



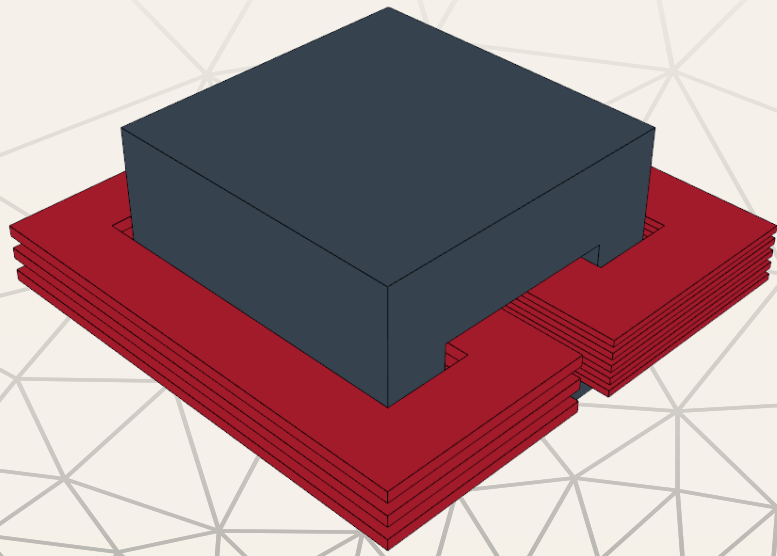
MAGNETISiM

Annual Meeting 2026

PLANNING

Part 1: 45mnt + Break

Part 2: 45mnt + 30mnt



1 MAGNETI... what?

Why, What and Inside MAGNETISiM

2 First Steps

Quick start guide

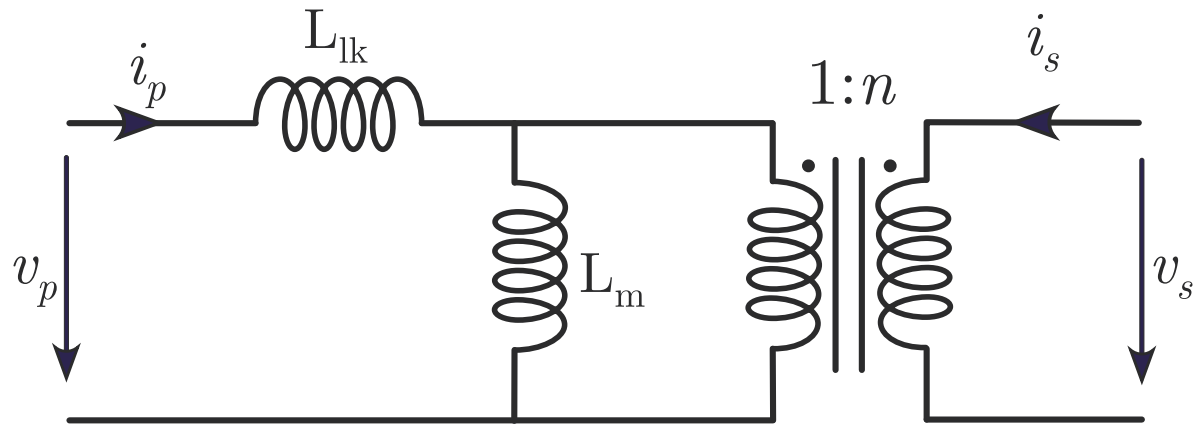
3 Use-Case

Testing with a real project

4 And That's a Wrap

MAGNETI... what?

- Why MAGNETISiM?
- What's MAGNETISiM?
- Inside MAGNETISiM



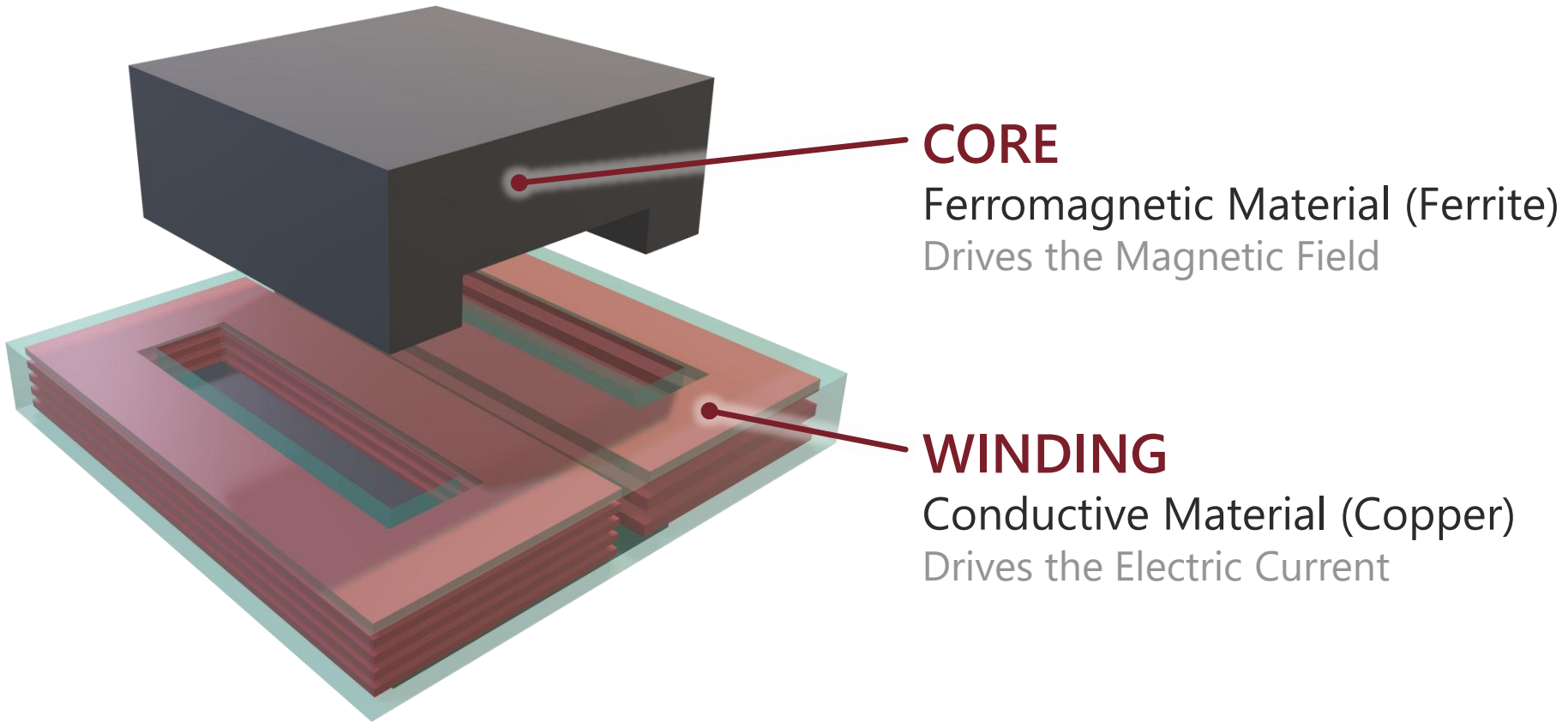
$$\begin{bmatrix} v_p \\ v_s \end{bmatrix} = \begin{bmatrix} Z_{pp} & Z_{sp} \\ Z_{sp} & Z_{ss} \end{bmatrix} \cdot \begin{bmatrix} i_p \\ i_s \end{bmatrix}$$

Component's ID

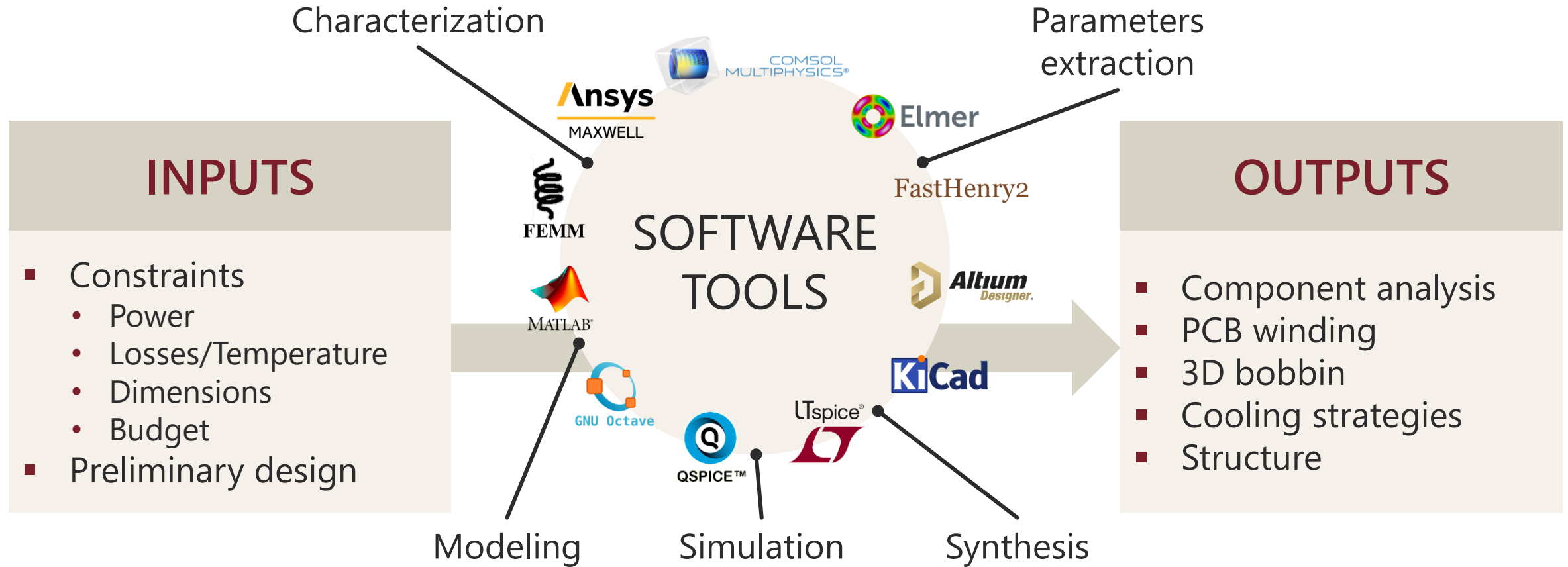
Transformer Pérez
MAGNETIC COMPONENT

Working @ CEIMM-UPM
Power Electronics Group
Mail: t.perez@upm.es

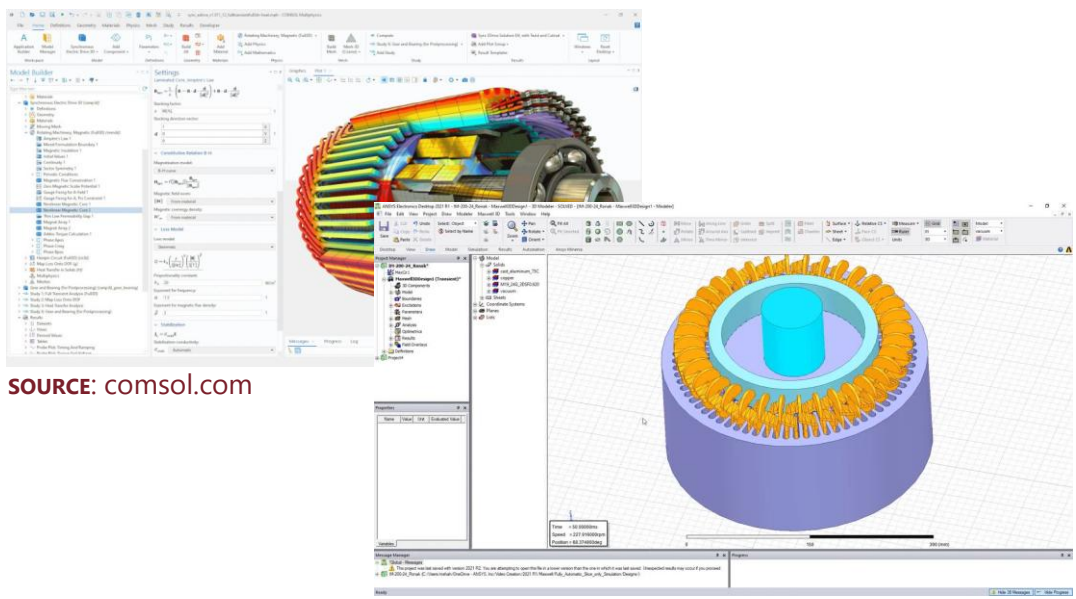
Some Context (II)



Magnetic Components Design Process



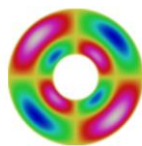
Why MAGNETISiM?



SOURCE: comsol.com

SOURCE: ansys.com

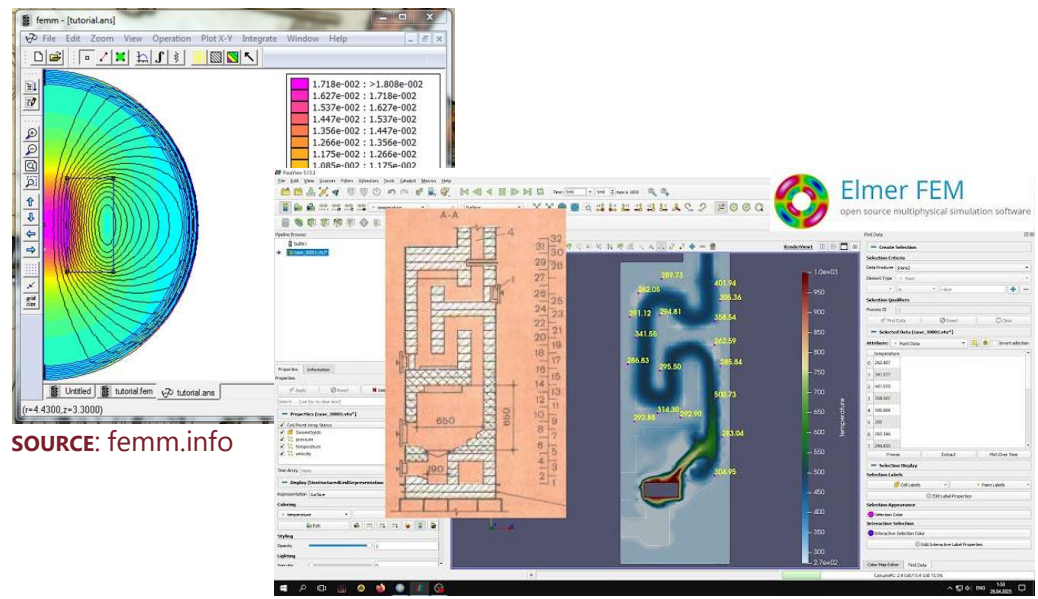
- ✗ License required
- ✓ Very powerful
- ✓ Moderate difficulty level



Elmer FEM
open source multiphysical simulation software



Finite Element
Method Magnetism

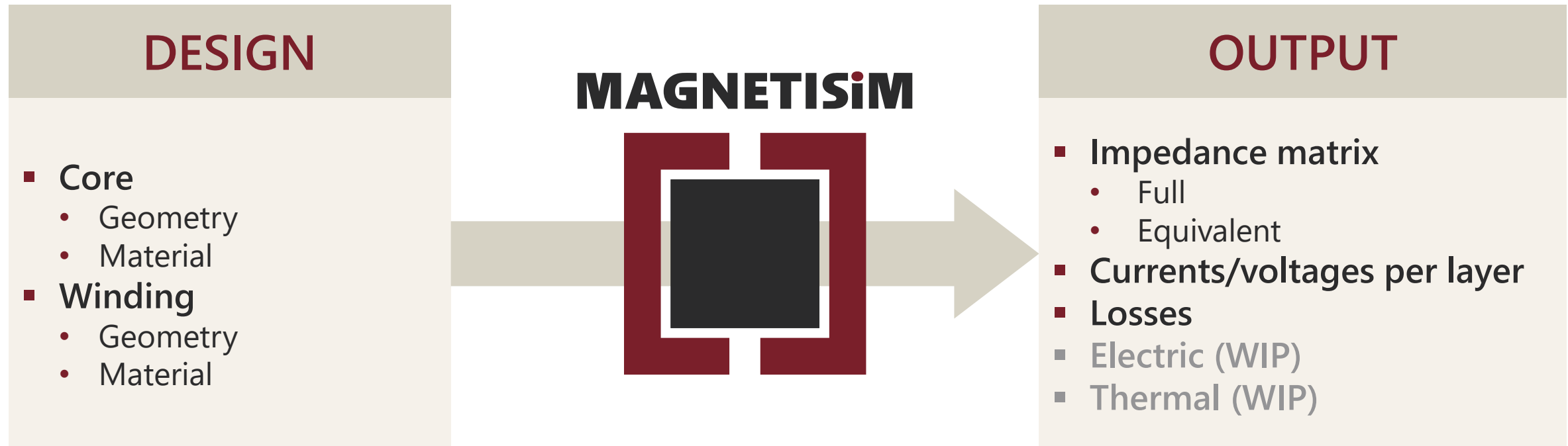


SOURCE: femm.info

SOURCE: Danial Iskhakov (YouTube)

- ✓ Free
- ✓ Powerful
- ✗ Difficult to use

What's MAGNETISiM?



MAGNETISM

Invisible physical force produced by moving electric charges or spinning electrons within a material, resulting in the attraction or repulsion of objects.

SOURCE: National Geographic

SiMULATION

Imitative representation of a real-world system, process, or object over time, often conducted using computers or mathematical models to predict behavior, analyze performance, or train users.

