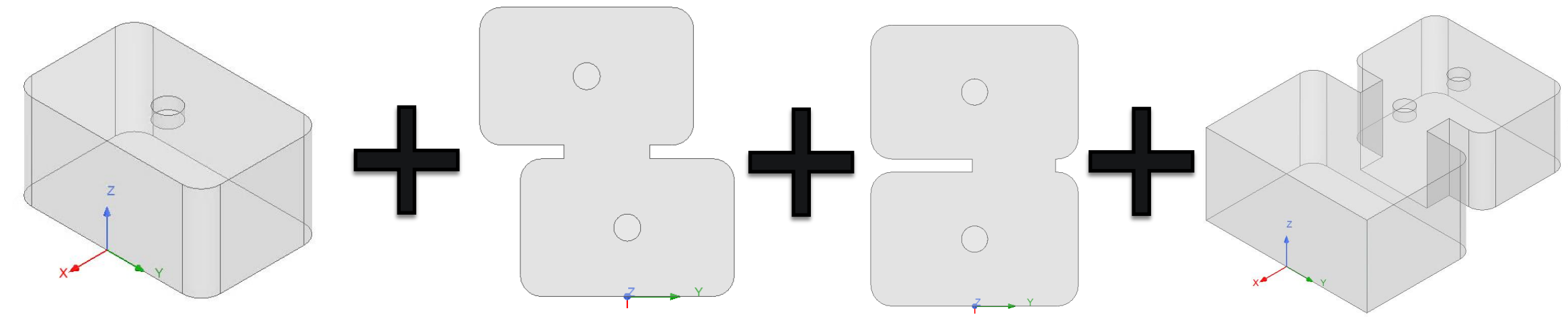
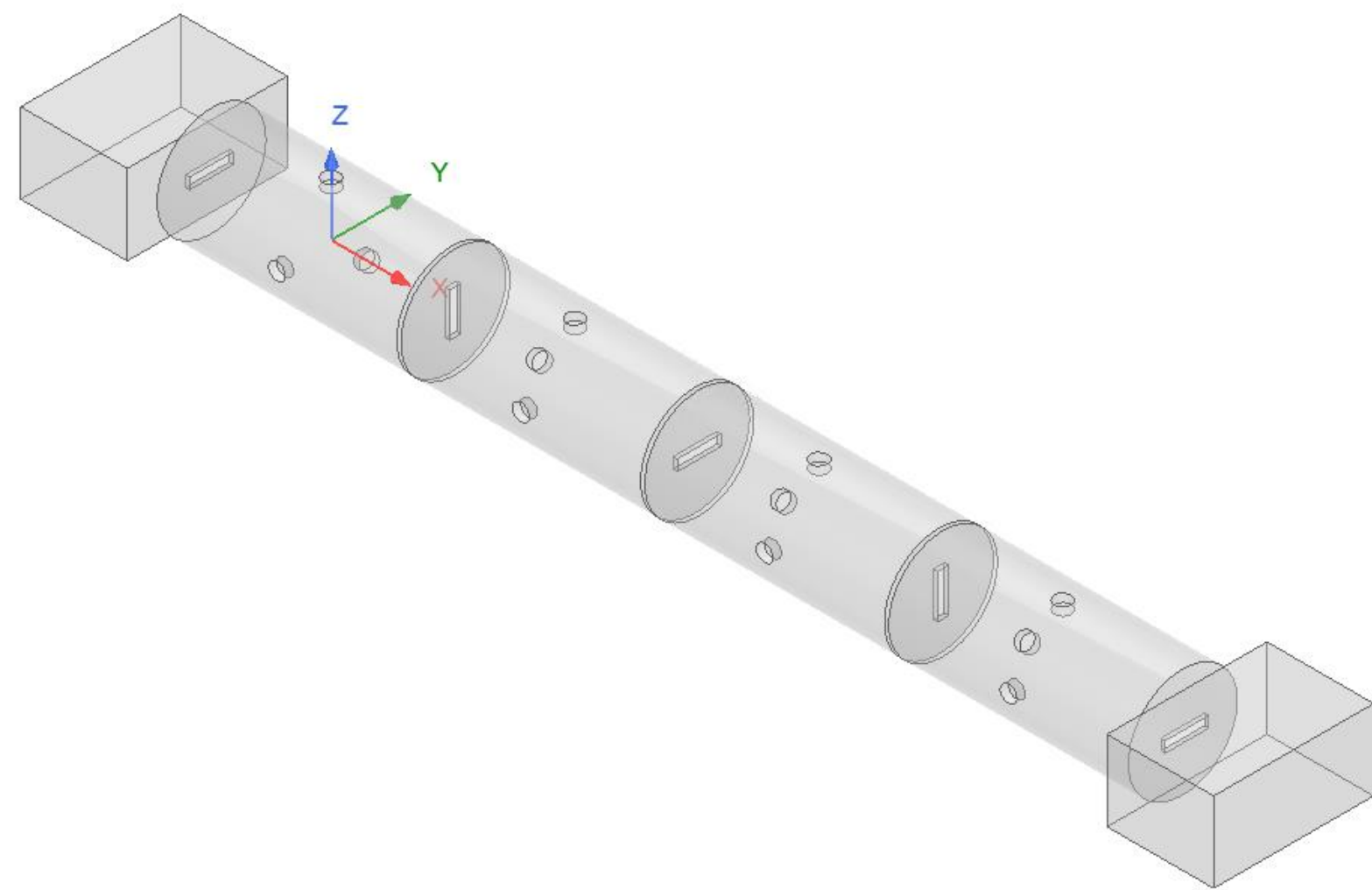