SOURCE: Ansys

MAGNETISiM

SPICESiM

CAPACITISiM

EXPERTISiM

PCBSiM

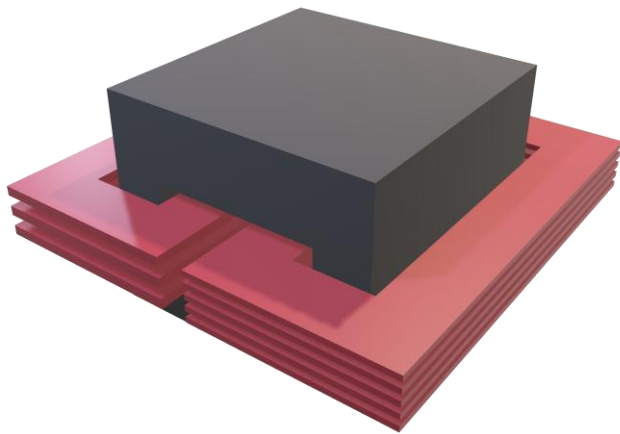
MAGNETISiM

SPICESiM

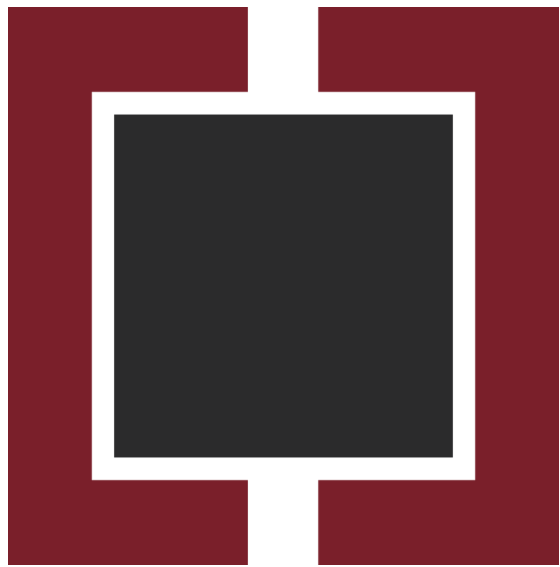
CAPACITISiM

EXPERTISiM

PCBSiM



MAGNETISiM



SPICESiM

CAPACITISiM

EXPERTISiM

PCBSiM

Core Configuration

Core Geometry

Manufacturer: Ferroxcube

Geometry Core: EQ

Core Reference: EQ13

A [mm]: 12.8

B [mm]: 9.05

Bp [mm]: 11.2

C [mm]: 5.0

Cp [mm]: 0

D [mm]: 2.85

E [mm]: 1.75

F [mm]: 8.7

Gap [mm]: 0

Core Material

Material: 3C91

Magnet Power Loss Electrical Thermal

Real Permeability: 3000

Imag Permeability: 0

Conductivity: 0.3333333333333333

Permeability(f) from Internal-Database

Winding Configuration

General Winding

Conductor Type: PCB

PCB/Bobbin Geometry

Left Center Right

Clearance XY [mm]: 0

Clearance Z [mm]: 0

Number of Layers: 0

Layer Pitch [mm]: 0

Winding Geometry

Left Center Right

Nturns: 0

Copper Thickness [mm]: 0

Width of Copper [mm]: 0

Pitch [mm]: 0

Edge [mm]: 0

Winding Material

Material: Copper

Magnet Electrical Thermal

Real Permeability: 1

Imag Permeability: 0

Conductivity: 58

Simulation Configuration

General Convergence Nominal Solver AC Sweep

Name Simulation: MAGNETISiM_file

Magnetic Field Simulation

Electric Field Simulation

Thermal Simulation

General Convergence Nominal Solver AC Sweep

Magnetic Field Simulation

Max Error [%]: 1e-08

Electric Field Simulation

Max Error [%]: 1e-05

Max Number of Passes: 1

General Convergence Nominal Solver AC Sweep

Select AC Sweep Type: Frequency Range

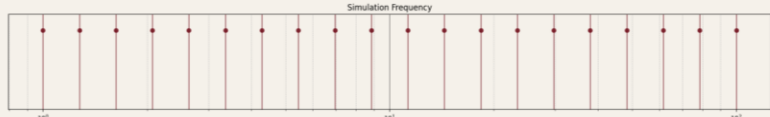
Sim Sweep Type: Logarithmic

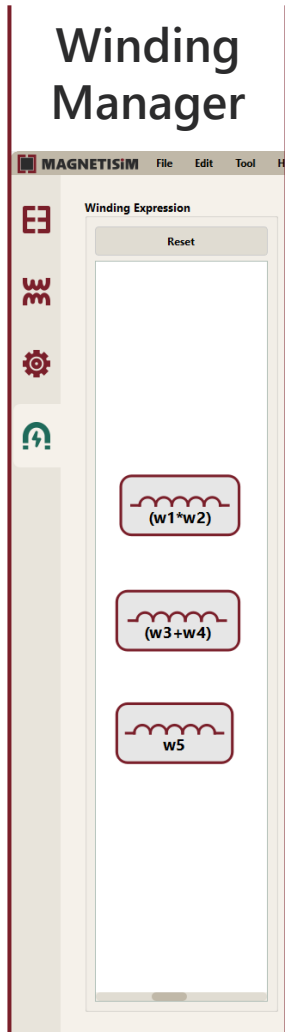
Min Frequency [kHz]: 1

Max Frequency [kHz]: 100

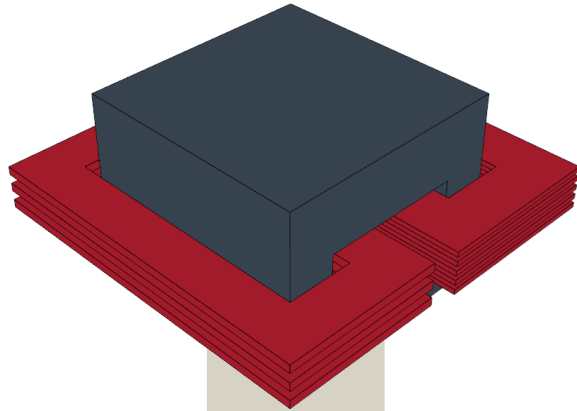
Number of Points: 20

Frequency/Waveform Plot: Simulation Frequency

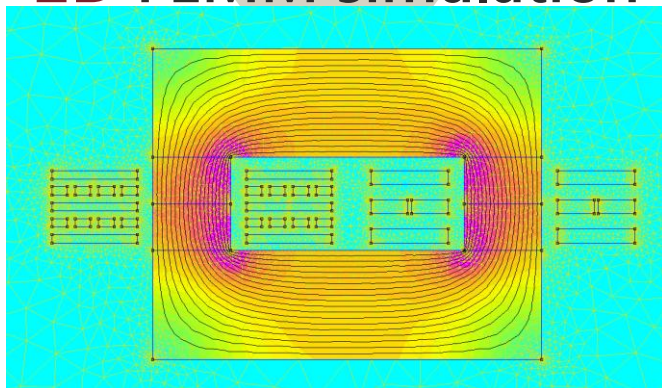




3D model



2D FEMM simulation



2D vs 3D simulations

- ✓ Faster
- ✓ Less resources
- ✗ But... not really the same model



Solution

- STEP 1 – Categorize cores
- STEP 2 – Include adjustments

Transparent
for the user!!!

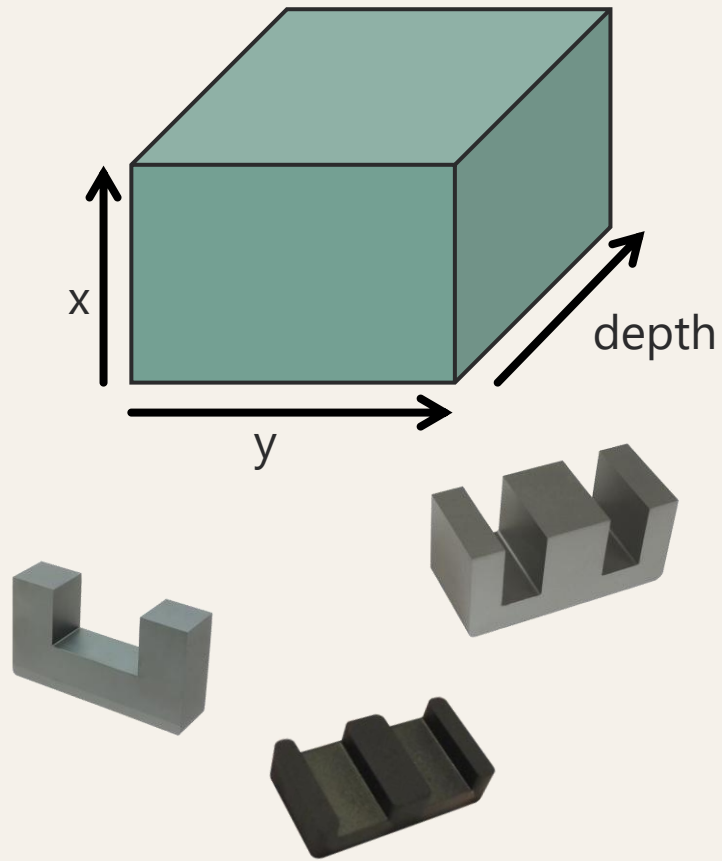
Adjusted 2D vs 3D simulations

- ✓ Faster
- ✓ Less resources
- ✓ Reliable results



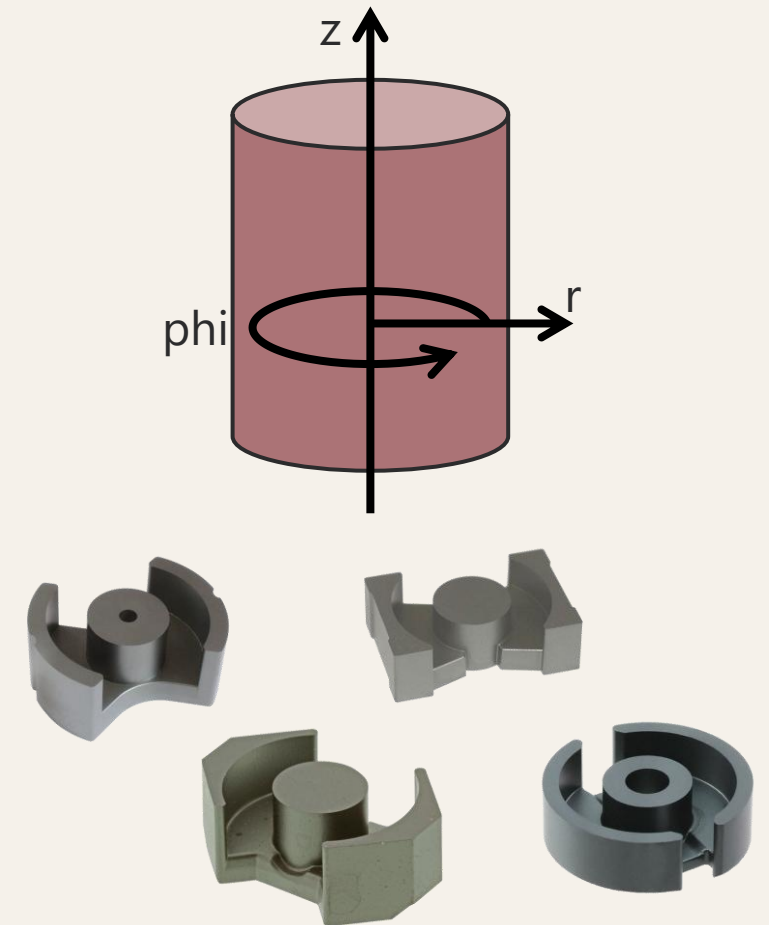
XY CORES

- AIRXY
- IPTXY
- E
- EI
- EPlanar
- EIPlanar
- EL
- ELT
- EC
- U
- UI



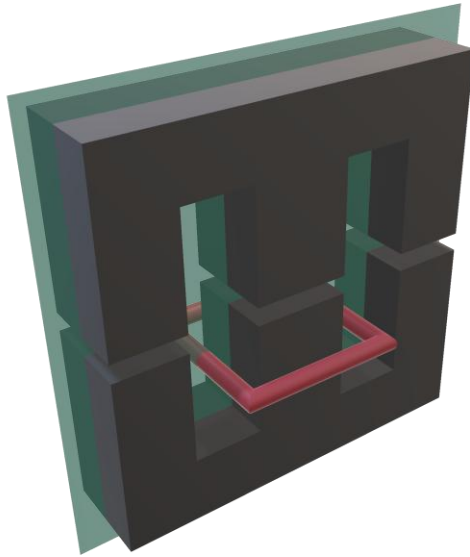
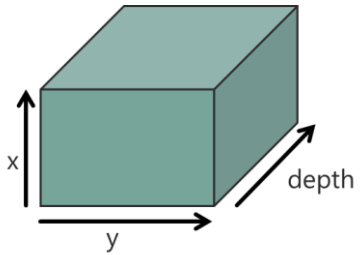
RZ CORES

- AIRRZ
- IPTRZ
- EQ
- EQPLT
- PQ
- PQI
- P
- PT
- PH
- PM
- RM
- ER
- ERPlanar
- EIRPlanar
- ETD



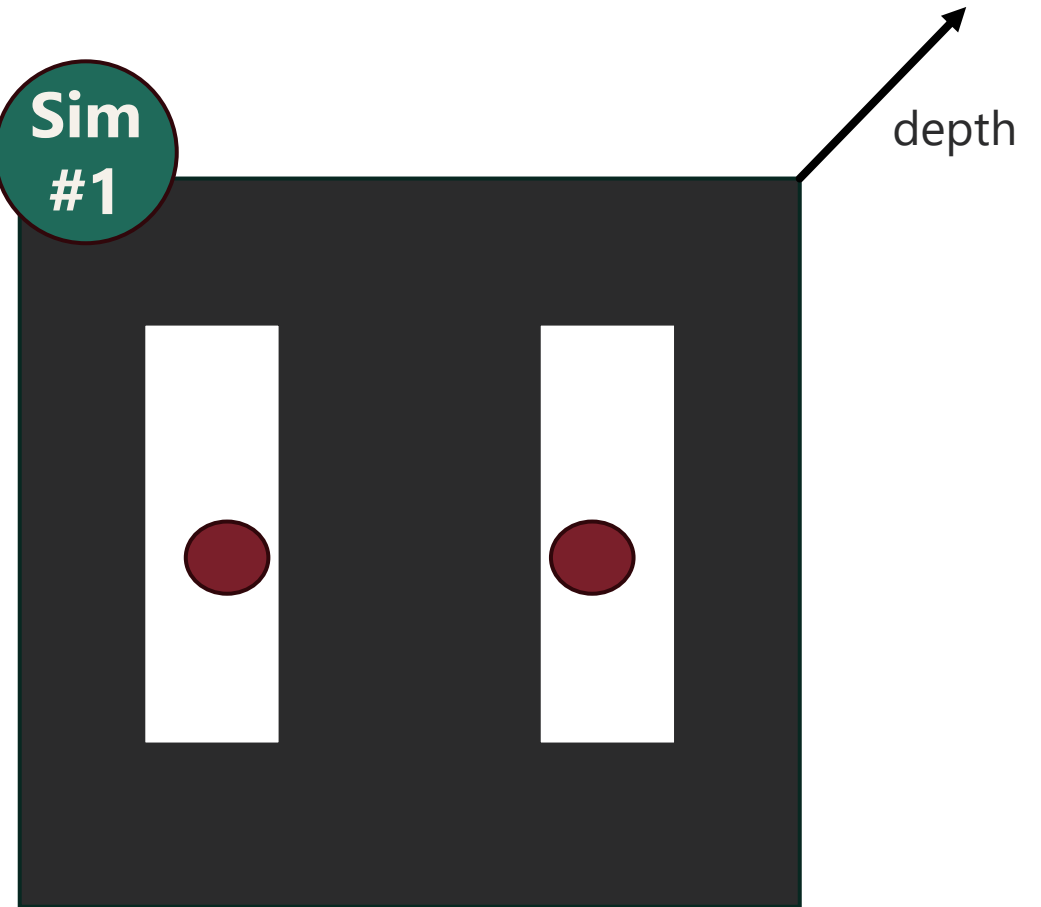
SOURCES: Ferroxcube Catalog

XY CORES

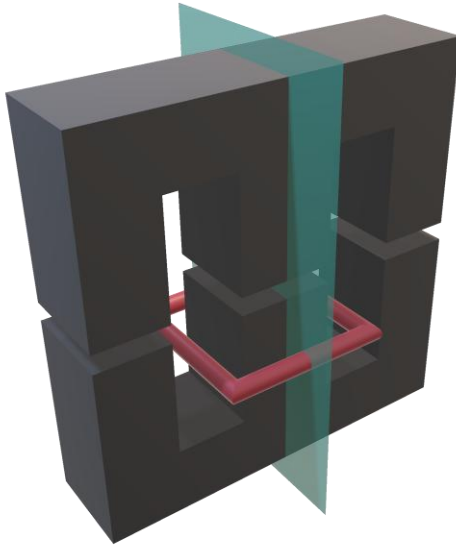
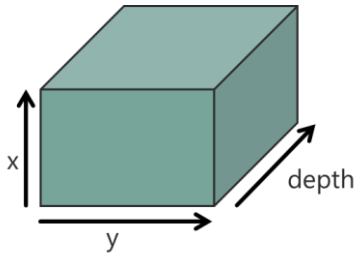


- AIRXY
- IPTXY
- E
- EI
- EPlanar
- EIPlanar
- EL
- ELT
- EC
- U
- UI

Sim
#1

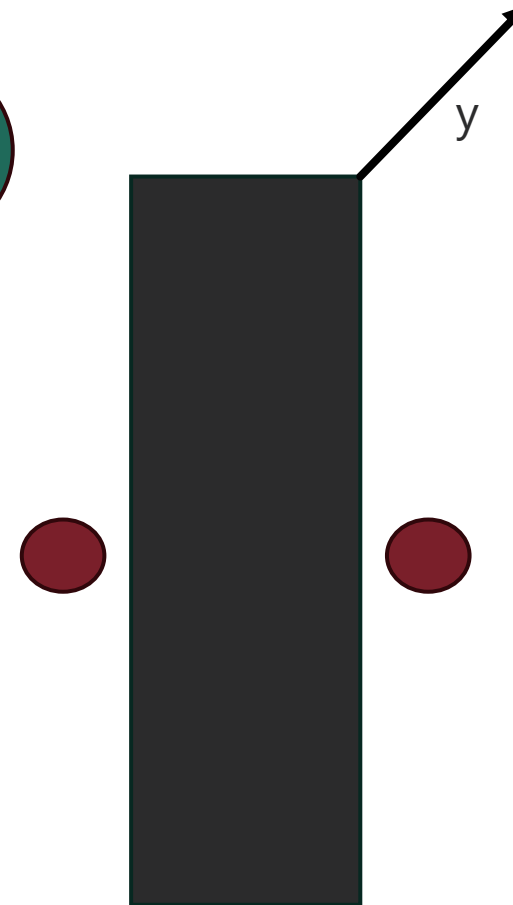


XY CORES

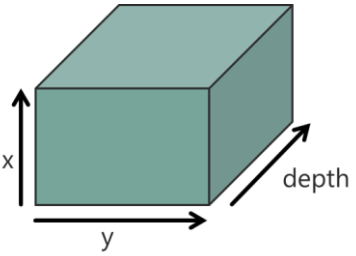


- AIRXY
- IPTXY
- E
- EI
- EPlanar
- EIPlanar
- EL
- ELT
- EC
- U
- UI

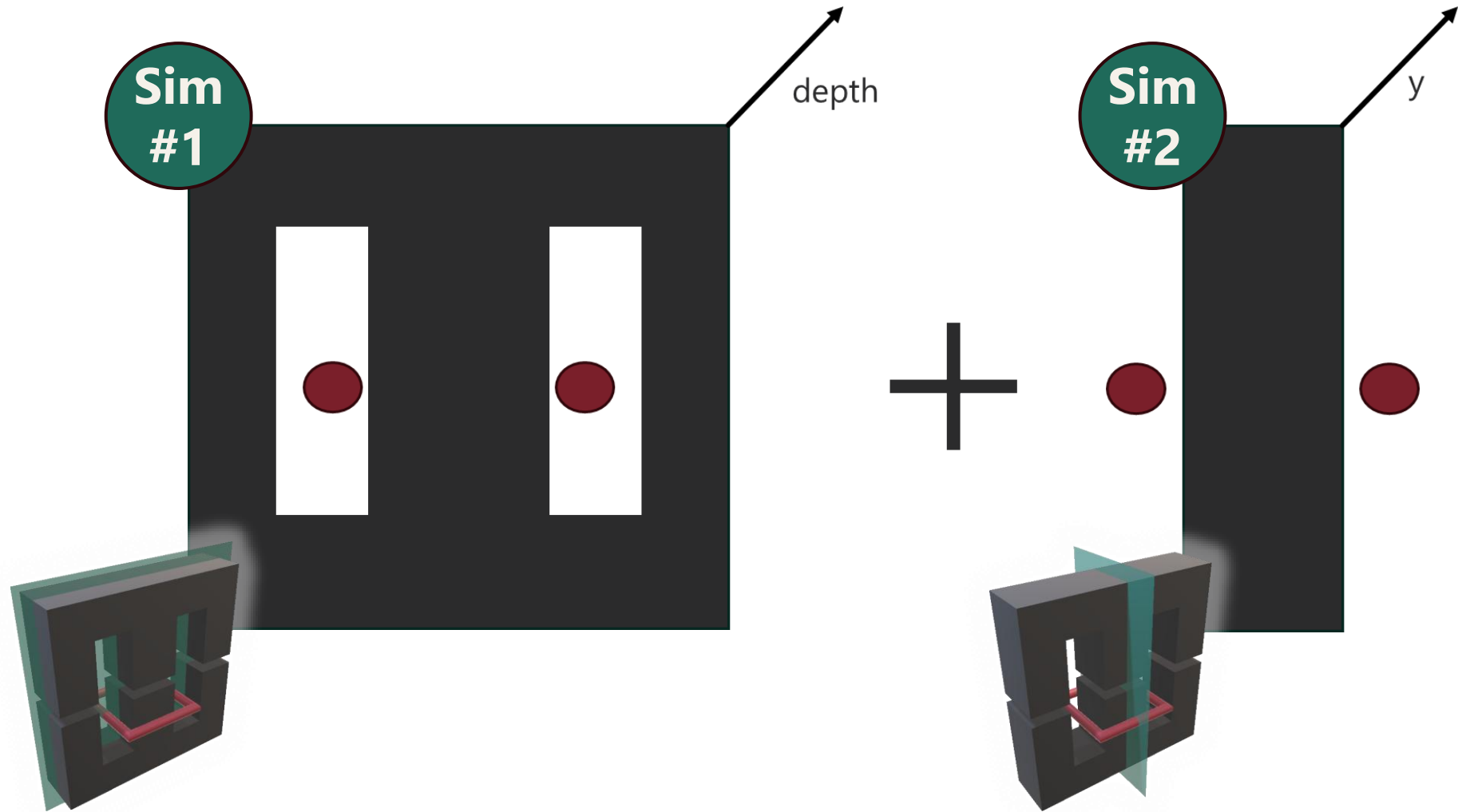
Sim
#2



XY CORES



- AIRXY
- IPTXY
- E
- EI
- EPlanar
- EIPlanar
- EL
- ELT
- EC
- U
- UI



Inside MAGNETISiM

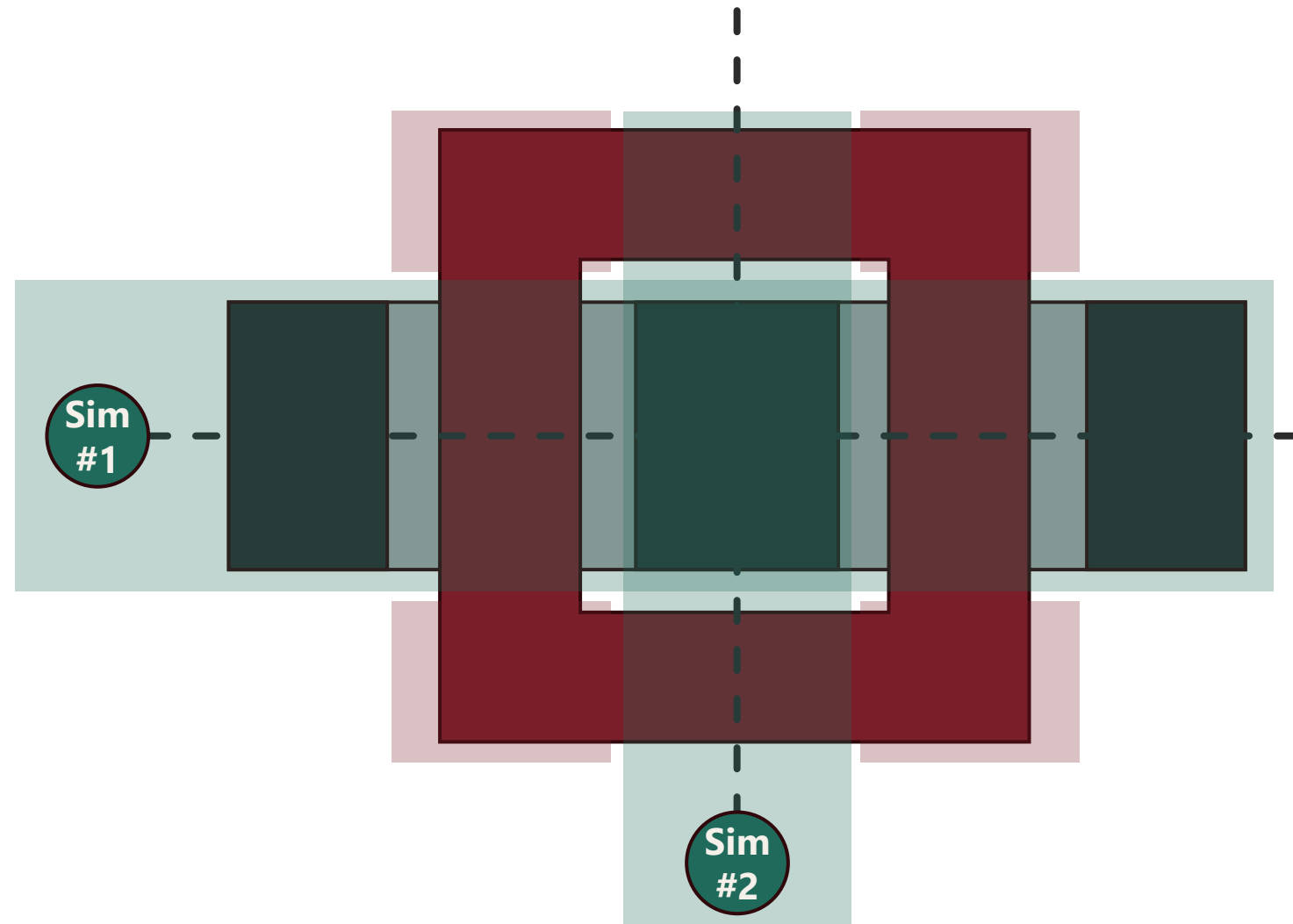
XY Core Modeling

Simulated regions

Not-simulated regions

- Small errors in resistance
- Negligible errors in energy

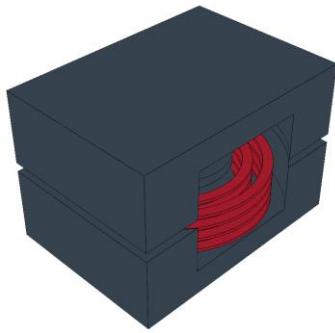
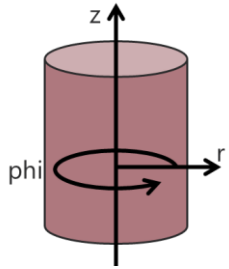
Good general results
(as we will see later on)



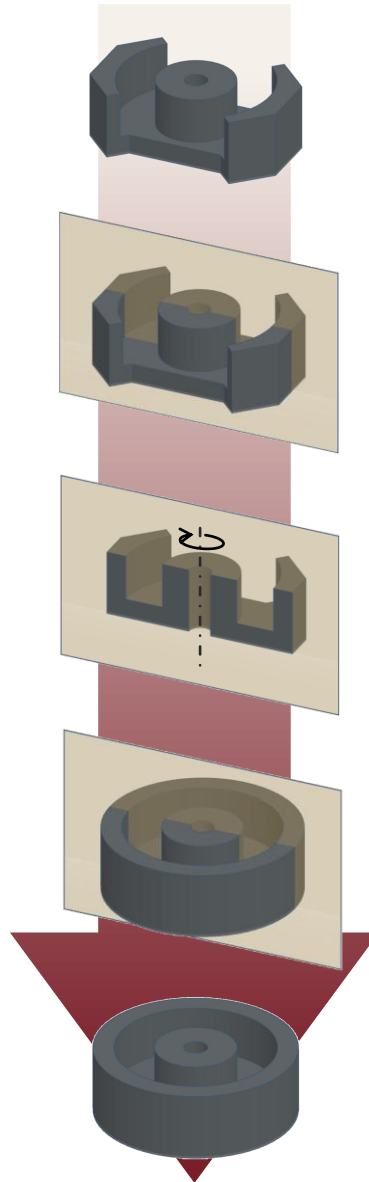
Inside MAGNETISiM

RZ Core Modeling

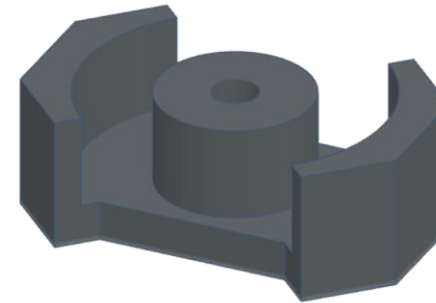
RZ CORES



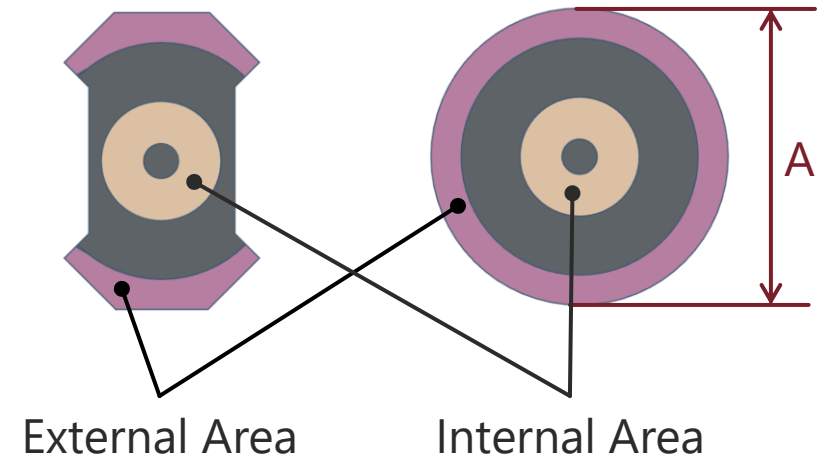
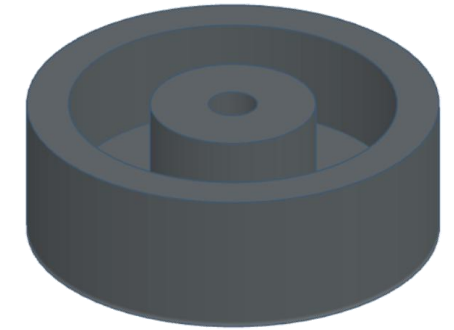
- AIRRZ
- IPTRZ
- EQ + EQPLT
- PQ + PQI
- P
- PT
- PH
- PM
- RM
- ER
- ERPlanar
- EIRPlanar
- ETD



Real Geometry

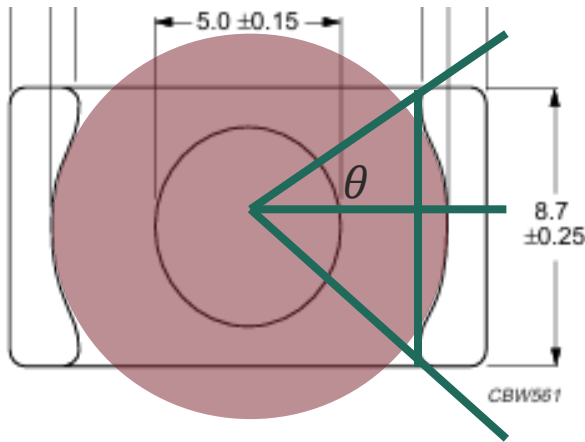
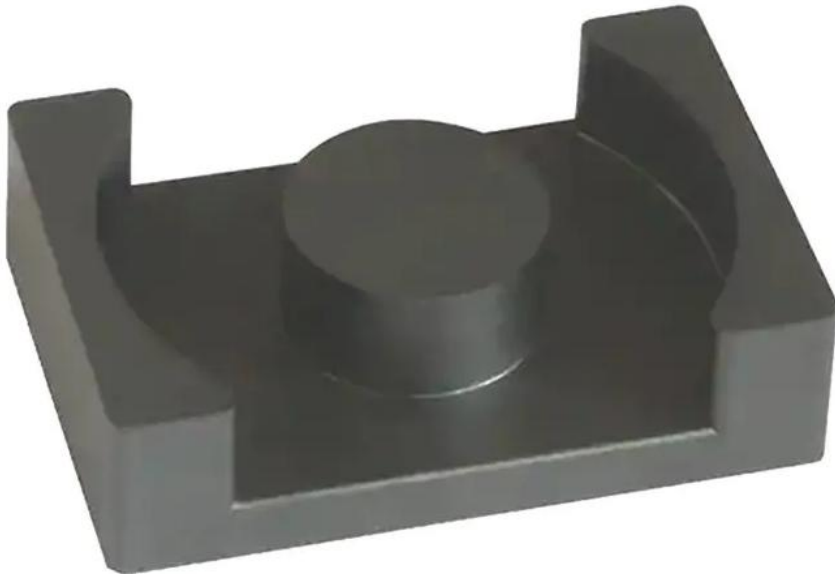


Simulated geometry



Inside MAGNETISiM

RZ Core Modeling



$$(A^2 - B_p^2) \frac{\pi}{4} = 2 (A_{\text{square}} - (A_{\text{cheese}} - 2A_{\text{triangle}}))$$

$$\cos\theta = \frac{B}{B_p} \rightarrow A_{\text{cheese}} = \frac{B_p^2}{4} \pi \cdot \frac{\arccos\left(\frac{B}{B_p}\right)}{2\pi} * 2 = \frac{B_p^2}{4} \arccos\left(\frac{B}{B_p}\right)$$

$$A_{\text{triangle}} = \frac{B}{2} \cdot \frac{F}{2} \quad A_{\text{square}} = F \cdot \frac{B - A}{2}$$

Planar and PCB



Round



Litz



Round Wizard

Round Conductor Configuration Wizard

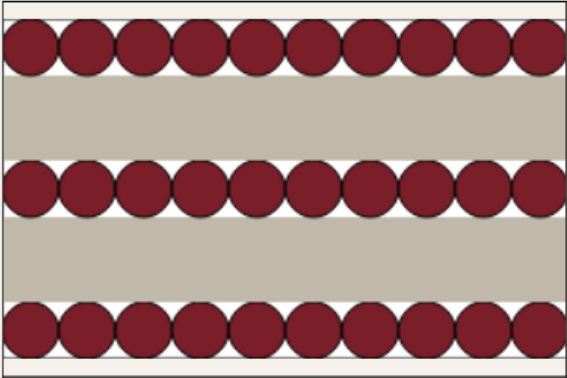
Total Build Thickness [mm]:

Number of layers:

Inter-layer Pitch [mm]:

Conductor Diameter [mm]:

Representative Winding Cross-Section:



PCB Wizard

PCB Configuration Wizard

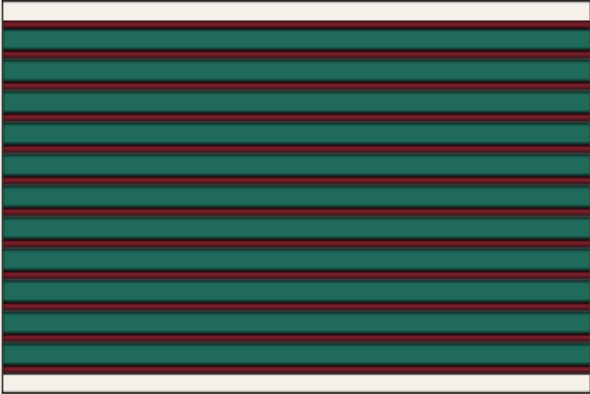
PCB Thickness [mm]:

Number of layers:

Layer Pitch [mm]:

Copper Thickness [mm]:

Representative Stackup Plot:



Inside MAGNETISiM

Simulation Configuration

The screenshot shows the 'General' configuration tab for a simulation named 'MAGNETISiM_file'. The interface includes several tabs: 'General', 'Convergence', 'Nominal Solver', 'AC Sweep', and 'Run Simulation'. Under the 'General' tab, there are three simulation options, each with an unchecked checkbox and a red arrow pointing to the right:

- Magnetic Field Simulation
- Electric Field Simulation
- Thermal Simulation

Below these options, the interface is divided into two columns:

- NOW**: This column is currently active. It features the 'Finite Element Method Magnetics' logo and the Windows logo.
- SOON**: This column is inactive. It features the 'Elmer FEM' logo (open source multiphysical simulation software) and the Linux and iOS logos.

Inside MAGNETISiM

Simulation Configuration

General Convergence

Magnetic Field Simulation

Max Error [%]: 1e-08

Electric Field Simulation

Max Error [%]: 1e-05

Max Number of Passes: 1

Thermal Simulation

Max Error [%]: 1

Max Number of Passes: 1

General Convergence Nominal Solver

Magnetic Field Simulation

Nominal Frequency [kHz]: 100

Electric Field Simulation

Nominal Frequency [kHz]: 100

Thermal Simulation

Sim Type: aNN

Ambient Temperature [°]: 20

Air Velocity [m/s]: 0

Inside MAGNETISiM

Simulation Configuration

The screenshot shows the 'AC Sweep' configuration window in MAGNETISiM. The 'Select AC Sweep Type' is set to 'Waveform'. The 'Waveform' is set to 'Square'. The 'Number of Harmonics' is set to 3. Below the settings is a plot titled 'Actual Waveform and Harmonic Creation'. The plot shows a square wave (Actual Waveform) and its harmonics (dashed red line) over a time range of 0 to 10 microseconds. The y-axis ranges from -1.0 to 1.0.

Actual Waveform and Harmonic Creation

Time (us)	Actual Waveform	Harmonics
0	0.0	0.0
0.5	1.0	0.8
1.0	1.0	0.9
2.0	1.0	0.9
3.0	1.0	0.9
4.0	1.0	0.9
4.5	0.0	0.8
5.0	-1.0	0.7
6.0	-1.0	0.6
7.0	-1.0	0.6
8.0	-1.0	0.6
9.0	-1.0	0.6
10.0	0.0	0.0

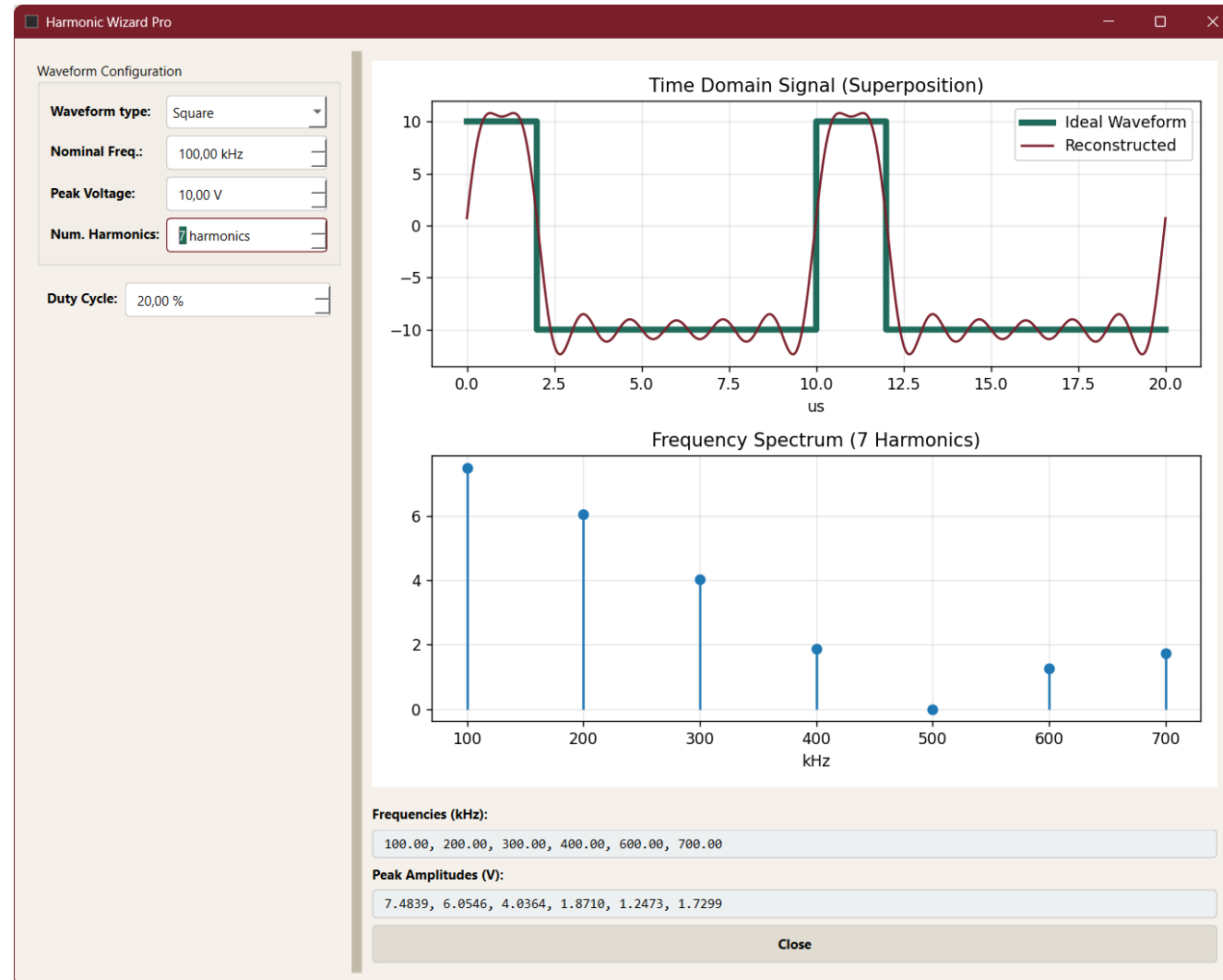
The screenshot shows the 'AC Sweep' configuration window in MAGNETISiM. The 'Select AC Sweep Type' is set to 'Frequency Range'. The 'Sim Sweep Type' is set to 'List'. The 'Vector of Frequencies [kHz]' is set to '10,30,120,230,1000'. The 'Include Nominal Frequency' checkbox is checked. Below the settings is a plot titled 'Simulation Frequency'. The plot shows the simulation frequency in kHz, with vertical lines and dots at 10, 30, 120, 230, and 1000 kHz. The x-axis ranges from 0 to 1000 kHz.