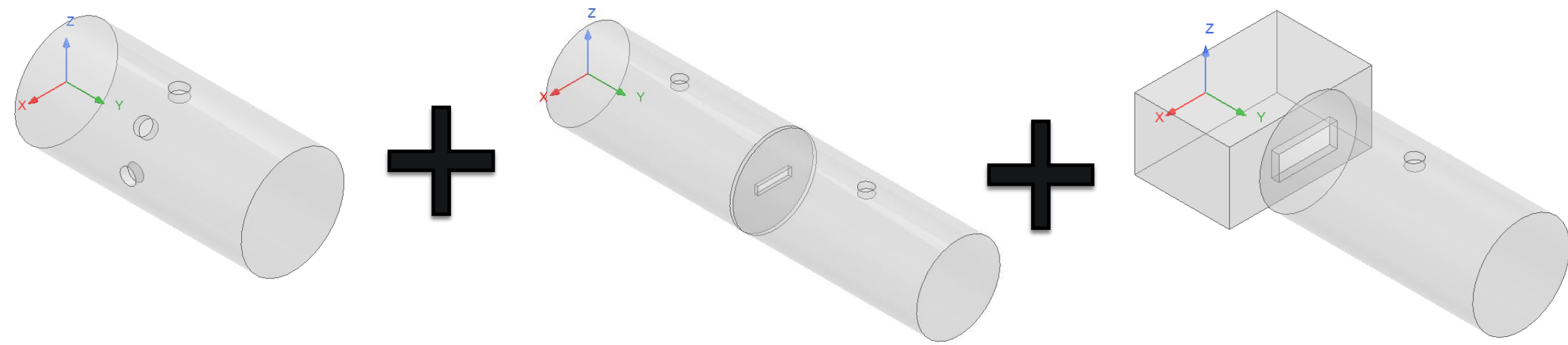
# 3D Modeling Function—Input/Output Analysis