Simulation Frequency

Frequency [kHz]
10
30
120
230
1000

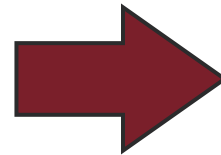
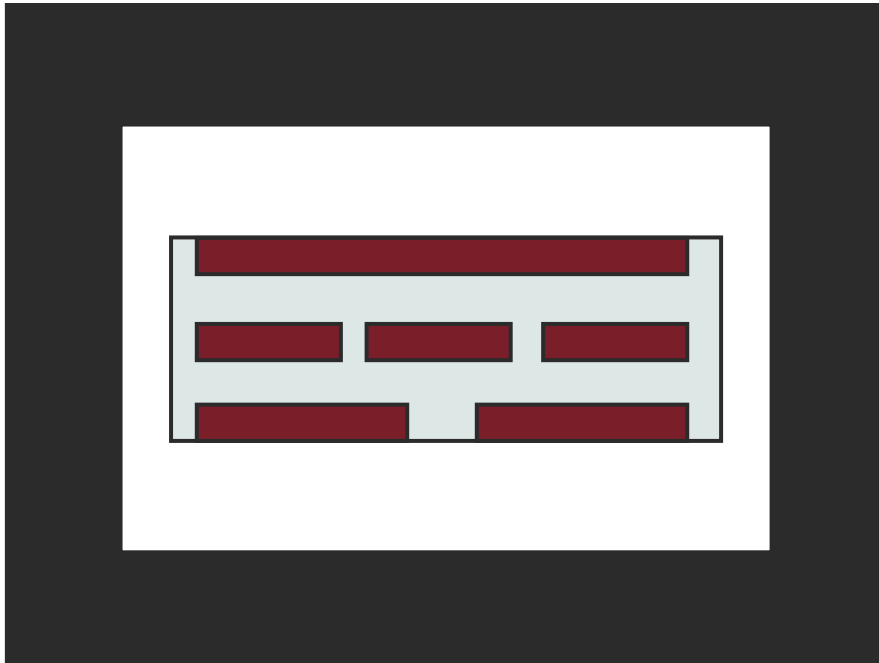
Inside MAGNETISiM

Harmonic Wizard (Pro)

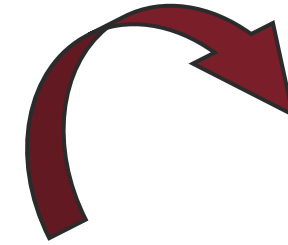


Inside MAGNETISiM

The ✨ Impedance Matrix ✨



$$\begin{bmatrix} Z_{AA} & Z_{AB} & Z_{AC} \\ Z_{BA} & Z_{BB} & Z_{BC} \\ Z_{CA} & Z_{CB} & Z_{CC} \end{bmatrix}$$



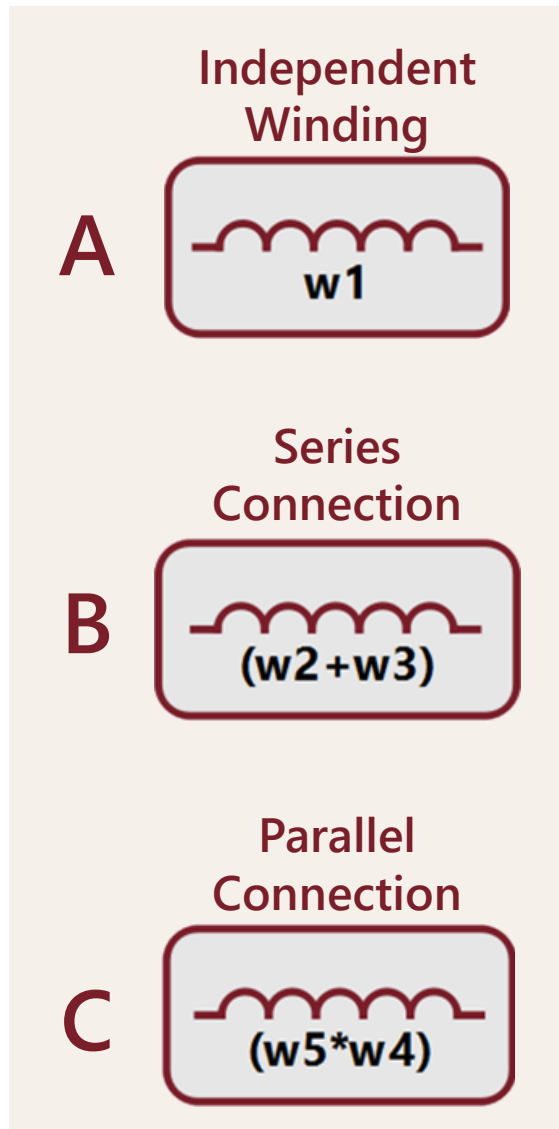
Transformer Pérez
MAGNETIC COMPONENT

Working @ CEIMM-UPM
Power Electronics Group
Mail: t.perez@upm.es

Now, we can do
whatever* we want



*almost whatever we want



ORIGINAL
MATRIX

$$\begin{bmatrix} Z_{11} & Z_{12} & Z_{13} & Z_{14} & Z_{15} \\ Z_{21} & Z_{22} & Z_{23} & Z_{24} & Z_{25} \\ Z_{31} & Z_{32} & Z_{33} & Z_{34} & Z_{35} \\ Z_{41} & Z_{42} & Z_{43} & Z_{44} & Z_{45} \\ Z_{51} & Z_{52} & Z_{53} & Z_{54} & Z_{55} \end{bmatrix}$$



REDUCED
MATRIX

$$\begin{bmatrix} Z_{AA} & Z_{AB} & Z_{AC} \\ Z_{BA} & Z_{BB} & Z_{BC} \\ Z_{CA} & Z_{CB} & Z_{CC} \end{bmatrix}$$

Why MAGNETISiM?

- Our contribution to the research community
- Not open, but always free
- You can help us!



Be Part of MAGNETISiM!

Join us!

- Bachelor's / Master's Thesis (TFG / TFM)
- PhD Research
- Freelance Collaboration



Sponsor us!

- Sponsor a Student Thesis (Industrial Council)
- Support the Project
- Sponsor a Custom Feature

Report bugs!

- Bugs Report – Public, not Available yet
- Pull request – Fix Bugs and Send Suggestions



02

First Steps

- Design Configuration
- Simulation Possibilities
- Postprocessing the Results

GUI Overview

TAB MENU

Core Geometry Tab (Ctrl+1)

Winding Geometry Tab (Ctrl+2)

Sim Config Tab (Ctrl+3)

Magnet Tab (Ctrl+4)

INPUT FRAME

The screenshot displays the MAGNETISiM software interface. At the top, a menu bar includes 'File', 'Edit', 'Tool', and 'Help'. The main window is divided into two primary sections. On the left is the 'INPUT FRAME', which is further divided into two tabs: 'Core Geometry' and 'Core Material'. The 'Core Geometry' tab contains several dropdown menus for 'Manufacturer' and 'Core Reference', and a series of input fields for dimensions: A [mm], B [mm], Bp [mm], C [mm], Cp [mm], D [mm], E [mm], F [mm], G [mm], I [mm], and Gap [mm]. The 'Core Material' tab includes a 'Material' dropdown, four sub-tabs for 'Magnet', 'Power Loss', 'Electrical', and 'Thermal', and input fields for 'Real Permeability', 'Imag Permeability', and 'Conductivity'. A button labeled 'Add Permeability(f) Curve' is located below these fields. On the right side of the interface is the 'MODELER WINDOW', which features a 2D/3D view toggle, a grid plot area with axes ranging from -0.6 to 0.6, and control buttons for 'Export', 'Refresh Plot', and 'Fit All' at the bottom.

BAR TOOL

MODELER WINDOW

Core Geometry Selection

1 Core Geometry

Manufacturer: Select Manufacturer

Geometry Core: Select Manufacturer

Core Reference: Select Manufacturer

2 Core Geometry

Manufacturer: Ferroxcube

Geometry Core: Select Geometry Core

Core Reference: Select Geometry Core

3 Core Geometry

Manufacturer: Ferroxcube

Geometry Core: E

Core Reference: Select RefCore

- 1 Select the **manufacturer** from the menu (e.g., Ferroxcube).
- 2 Select the core **geometry** (e.g., the "E" model).
- 3 Select the core **reference** (e.g., E19/8/9).
- 4 The system **automatically** loads the core parameters from the built-in database.

4 Core Geometry

Manufacturer: Ferroxcube

Geometry Core: E

Core Reference: E19/8/9

A [mm]: 19.05

B [mm]: 14.33

C [mm]: 4.75

D [mm]: 8.05

E [mm]: 5.69

F [mm]: 8.71

Gap [mm]: 0

Core Material Selection

1

Core Material

Material: 3C94

Magnet | Power Loss | Electrical | Thermal

Real Permeability: 2300

Imag Permeability: 0

Conductivity: 0.3333333333333333

[Add Permeability\(f\) Curve](#)

Permeability(f) from Internal-Database

- 1 Select the **material** from the menu (e.g., 3C94).
The system **automatically** loads the material parameters from the built-in database.

CORE MATERIAL CHARACTERIZATION

- **Magnet**
 $\mu'_r - j\mu''_r$ – Complex permeability
Conductivity – Electrical Conductivity
- **Power Loss**
 k, α, β – Steinmetz loss model coefficients
- **Electrical**
Pending electrical data spec
- **Thermal**
The thermal model release is planned to take place in September 2026.

More information in [Create Material](#)

Modeler Window

MAGNETISiM File Edit Tool Help

Core Geometry

Manufacturer: Ferroxcube

Geometry Core: E

Core Reference: E19/8/9

A [mm]: 19.05

B [mm]: 14.33

C [mm]: 4.75

D [mm]: 8.05

E [mm]: 5.69

F [mm]: 8.71

Gap [mm]: 0

Core Material

Material: 3C94

Magnet Power Loss Electrical Thermal

Real Permeability: 2300

Imag Permeability: 0

Conductivity: 0.3333333333333333

Add Permeability(f) Curve

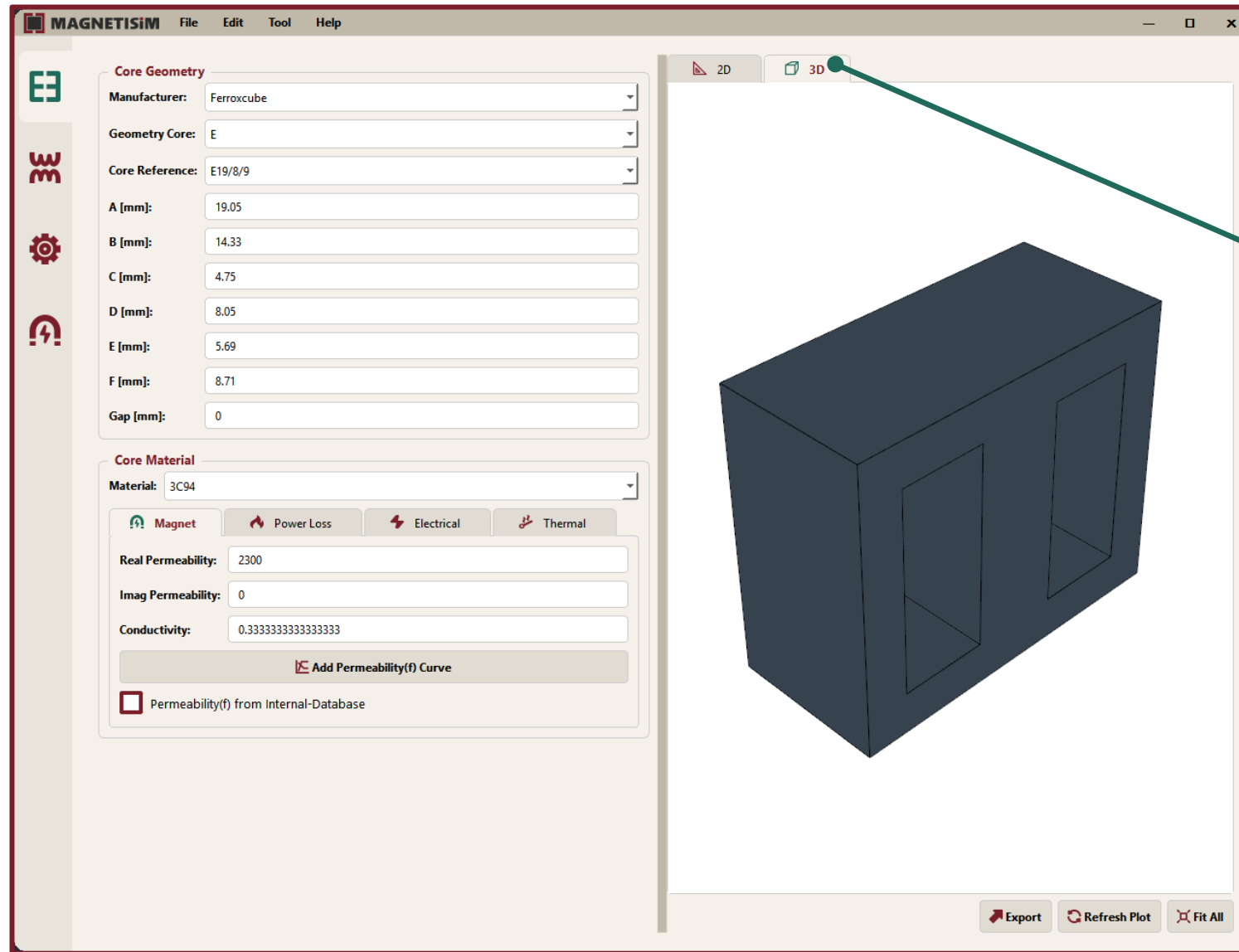
Permeability(f) from Internal-Database

2D 3D

Export Refresh Plot Fit All

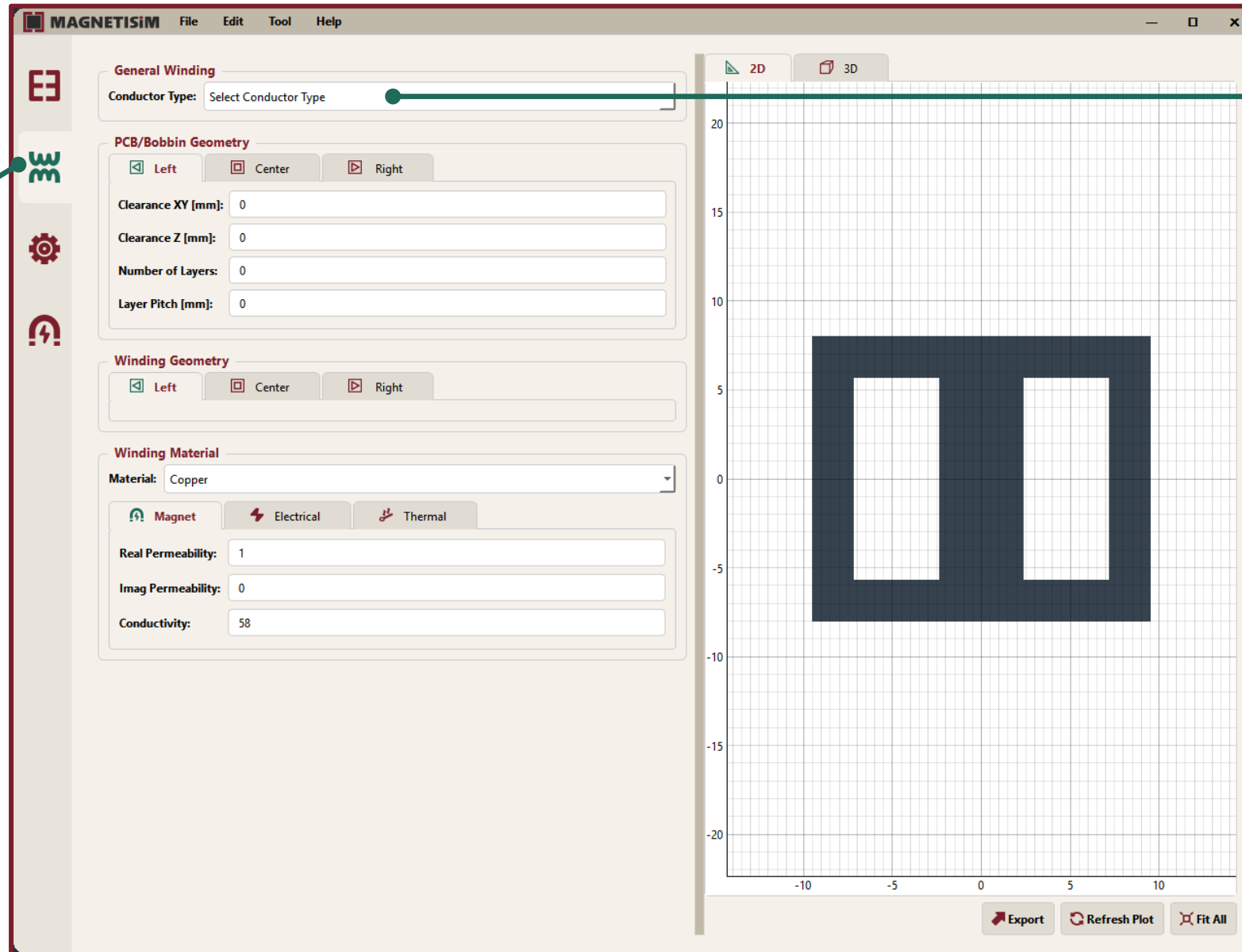
Once the core and its material are configured, the **Modeler Window** allows us to confirm that everything is correctly set up.

Modeler Window



We can easily switch between a **2D view** superimposed on a grid and an **interactive 3D view** of the core we just designed.

Winding Geometry Tab



1 GENERAL

We choose the conductor type:

- Round
- PCB/Planar
- Litz

WINDING GEOMETRY TAB (Ctrl+2)

Accessing the "Winding Geometry Tab" we proceed to include the coils in our design.

Round Conductors

General Winding
Conductor Type: Round

2 PCB/Bobbin Geometry
 Left Center Right
Clearance XY [mm]: 0.5
Clearance Z [mm]: 0.5
Number of Layers: 1
Layer Pitch [mm]: 0

3 Winding Geometry
 Left Center Right
Distribution: V
Nturns: 6
Copper Radius [mm]: 0.6
Pitch [mm]: 0.3

4 Winding Material
Material: Copper
 Magnet Electrical Thermal
Real Permeability: 1
Imag Permeability: 0
Conductivity: 58

2 PCB/BOBBIN GEOMETRY

- **Clearance XY** – This is the safety distance in the horizontal plane between the winding and the core legs.
- **Clearance Z** – This represents the separation along the vertical axis.
- **Number of layers** – Indicates the total amount of layers that will be superimposed to form the winding.
- **Layer Pitch** – This is the vertical distance or separation between one wire layer and the next one.

3 PCB/BOBBIN GEOMETRY

- **Distribution** – Defines the arrangement pattern of the turns (for example, a "V" vertical distribution).
- **Nturns** – The total number of turns or loops of wire that make up the winding.
- **Copper Radius [mm]** – Refers to the physical radius of the solid copper conductor.
- **Pitch [mm]** – The center-to-center distance between two consecutive turns within the exact same layer.

4 Winding Material

- **Magnet**
- **Electrical**
- **Thermal**

More details in [Defining Winding](#)

Defining a Winding

General Winding
Conductor Type: Round

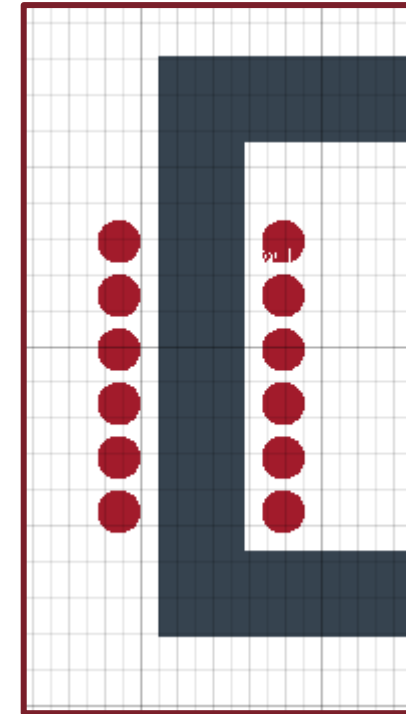
PCB/Bobbin Geometry
 Left Center Right
Clearance XY [mm]: 0.5
Clearance Z [mm]: 0.5
Number of Layers: 1
Layer Pitch [mm]: 0

Winding Geometry
 Left Center Right
Distribution: V
Nturns: 6
Copper Radius [mm]: 0.6
Pitch [mm]: 0.3

Winding Material
Material: Copper
 Magnet Electrical Thermal
Real Permeability: 1
Imag Permeability: 0
Conductivity: 58

THE TOOL IS VERY VISUAL

When we change parameters like the layer pitch or play with the legs' position, the 2D **view updates instantly** to show us how the different layers look.