- ✓ Group delay method to analyze the input and output performance
- ✓ Customize the port interface by selecting different waveguide sizes
- ✓ Parametrized modeling allow users to modify the structures manually
- ✓ Parametric study analysis for key variables

I/O structure for rectangular and cylinder waveguides

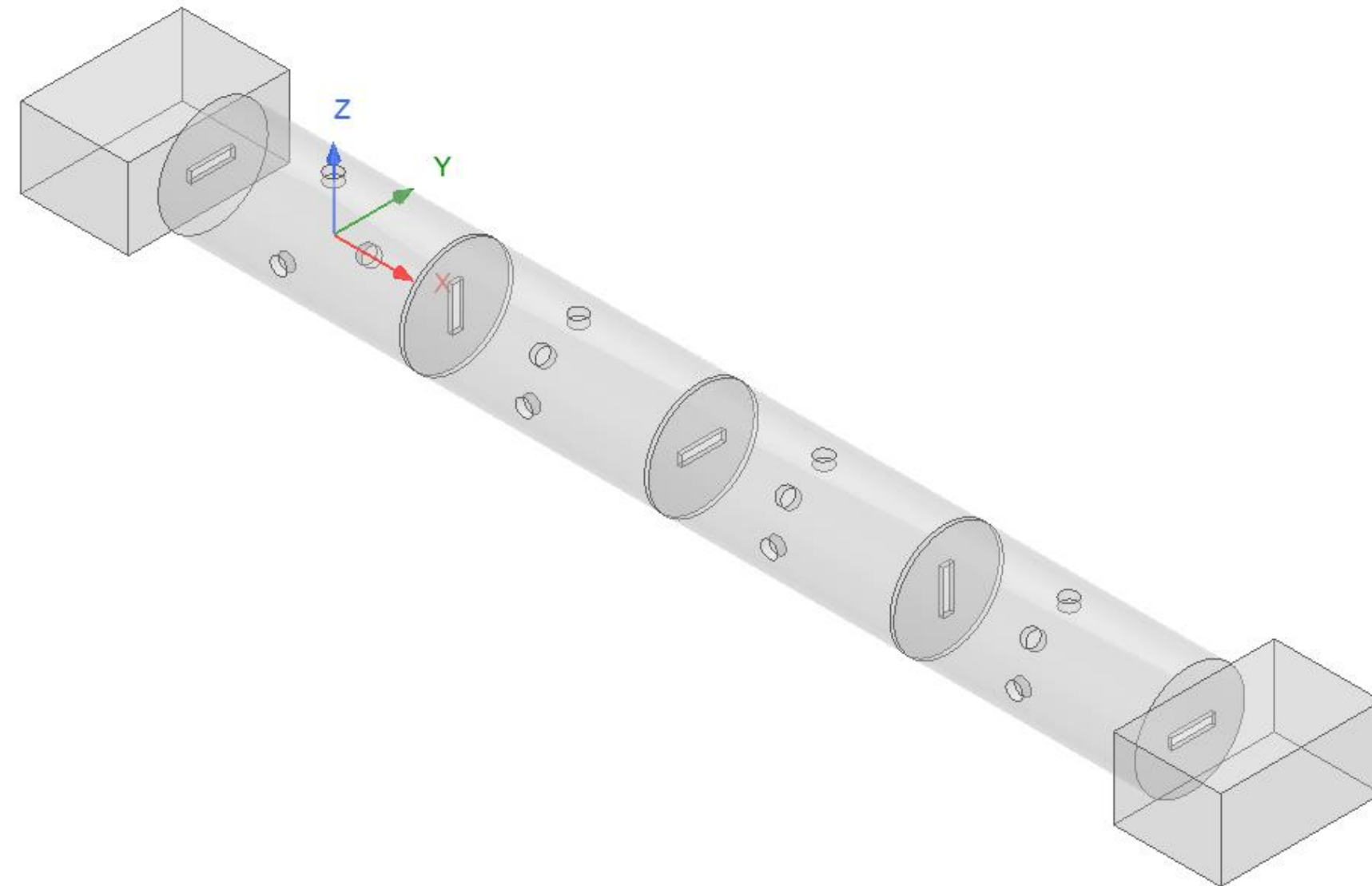
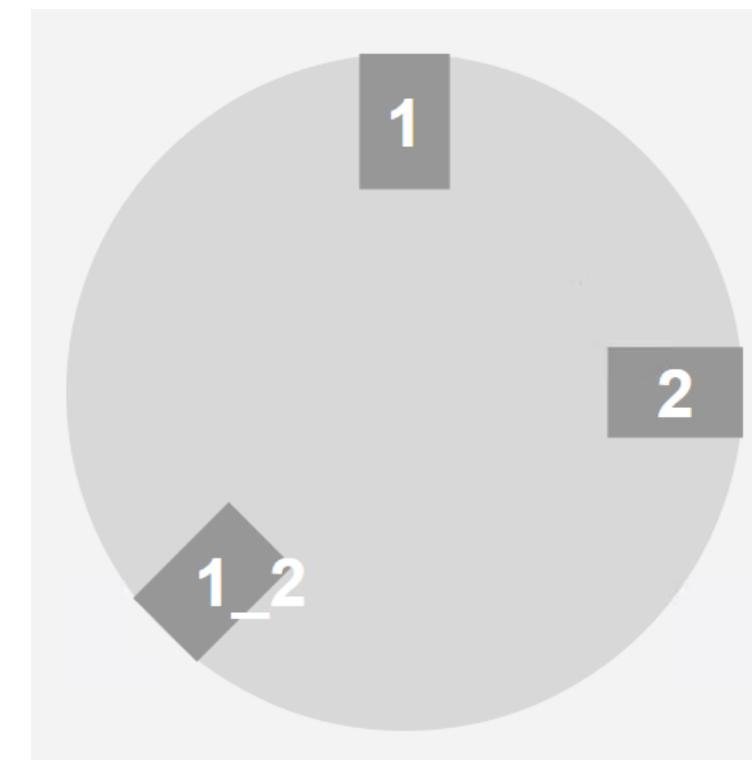
# 3D Modeling Function—Full 3D Layout Design



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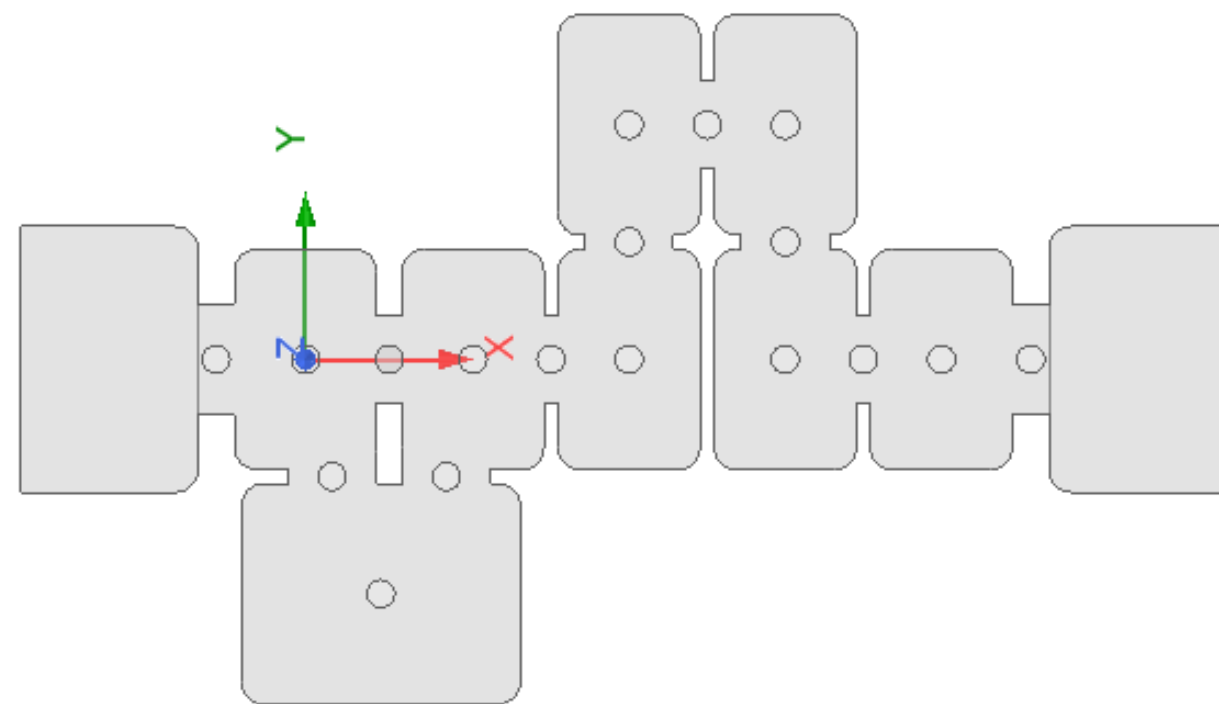