More details in [Defining Winding](#)

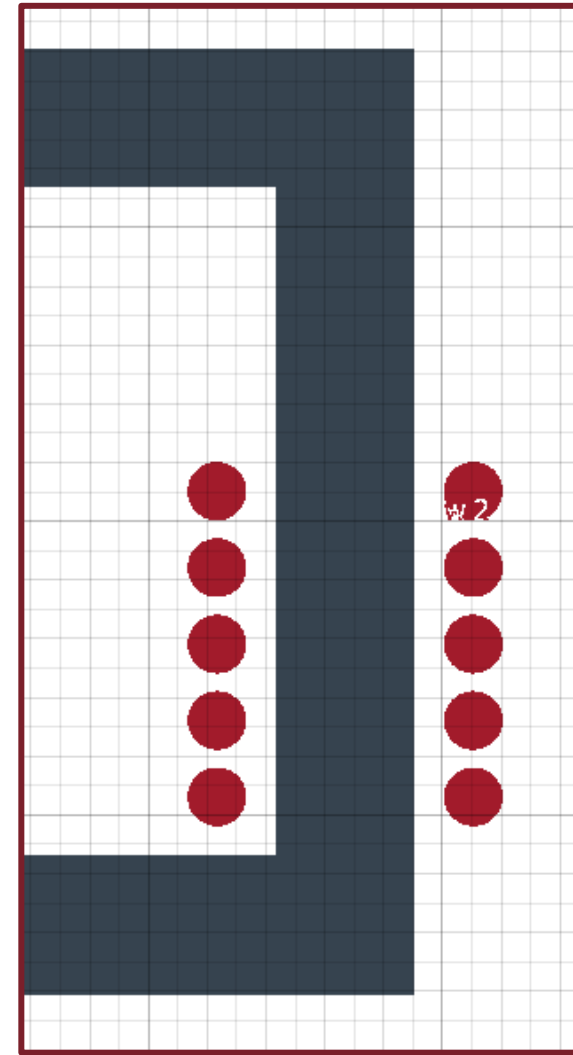
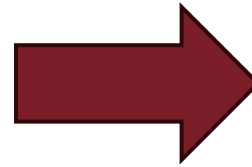
Defining a Winding

General Winding
Conductor Type: Round

PCB/Bobbin Geometry
 Left Center Right
Clearance XY [mm]: 0.5
Clearance Z [mm]: 0.5
Number of Layers: 1
Layer Pitch [mm]: 0

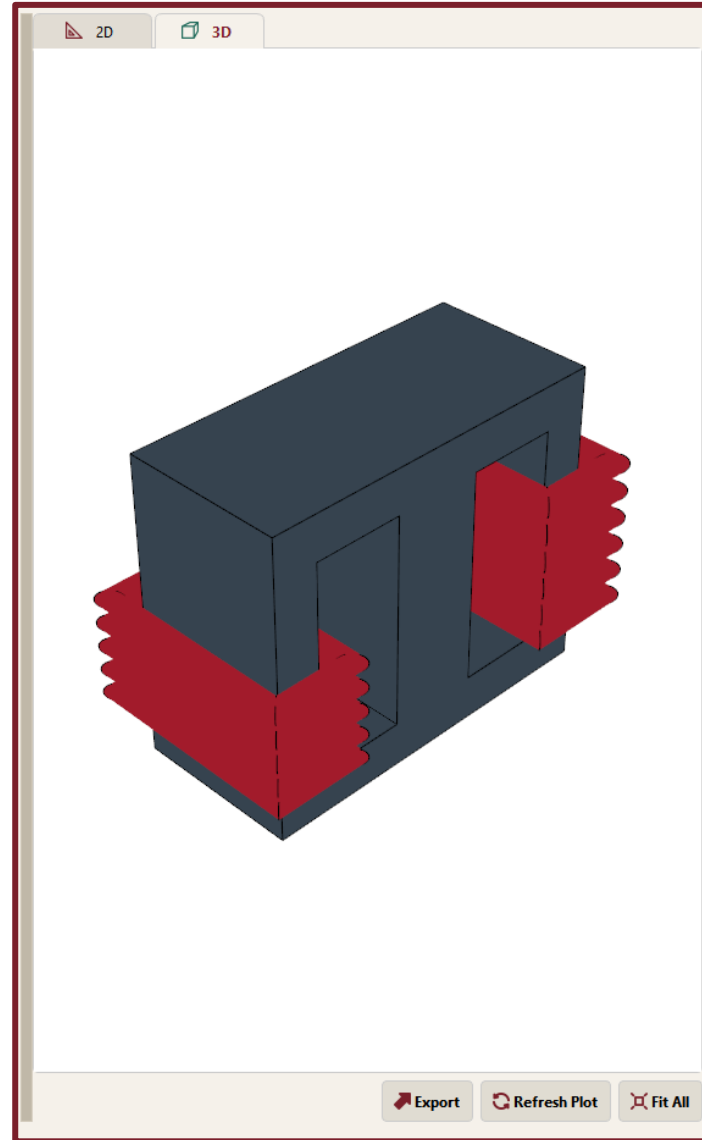
Winding Geometry
 Left Center Right
Distribution: V
Nturns: 6
Copper Radius [mm]: 0.6
Pitch [mm]: 0.3

Winding Material
Material: Copper
 Magnet Electrical Thermal
Real Permeability: 1
Imag Permeability: 0
Conductivity: 58

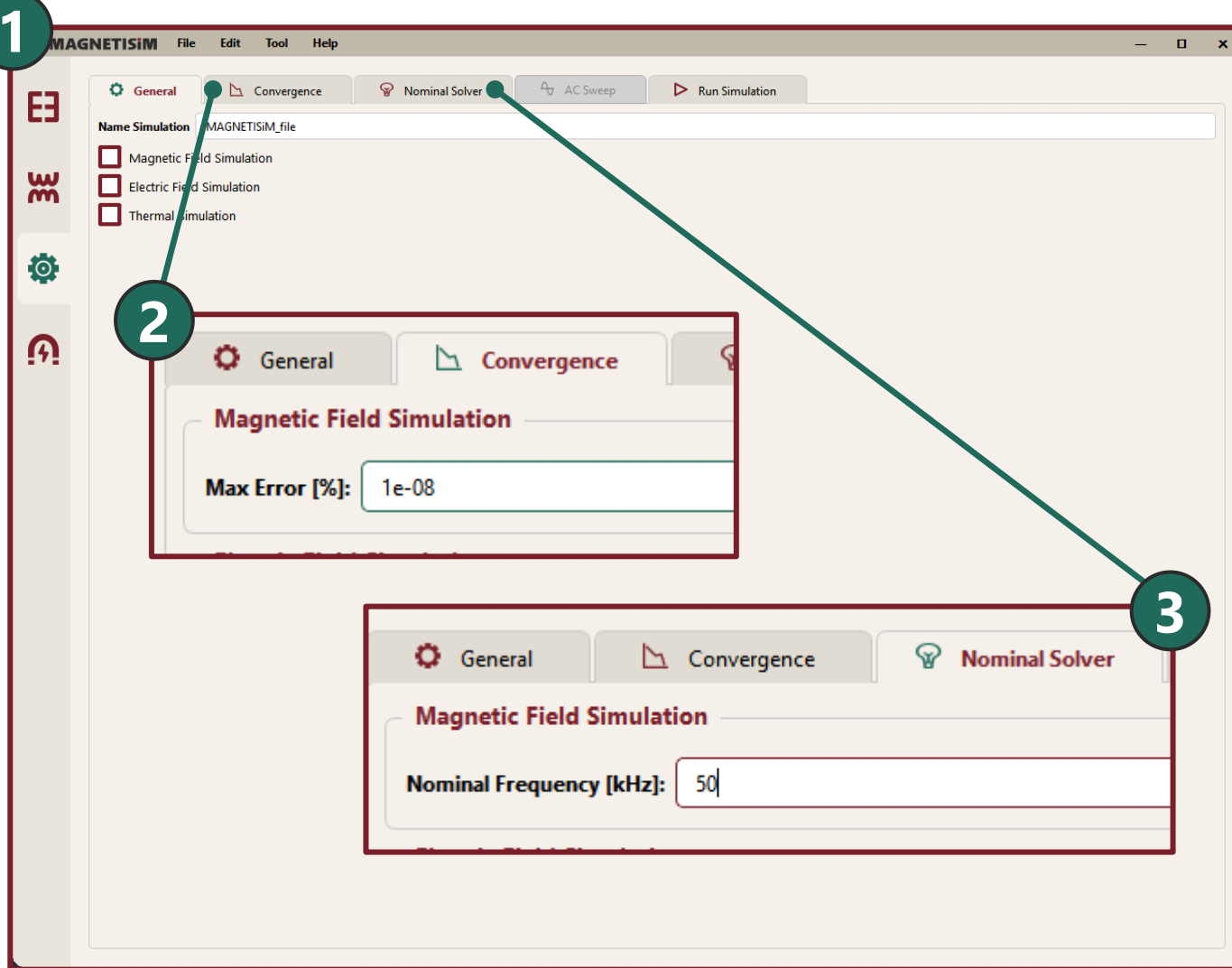


More details in [Defining Winding](#)

This Must be the Result



Configure the Simulation



1 GENERAL

We assign a simulation name and select the desired simulations:

- Magnetic Field
- Electric Field
- Thermal Simulation

2 CONVERGENCE

We define the mathematical precision criteria, such as the maximum error.

3 NOMINAL SOLVER

We adjust the nominal frequency of the system.

More details in [Configure Sim](#)

Configure the Simulation

4 AC SWEEP

We configure a frequency sweep, being able to select the sweep type (e.g., logarithmic) and defining the min and max frequencies to see the behavior over a broad spectrum.

5 RUN SIMULATION

Well, to run the simulation.

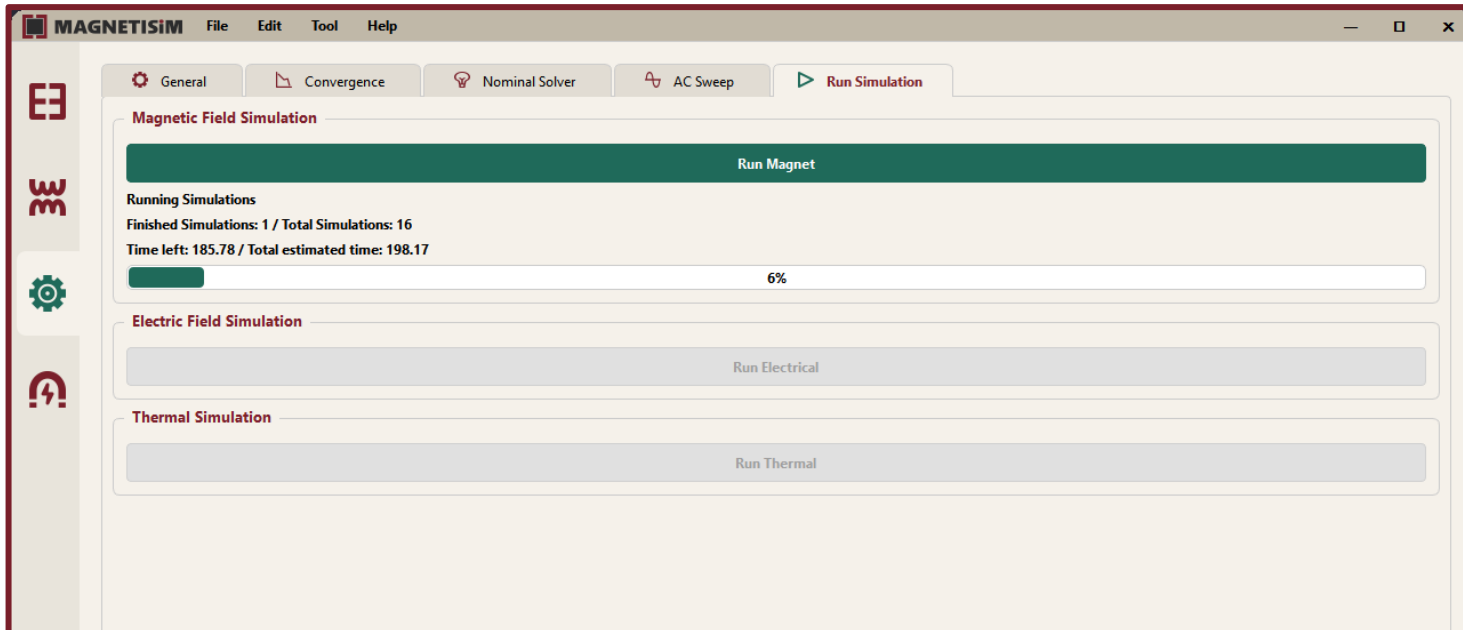
The screenshot displays the simulation configuration interface with the following settings:

- Select AC Sweep Type:** Frequency Range
- Sim Sweep Type:** Logarithmic
- Min Frequency [kHz]:** 1
- Max Frequency [kHz]:** 100
- Number of Points:** 3
- Include Nominal Frequency

The **Frequency/Waveform Plot:** section shows a plot titled "Simulation Frequency" with a logarithmic x-axis labeled "Frequency [kHz]". The x-axis has major ticks at 10^0 , 10^1 , and 10^2 . Three red vertical lines with dots at the top represent the simulation points at 1 kHz, 10 kHz, and 100 kHz.

More details in [Configure Sim](#)

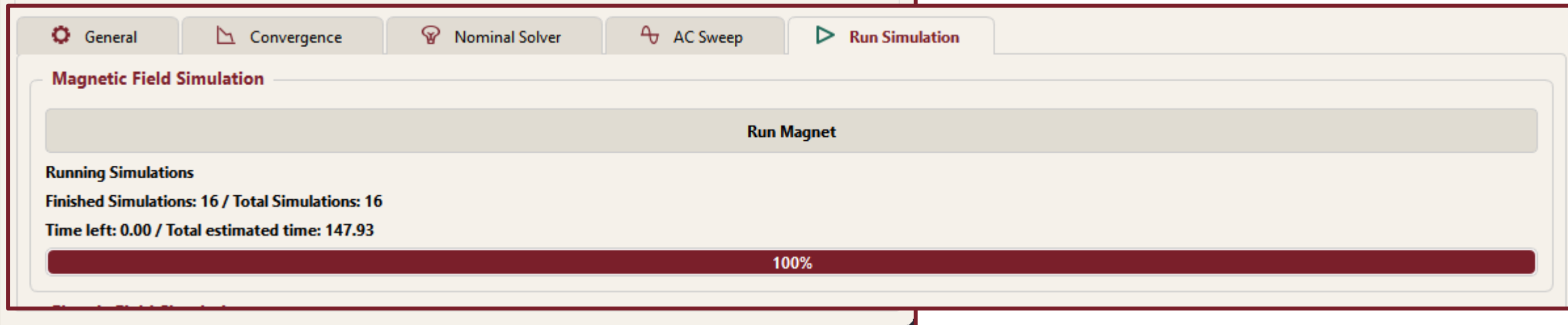
Simulating...



When launching the simulation in the **Run Simulation tab** (Ctrl+3), the interface locks momentarily to dedicate all resources to the field calculations.

The development team promises this will be improved!

You can follow the progress using a bar. Once the red bar reaches 100% and finishes counting, the results can be viewed.



Results Viewer (Ctrl+4)

WINDING EXPRESSION WINDOW

In the "Winding Expression" window, we can right-click on the windings to define a series or parallel connection.

The screenshot shows the MAGNETISIM software interface. The 'Winding Expression' window is on the left, featuring a 'Reset' button and two winding symbols labeled 'w1' and 'w2'. The 'Matrix Results' window is on the right, displaying various settings and a data table. The settings include 'Visualizer Mode' set to 'Matrix @ Freq', 'Selected Frequency' at '1.00 kHz', 'Matrix Type' as 'Z', 'Units' as 'Ohm', and 'N Decimals' as '2'. The data table below shows the following values:

	w1	w2
w1	0.43j	(-0-0.06j)
w2	(-0-0.06j)	0.3j

Buttons for 'Export CSV' and 'Export VectorFitting' are located at the bottom of the Matrix Results window.

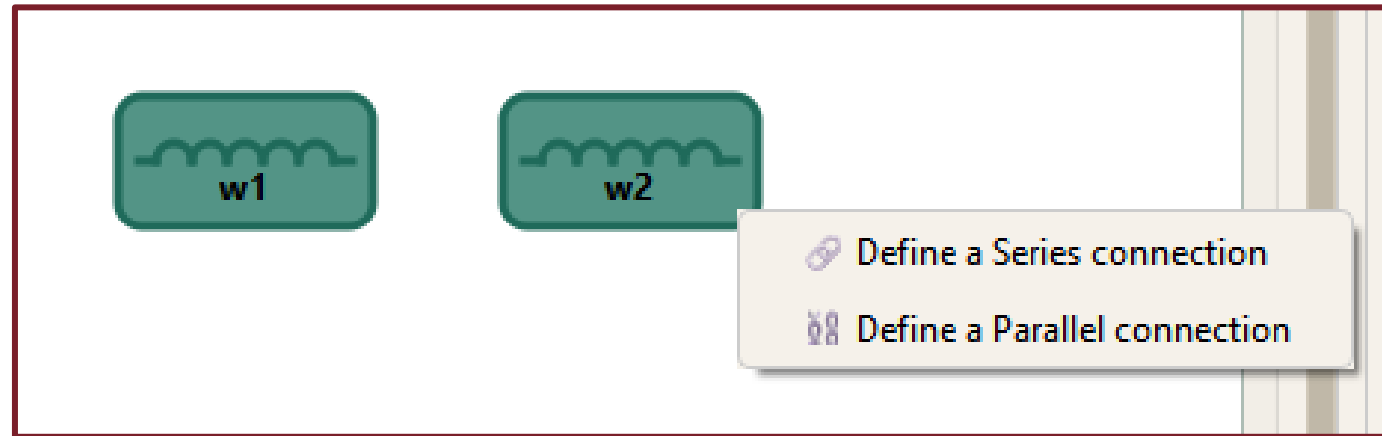
RESULTS WINDOW

With the **Visualizer Mode**, we select how we want to view the data.

We can filter the data by selecting a specific frequency, the matrix type, and adjusting the units and the number of decimals plotted.

More details in [Analysing Results](#)

Winding Manager (per Layer)



More details in [Analysing Results](#)

Matrix Viewer

Winding Expression

Reset

Matrix Viewer

Circuit Viewer

Power Loss Viewer

Matrix Results

Visualizer Mode:

Matrix @ Freq

Selected Frequency:

1.00 kHz

Matrix Type:

k

Units:

1

N Decimals:

4

	w1	w2
w1	1.0	-0.1622
w2	-0.1622	1.0

Export CSV

Export VectorFitting

1 VISUALIZER MODE

Determines how the matrix data is presented on the screen. For example, setting it to "**Matrix @ Freq**" allows you to view the data table for one specific frequency.

2 SELECTED FREQUENCY

The specific frequency point (e.g., 1.00 kHz) from your simulation sweep that you want to examine in the matrix.

3 MATRIX TYPE

Selects the specific electrical or magnetic parameter you want to analyze. In the image, 'k' is selected, which represents the coupling coefficient between the windings.

4 UNITS

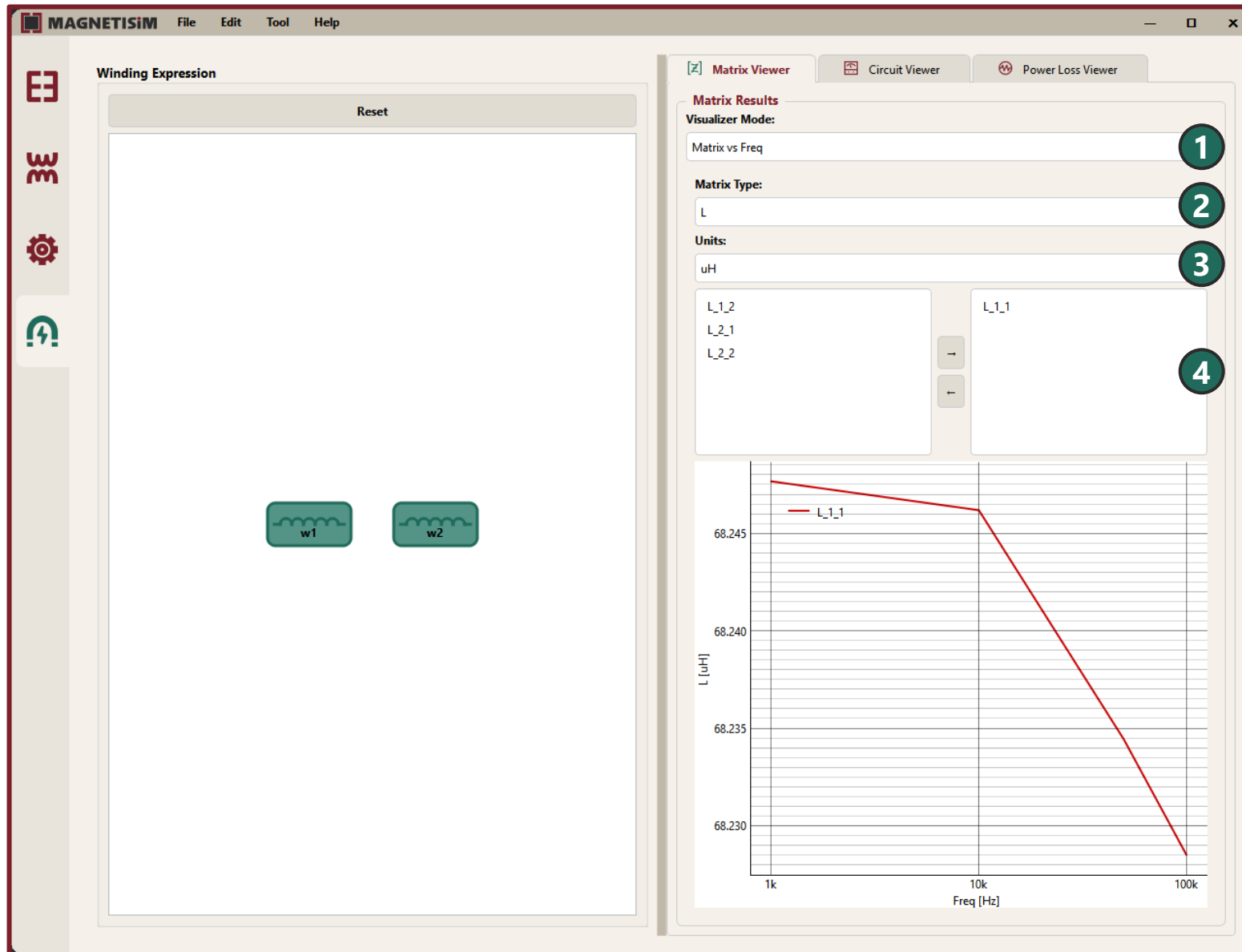
The physical measurement units applied to the values within the matrix. For the coupling coefficient ('k'), it is represented as a dimensionless unit ('1').

5 N DECIMALS

Controls the visual precision of the data by defining the exact number of decimal places shown for the numerical values inside the generated matrix.