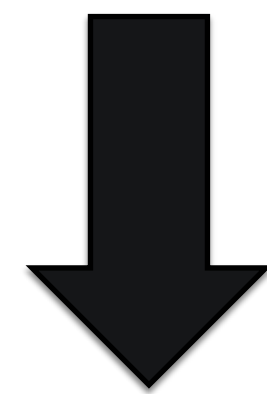
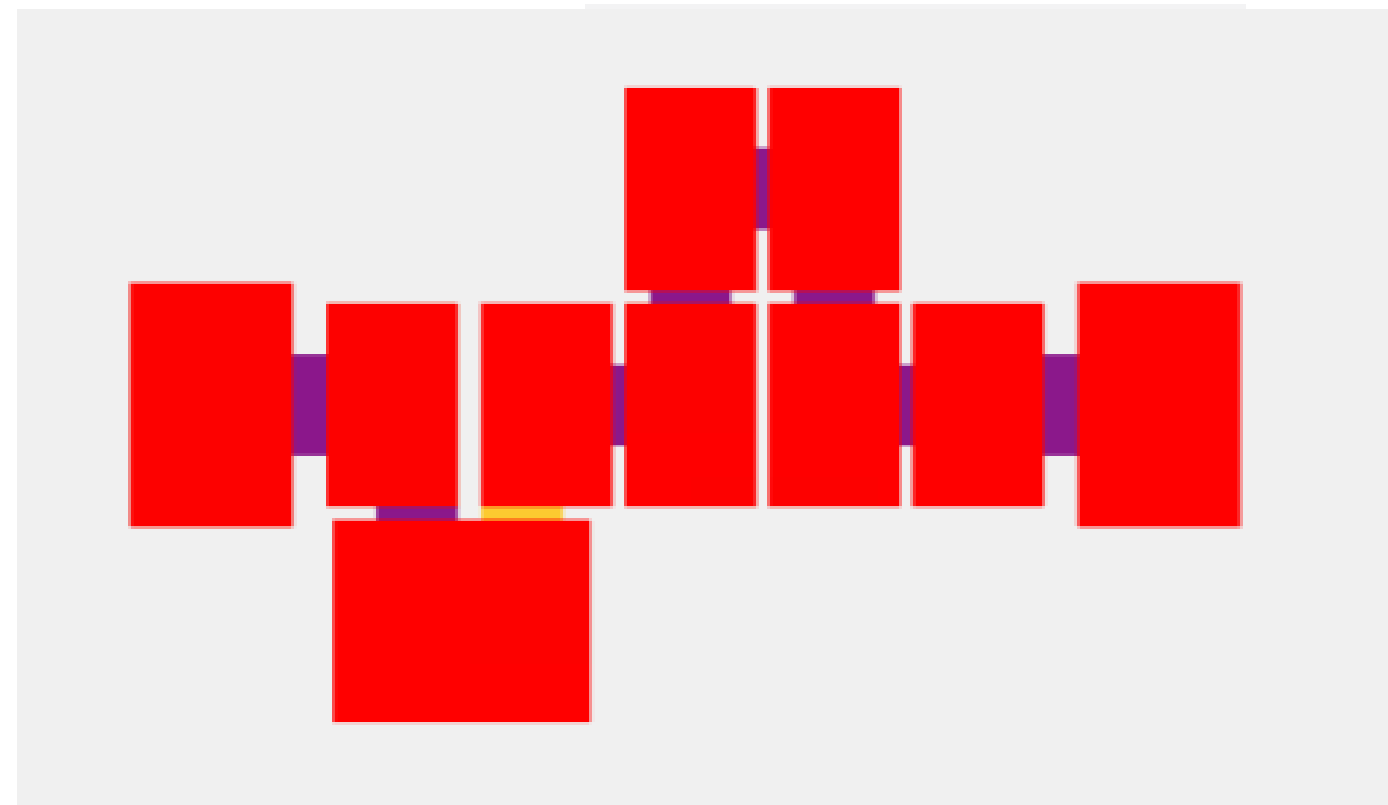