More details in [Analysing Results](#)

Matrix Viewer



1 VISUALIZER MODE

Determines how to display the data. By setting it to "**Matrix vs Freq**", the viewer changes from a data table to a 2D graph, allowing you to observe how a specific parameter behaves across the entire simulated frequency range (AC Sweep).

2 MATRIX TYPE

Selects the specific electrical or magnetic parameter you want to evaluate. In the image provided, 'L' is selected, meaning the graph will display Inductance values.

3 UNITS

Sets the physical measurement unit for the graph's vertical axis (Y-axis). For the chosen inductance, it is configured to 'uH' (microhenries).

4 DATA TO PLOT

This selection area lets you choose exactly which elements from the matrix you want to render on the graph. You can select individual matrix components—such as a specific self-inductance or mutual inductances—and use the arrow buttons to add or remove them from the active plot.

More details in [Analysing Results](#)

Winding Expression

Reset

Circuit Results

Frecuencia: 1.00 kHz

Winding Conf.	Excitation Type	Value
1 w1	v	1
2 w2	r	1

Run Circuit Sim

	V	Mag(V)	Phase(V)	I	Mag(I)	Phase(I)
w1	1.000-0.000j	1.000	-0.000	-0.006-2.337j	2.337	-90.142
w2	-0.125-0.037j	0.130	-163.505	-0.125-0.037j	0.130	-163.505

Export to CSV Run FEA Simulation

CIRCUIT VIEWER

The Circuit Viewer is designed for direct electrical analysis.

1 Frequency, Winding Conf, Excitation Type, Value

You just need to select the frequency and apply a configuration to your windings including Winding Conf, Excitation Type, and Value.

2 Run Circuit Sim

By clicking "Run Circuit Sim", the program returns the electrical data, solving the circuit and showing you the results layer by layer.

More details in [Analysing Results](#)

Winding Expression

Reset

w1 w2

Power Loss Results

Frecuencia: 50.00 kHz

Winding Conf.	Excitation Type	Value
1 w1	v	1
2 w2	r	1

Analytical Power Loss Simulate Power Loss

	Power Loss (W)
w1	-0.000019+0.023952j
w2	0.000043+0.000000j
Total Winding Loss	0.000024
Bpk (mT)	16.117111-0.000000j
Core Loss	0.001038

Export to CSV

POWER LOSS VIEWER

The Power Loss Viewer is designed for direct power loss analysis.

1 Frequency, Winding Conf, Excitation Type, Value

Similar to the circuit viewer, you input the frequency, the excitation type, and its value.

2 Run Circuit Sim

Then you can calculate the losses by clicking on "Analytical Power Loss" or "Simulate Power Loss".

You will see the results broken down per layer, including total winding loss and core loss.

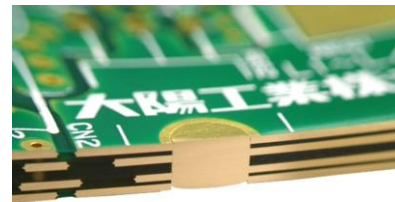
More details in [Analysing Results](#)

03

Use-Case

- Project Context
- Design Configuration
- Simulation and Evaluation

Specifications



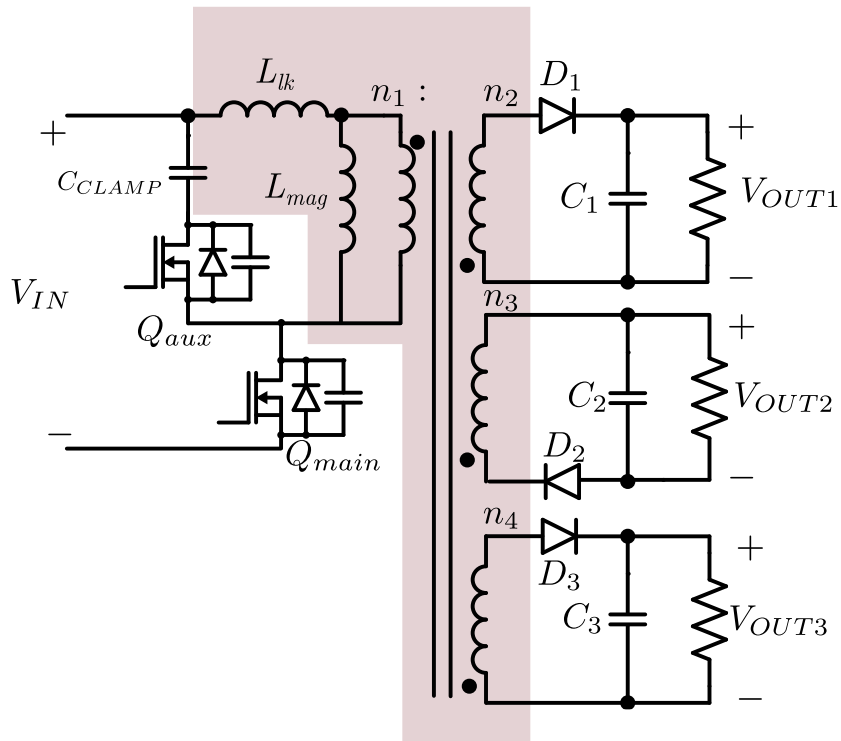
✗ Parasitic Capacitance → **CAPACITISiM**

✗ PCB Design → **PCBSiM**

✓ Manufacturer process

✓ Simulation = Measurements

Design Specifications

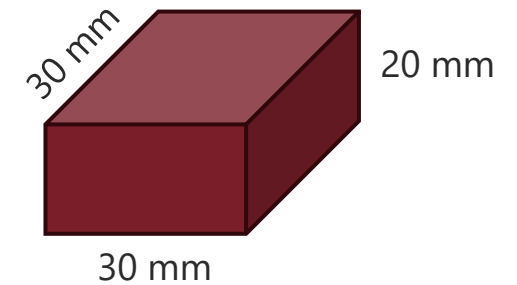


VOLTAGE-POWER SPECIFICATION

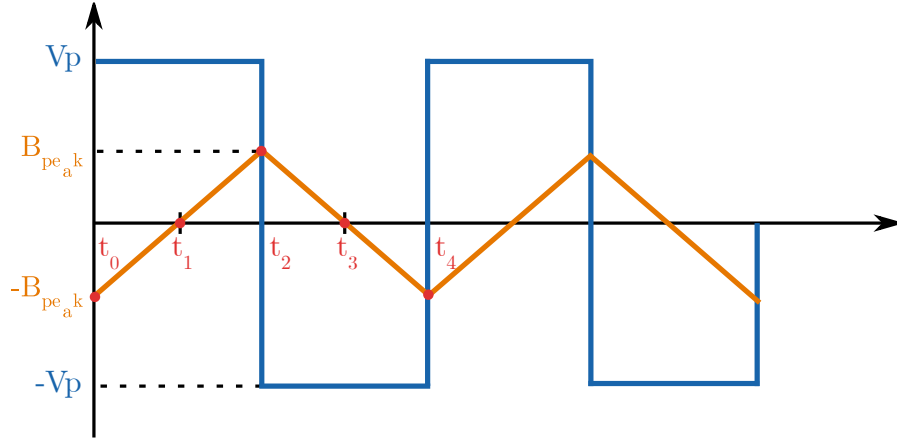
Port	Parameter	Value
Input	V_{in}	42 V
	f_{sw}	350 kHz
Output 1*	V_{out}	6 V
	P_{out}	10 W
Output 2	V_{out}	-6 V
	P_{out}	1.5 W
Output 3	V_{out}	9 V
	P_{out}	20 W

Operating frequency: 350 kHz

FORM FACTOR

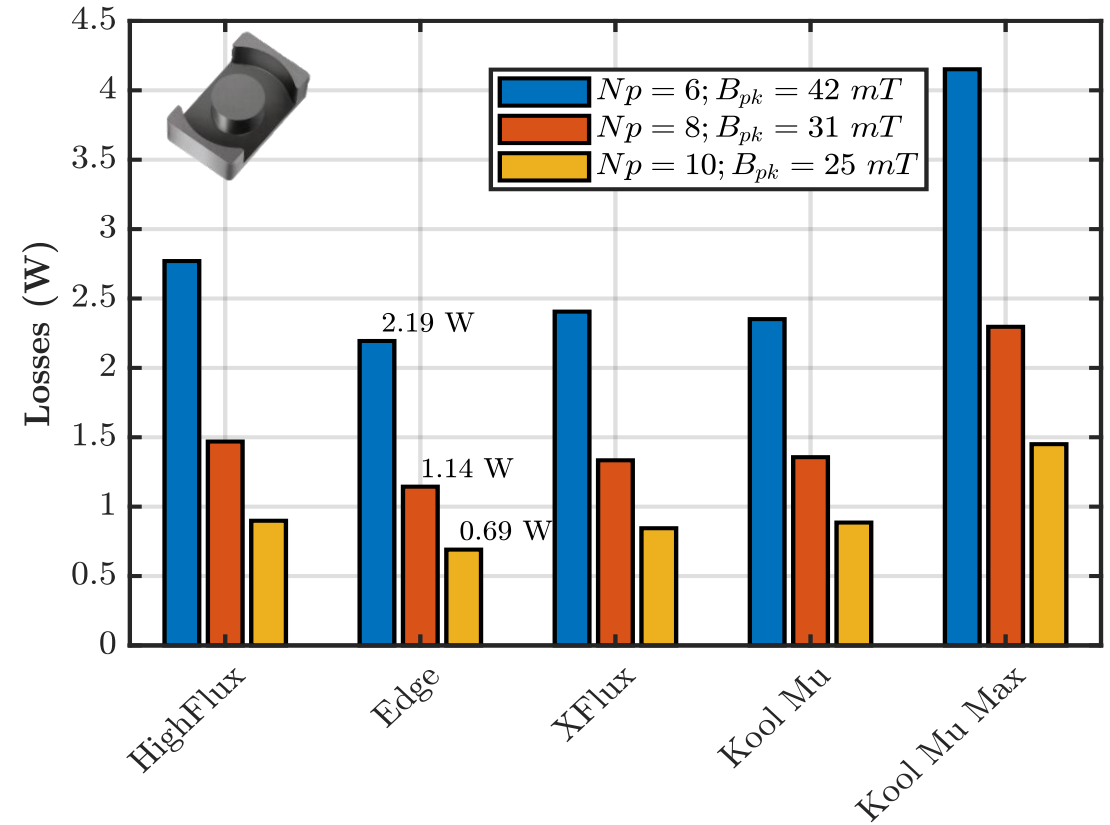


Preliminary Calculation



$$\frac{\partial \phi}{\partial t} = \frac{V}{N} \rightarrow B_{pk} = \frac{V_p}{A_{eff} N_p} \cdot \frac{1}{4f_{sw}}$$

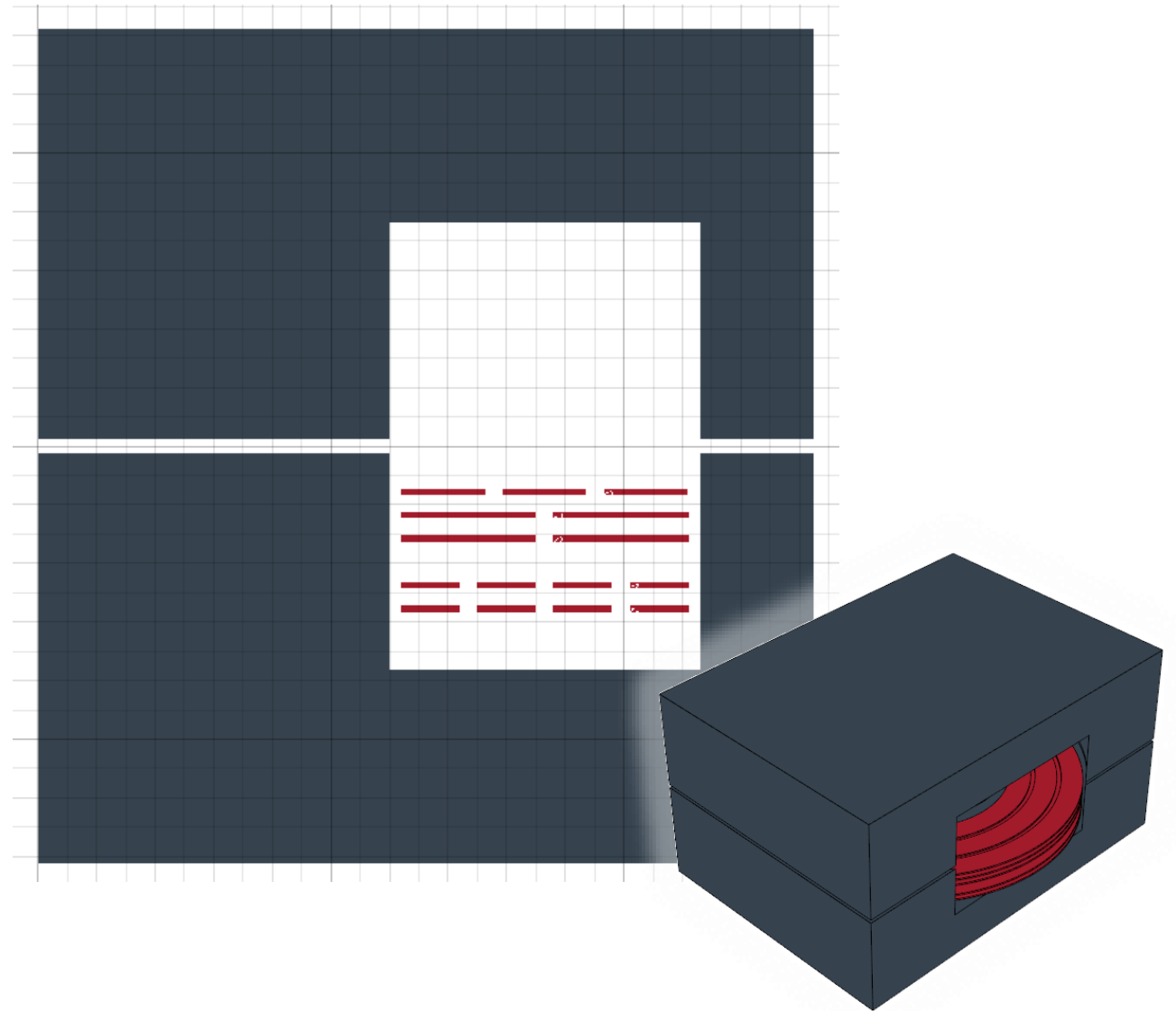
$$\Delta I \rightarrow L_{mag} \approx \frac{A_{eff}}{l_{eff}} N_p^2 \mu_r \mu_0 \approx 8 \mu H$$



EXPERTISiM

WINDING SPECIFICATIONS		
Port	Layer ID	No. Turns
Input	w1	4
	w2	4
Output 1	w3	2
Output 2	w4	2
Output 3	w5	3

EXPERTISiM



Core Selection

$$A_L \approx \frac{8 \mu H}{8^2} \approx 125 nH$$



Edge Toroids	E Cores			U Cores	EQ Cores	LP Cores	EER Cores	Blocks	
Core Data	A _L nH/T ² (nominal)			L _e Path Length mm	A _e Cross Section mm ²	Length mm	Height mm	Width mm	
	26μ	40μ	60μ						
EQG20 L050	81	120	167	29.3	60.8	20.0	5.0	14.0	
EQG20 L061	67	98	138	35.8	60.8	20.0	6.1	14.0	
EQG26 L070	111	164	228	42.3	119.8	26.5	7.0	19.0	
EQG26 L088	95	140	195	49.5	119.8	26.5	8.8	19.0	
EQG26 L101	86	127	177	54.7	119.8	26.5	10.1	19.0	
EQG26 L124	74	108	151	63.9	119.8	26.5	12.4	19.0	
EQG32 L101	100	148	207	59.5	152.3	32.0	10.1	22.0	
EQG32 L152	75	110	156	79.9	152.3	32.0	15.2	22.0	
EQG32 L180	66	97	136	91.1	152.3	32.0	18.0	22.0	
EQG36 L100	109	160	223	65.1	180.8	36.0	10.0	26.0	
EQG36 L110	102	151	211	69.1	180.8	36.0	11.0	26.0	
EQG36 L174	75	110	154	94.7	180.8	36.0	17.4	26.0	
EQG41 L120	94	138	193	83.6	199.7	41.5	12.0	28.0	
EQG41 L199	68	100	140	115.2	199.7	41.5	19.9	28.0	
EQG50 L200	109	160	223	113.4	314.1	50.0	20.0	32.0	
EQG50 L250	92	136	190	133.4	314.1	50.0	25.0	32.0	

Design Configuration

Core Geometry

Manufacturer: **MagInc**

MAGNETISiM File Edit Tool Help

Core Geometry

Manufacturer: AirCore
CustomCore
Ferroxcube
IPT
MagInc
Micrometals
TDK

Geometry Core: [Empty]

Core Reference: [Empty]

A [mm]: 0

B [mm]: 0

Bp [mm]: 0

C [mm]: 0

Cp [mm]: 0

D [mm]: 0

E [mm]: 0

F [mm]: 0

G [mm]: 0

I [mm]: 0

Gap [mm]: 0

Core Material

Material: Select Manufacturer

Magnet Power Loss Electrical Thermal

Real Permeability: 0

Imag Permeability: 0

Conductivity: 0

Add Permeability(f) Curve

Permeability(f) from Internal-Database

Geometry Core: **EQ**

MAGNETISiM File Edit Tool Help

Core Geometry

Manufacturer: MagInc

Geometry Core: EC
EERP
E
EI
EQ
ER
ETD
LP
P
PQ
U

Core Reference: [Empty]

A [mm]: 0

B [mm]: 0

Bp [mm]: 0

C [mm]: 0

Cp [mm]: 0

D [mm]: 0

E [mm]: 0

F [mm]: 0

G [mm]: 0

I [mm]: 0

Gap [mm]: 0

Core Material

Material: Select Manufacturer

Magnet Power Loss Electrical Thermal

Real Permeability: 0

Imag Permeability: 0

Conductivity: 0

Add Permeability(f) Curve

Permeability(f) from Internal-Database

Core Reference: **EQM26x19_L070**

MAGNETISiM File Edit Tool Help

Core Geometry

Manufacturer: MagInc

Geometry Core: EQ

Core Reference: EQM20x14_L050
EQM20x14_L061
EQM26x19_L070
EQM26x19_L088
EQM26x19_L101
EQM26x19_L124
EQM32x22_L101
EQM32x22_L152
EQM32x22_L180
EQM36x26_L100
EQM36x26_L110
EQM36x26_L174
EQM41x28_L120
EQM41x28_L199
EQM50x32_L200
EQM50x32_L250

A [mm]: 0

B [mm]: 0

Bp [mm]: 0

C [mm]: 0

D [mm]: 0

E [mm]: 0

F [mm]: 0

G [mm]: 0

Gap [mm]: 0

Core Material

Material: Select Manufacturer

Magnet Power Loss Electrical Thermal

Real Permeability: 0

Imag Permeability: 0

Conductivity: 0

Add Permeability(f) Curve

Permeability(f) from Internal-Database

Design Configuration

Core Modification

Gap [mm]: 0.25

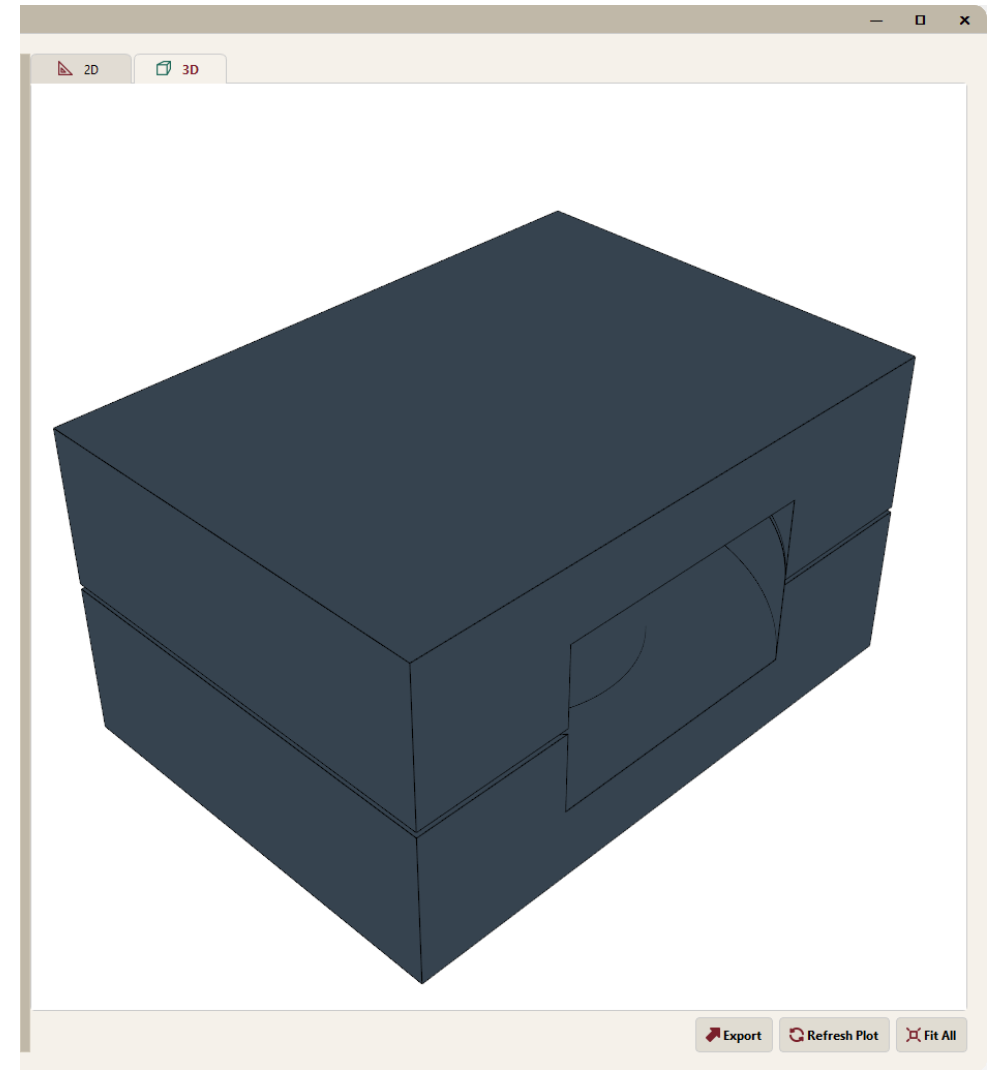
The screenshot shows the MAGNETISiM software interface. The 'Core Geometry' panel on the left contains the following settings:

- Manufacturer: MagInc
- Geometry Core: EQ
- Core Reference: EQM26x19_L070
- A [mm]: 26.5
- B [mm]: 15
- Bp [mm]: 22.6
- C [mm]: 12.0
- D [mm]: 7.0
- E [mm]: 3.7
- F [mm]: 19.0
- G [mm]: 19.0
- Gap [mm]: 0.25

The 'Core Material' panel below it has the following settings:

- Material: Select Manufacturer
- Magnet: Magnet
- Power Loss: Power Loss
- Electrical: Electrical
- Thermal: Thermal
- Real Permeability: 0
- Imag Permeability: 0
- Conductivity: 0
- Permeability(f) from Internal-Database:

The 2D plot on the right shows a dark blue square core with a central square hole. The axes range from -1 to 18 on the x-axis and -10 to 10 on the y-axis. A red arrow points from the 'Gap [mm]: 0.25' text above to the 'Gap [mm]: 0.25' field in the software interface.



Design Configuration

Core Material

The screenshot displays the MAGNETISiM software interface. On the left, a tree view lists various parameters under 'Core Material'. The 'Material' section is expanded, showing 'Edge_26' selected. Below this, there are input fields for 'Conductivity' (set to 0) and a checkbox for 'Permeability(f) from Internal-Database'. The main window shows a 2D plot of a core geometry on a grid, with axes ranging from -1 to 18. The core is a dark blue shape with a central square hole. The plot is titled '2D' and has buttons for 'Export', 'Refresh Plot', and 'Fit All' at the bottom.

Core Material Parameters:

- Core Ge: F, P, R, T
- Manufact: L
- Geometry: MPP_14, MPP_26, MPP_40, MPP_60, MPP_125, MPP_160, MPP_200, MPP_300
- Core Refe: MPP_550
- A [mm]: HighFlux_14, HighFlux_26, HighFlux_40, HighFlux_60, HighFlux_125, HighFlux_160
- B [mm]: KoolMu_14, KoolMu_26, KoolMu_40, KoolMu_60
- Bp [mm]: KoolMu_75, KoolMu_90
- C [mm]: KoolMu_125
- D [mm]: XFlux_26, XFlux_40, XFlux_60, XFlux_75, XFlux_125
- E [mm]: Edge_14
- F [mm]: Edge_26, Edge_40, Edge_60, Edge_75, Edge_90
- G [mm]: Real Per 75_26, 75_40, 75_60
- Gap [mm]: Imag Pe 75_60
- Core Ma: Edge_14
- Material: Edge_26, Edge_40, Edge_60, Edge_75, Edge_90
- Real Per: 75_26, 75_40, 75_60
- Imag Pe: 75_60

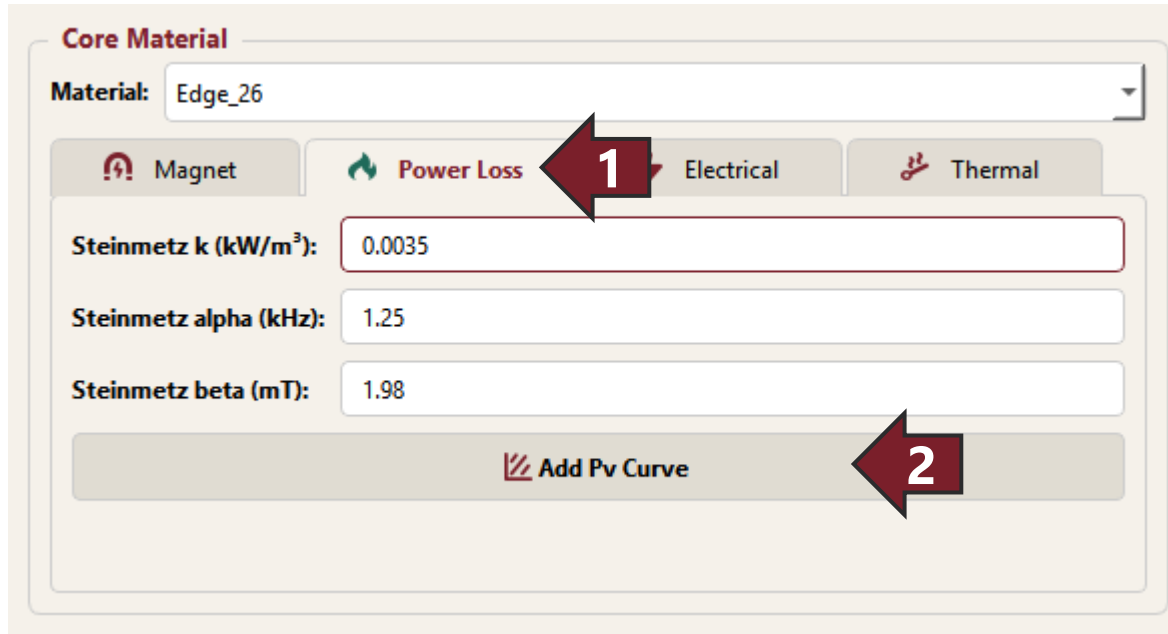
Core Material Configuration:

- Conductivity: 0
- Add Permeability(f) Curve
- Permeability(f) from Internal-Database

Material: **Edge_26**

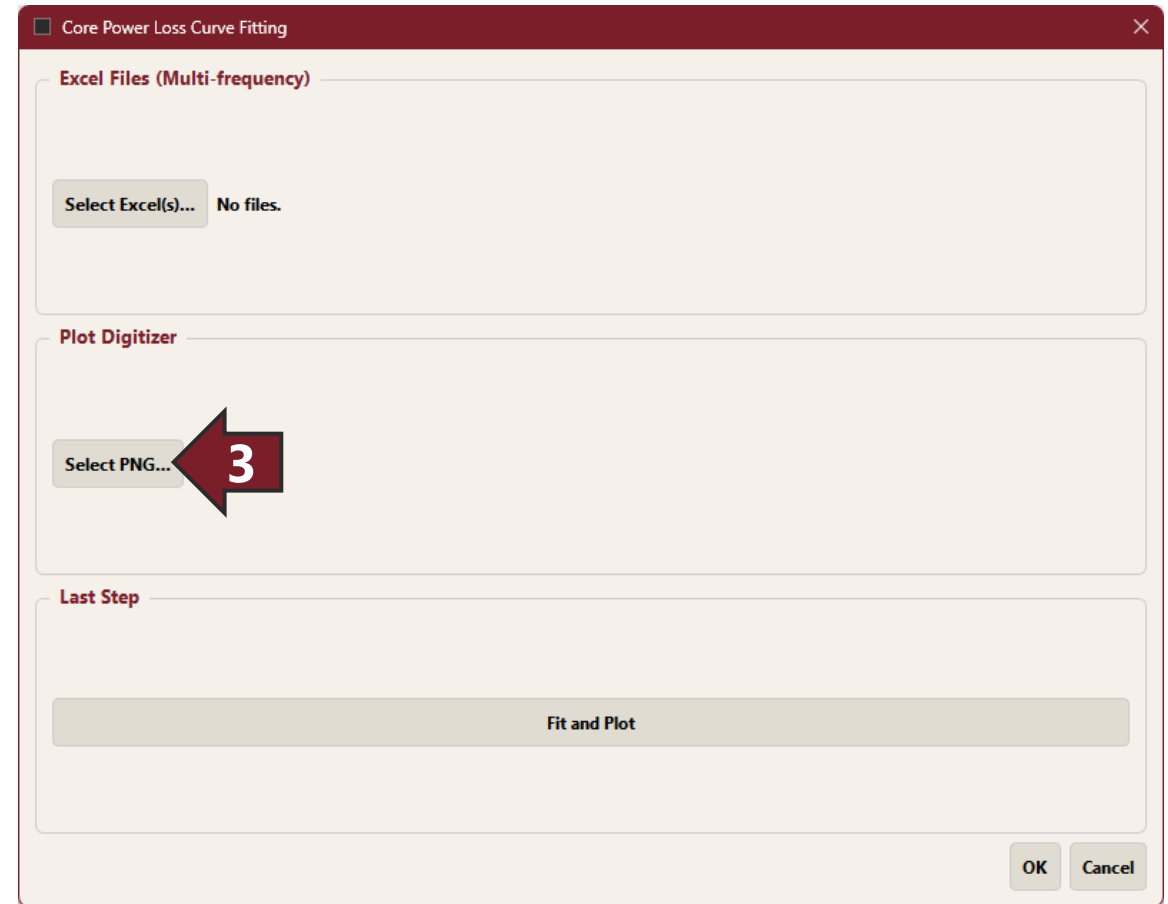
Design Configuration

Core Material Power Losses (I)



This is already characterized, but lets see how would we do it manually.

- 1 Power loss tab
- 2 Add Pv Curve
- 3 Plot Digitalizer – Select PNG



Design Configuration

Core Material Power Losses (II)

Fit $P_v(B)$ from image (log-log) ✕

B min [mT] (X):

B max [mT] (X):

P_v min [kW/m³] (Y):

P_v max [kW/m³] (Y):

Load imagen...

Calibrate (3 clicks)

Add Curve (Freq)

Delete Selected Curve

Accept and Close

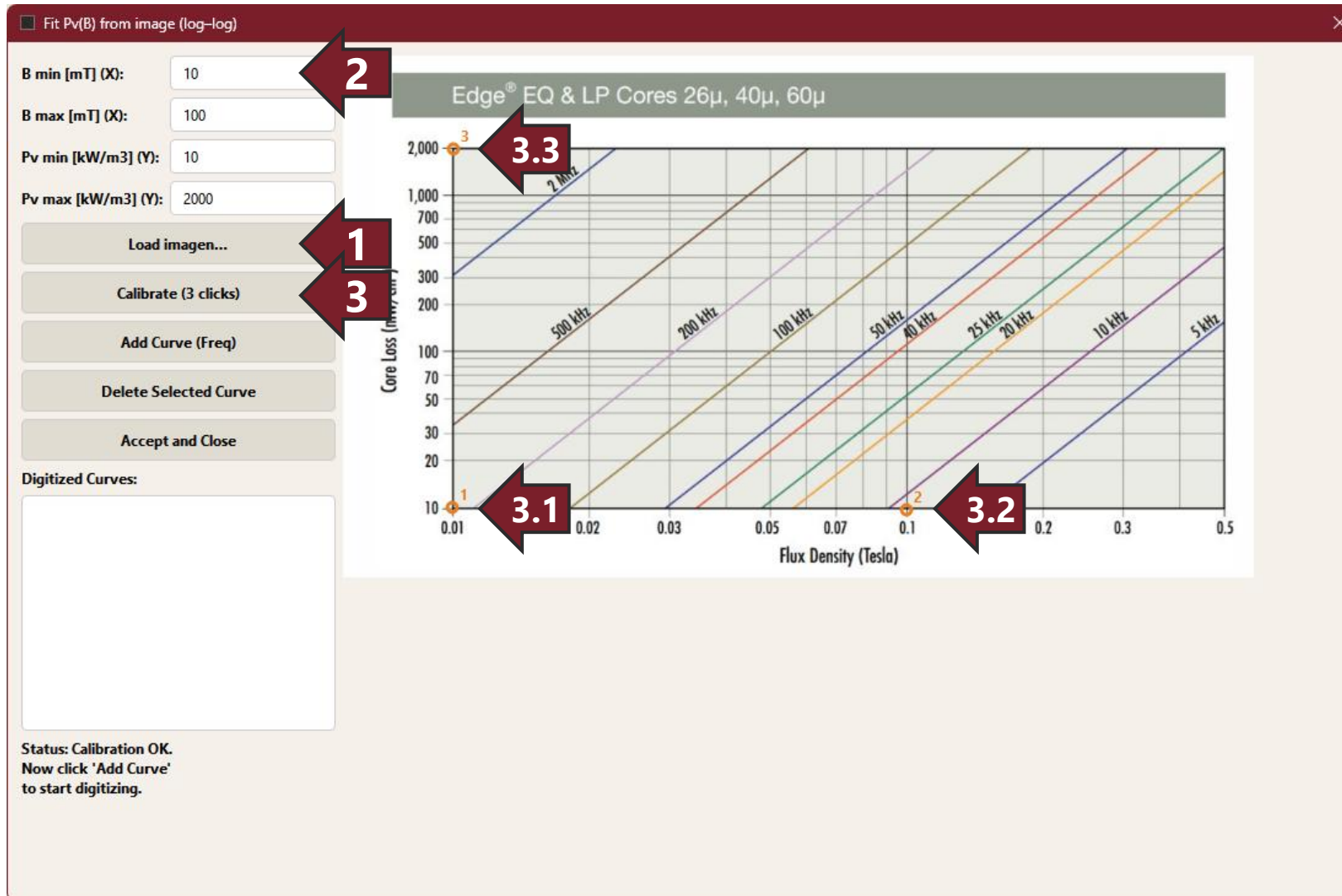
Digitized Curves:

Status: no image.

DIGITALIZE PLOTS

Design Configuration

Core Material Power Losses (III)

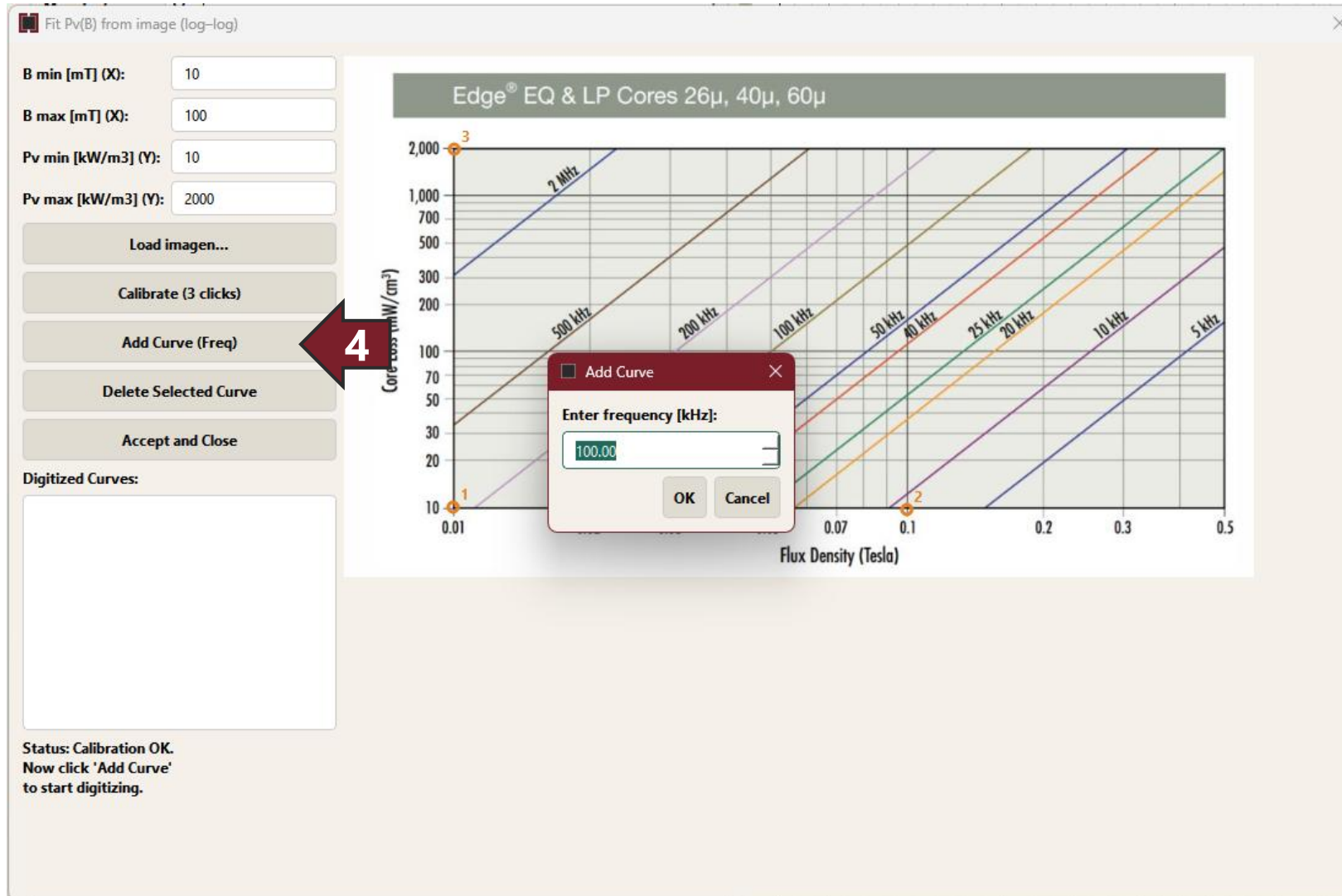


DIGITALIZE PLOTS

- 1 Load image
- 2 Introduce graph limits
- 3 Calibrate

Design Configuration

Core Material Power Losses (IV)

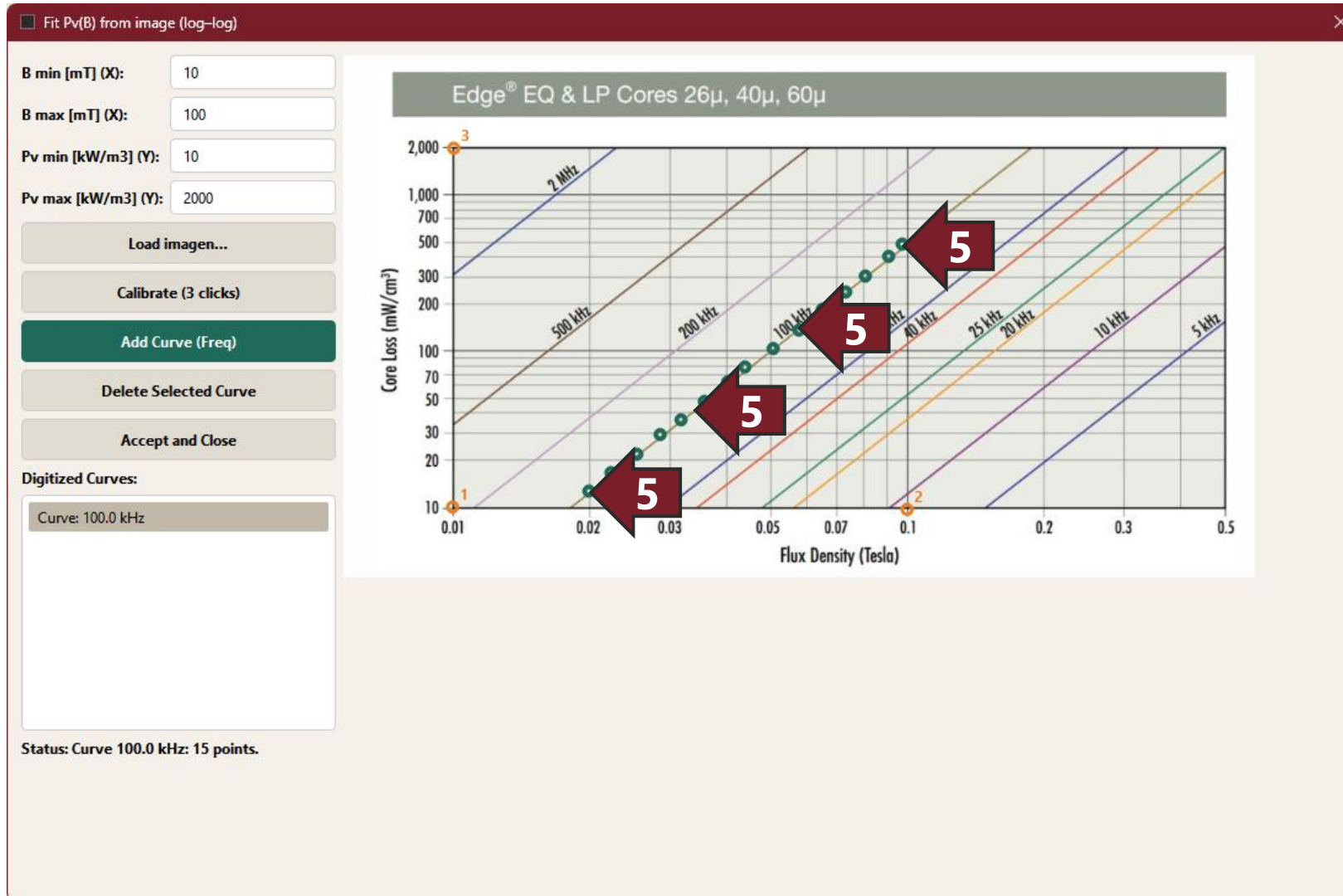


DIGITALIZE PLOTS

- 1 Load image
- 2 Introduce graph limits
- 3 Calibrate
- 4 Add curve

Design Configuration

Core Material Power Losses (V)