Flexible & customizable layout design tool

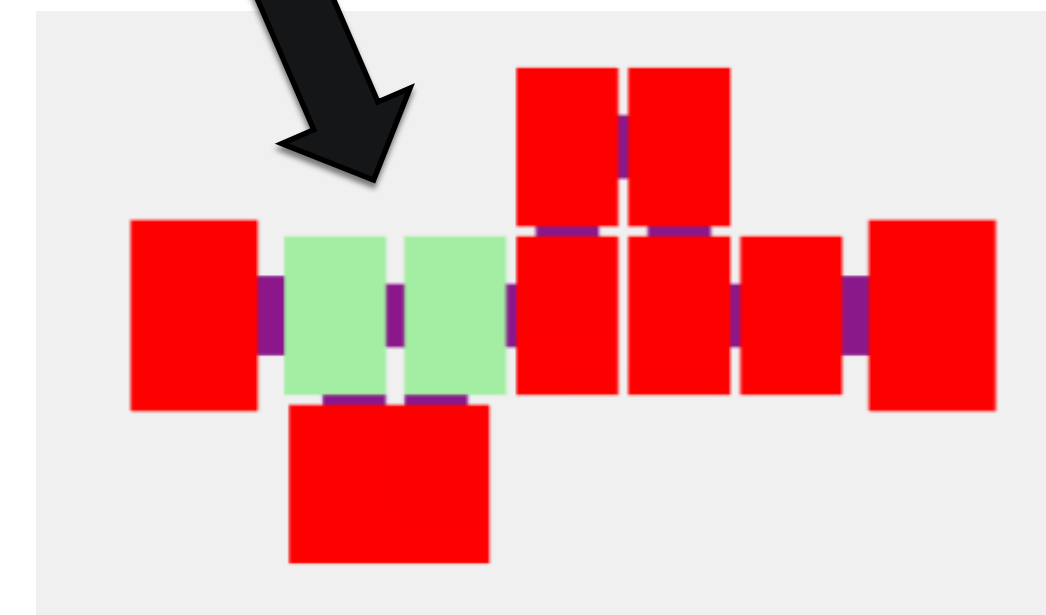


- ✓ Uniform & non-uniform cavity size definition
- ✓ Fully customized tuning screw position definition
- ✓ Coupling slot rotation definition
- ✓ Add Transmission zero slots and customize them

# 3D Modeling Function—Full 3D Layout Design



Flexible & customizable layout design tool



- ✓ Uniform & non-uniform cavity size definition
- ✓ Add Transmission zero irises and customize them
- ✓ Easily drag and rotate the layout design in the GUI interface
- ✓ Seamless HFSS data transfer with automatic 3D modelling completed in seconds

# Contact

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