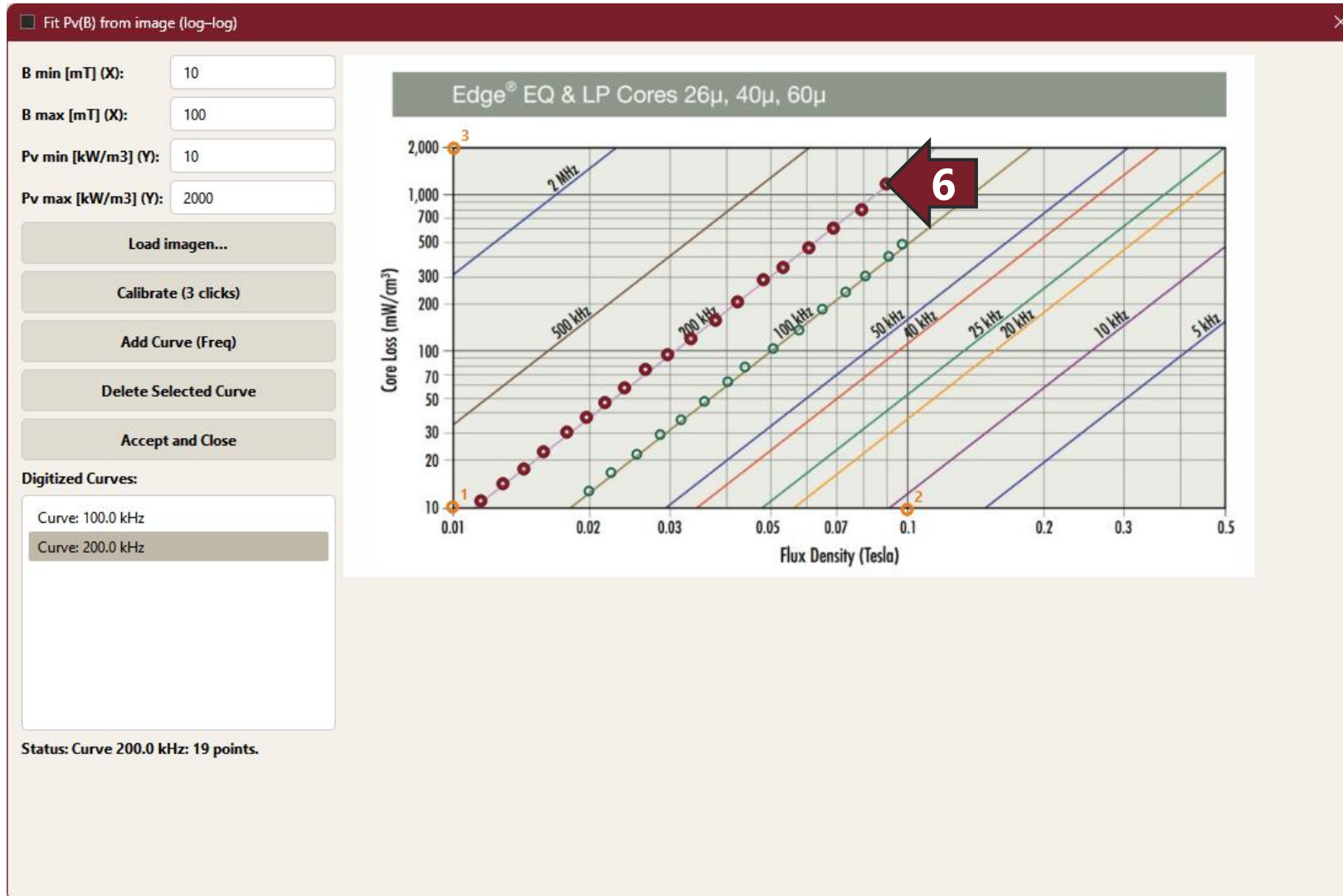


DIGITALIZE PLOTS

- 1 Load image
- 2 Introduce graph limits
- 3 Calibrate
- 4 Add curve
- 5 Click along the curve

Design Configuration

Core Material Power Losses (VI)

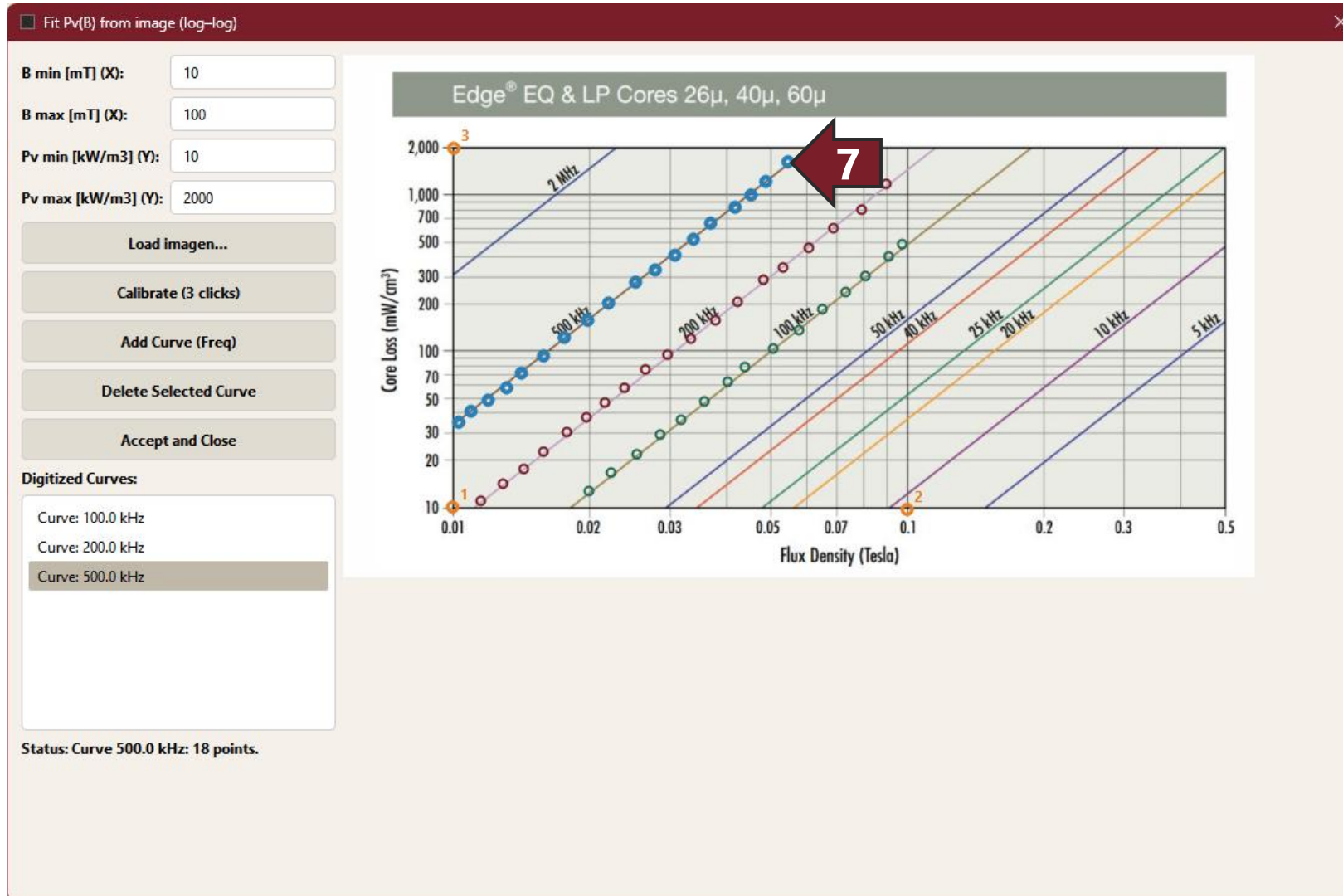


DIGITALIZE PLOTS

- 1 Load image
- 2 Introduce graph limits
- 3 Calibrate
- 4 Add curve
- 5 Click along the curve
- 6 Add more curves

Design Configuration

Core Material Power Losses (VII)

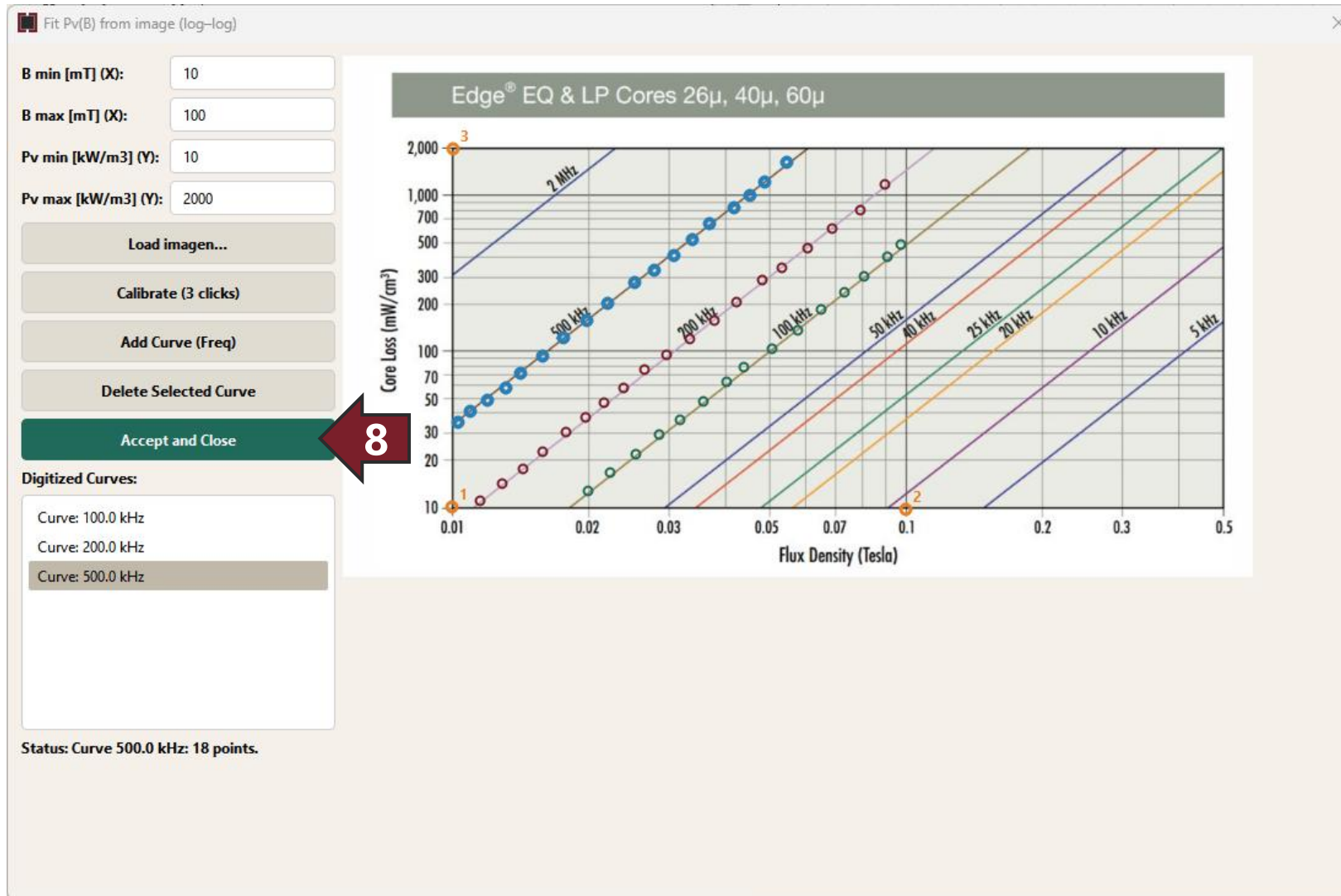


DIGITALIZE PLOTS

- 1 Load image
- 2 Introduce graph limits
- 3 Calibrate
- 4 Add curve
- 5 Click along the curve
- 6 Add more curves
- 7 And more curves!

Design Configuration

Core Material Power Losses (VIII)

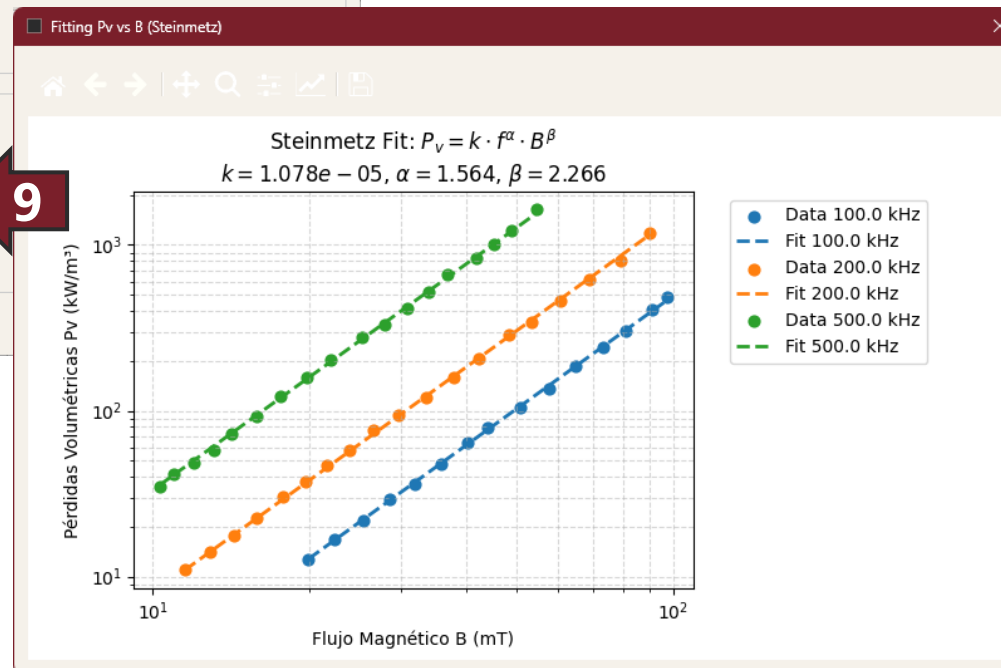
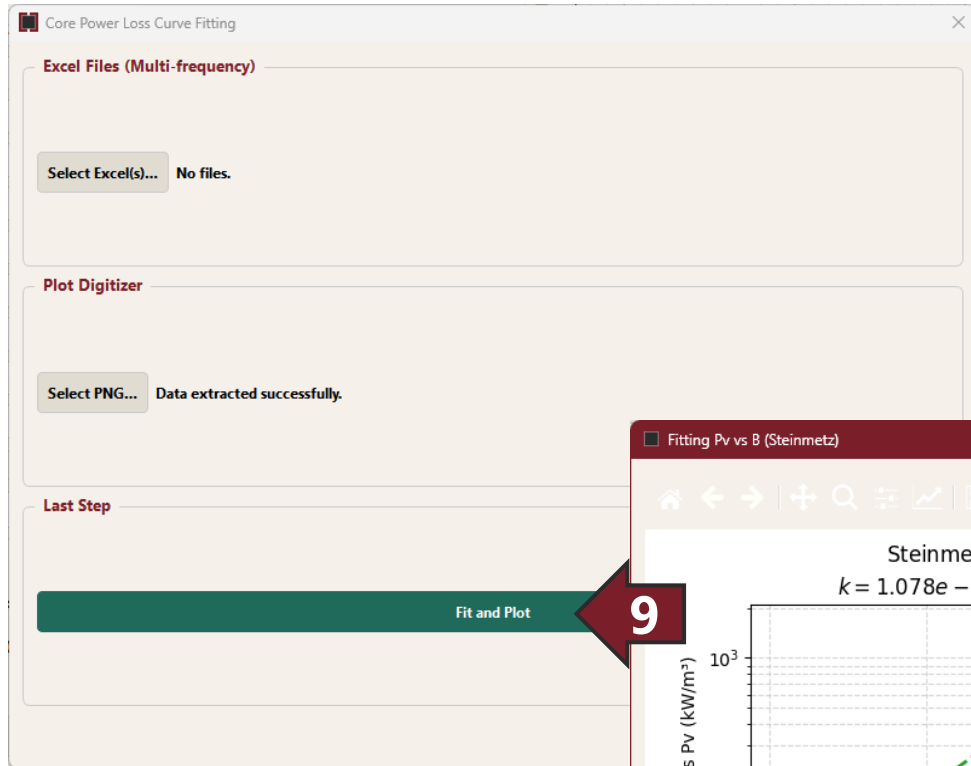


DIGITALIZE PLOTS

- 1 Load image
- 2 Introduce graph limits
- 3 Calibrate
- 4 Add curve
- 5 Click along the curve
- 6 Add more curves
- 7 And more curves!
- 8 Accept and close

Design Configuration

Core Material Power Losses (IX)



DIGITALIZE PLOTS

- 1 Load image
- 2 Introduce graph limits
- 3 Calibrate
- 4 Add curve
- 5 Click along the curve
- 6 Add more curves
- 7 And more curves!
- 8 Accept and close
- 9 Fit and plot

Design Configuration

Winding Geometry

The screenshot displays the MAGNETISIM software interface, specifically the Design Configuration window for Winding Geometry. The window is divided into several sections:

- General Winding:** Conductor Type: PCB
- PCB/Bobbin Geometry:** Left, Center, Right (Center is selected). Clearance XY [mm]: 0, Clearance Z [mm]: 0, Number of Layers: 0, Layer Pitch [mm]: 0.
- Winding Geometry:** Left, Center, Right (Center is selected). Nturns: 0, Copper Thickness [mm]: 0, Width of Copper [mm]: 0, Pitch [mm]: 0, Edge [mm]: 0.
- Winding Material:** Material: Copper. Magnet, Electrical, Thermal (Magnet is selected). Real Permeability: 1, Imag Permeability: 0, Conductivity: 58.

The main workspace shows a 2D plot of a winding geometry on a grid. The plot is a dark blue square with a white square hole in the center. The axes range from -1 to 14 on the x-axis and -12 to 12 on the y-axis. The plot is titled "2D" and "3D" tabs are visible at the top. At the bottom of the plot area, there are buttons for "Export", "Refresh Plot", and "Fit All".

Design Configuration

PCB/Bobbin Geometry

General Winding
Conductor Type: PCB

PCB/Bobbin Geometry
 Left Center Right
Clearance XY [mm]: 0.5
Clearance Z [mm]: 1
Number of Layers: 5
Layer Pitch [mm]: 0

Winding Geometry
 Left Center Right
Nturns: 0
Copper Thickness [mm]: 0
Width of Copper [mm]: 0
Pitch [mm]: 0
Edge [mm]: 0

Winding Material
Material: Copper
 Magnet Electrical Thermal
Real Permeability: 1
Imag Permeability: 0
Conductivity: 58

PCB/Bobbin Geometry	
Clearance XY [mm]	0.5
Clearance Z [mm]	1
Number of Layers	5
Layer Pitch [mm]	0

Design Configuration

PCB Configuration Wizard

The screenshot shows the MAGNETISIM software interface. The 'Tool' menu is open, and the 'PCB Wizard' option is highlighted. A red arrow points to this menu item with the text 'PCB Configuration Wizard'. The main workspace displays a grid with a dark blue square shape, representing a PCB layout. The interface includes several configuration panels on the left:

- General Winding:** Conductor Type: PCB
- PCB/Bobbin Geometry:** Left, Center, Right (Center selected); Clearance XY [mm]: 0.5; Clearance Z [mm]: 1; Number of Layers: 5; Layer Pitch [mm]: 0
- Winding Geometry:** Left, Center, Right (Center selected); Nturns: 0; Copper Thickness [mm]: 0; Width of Copper [mm]: 0; Pitch [mm]: 0; Edge [mm]: 0
- Winding Material:** Material: Copper; Magnet, Electrical, Thermal (Magnet selected); Real Permeability: 1; Imag Permeability: 0; Conductivity: 58

At the bottom of the grid, there are buttons for 'Export', 'Refresh Plot', and 'Fit All'.

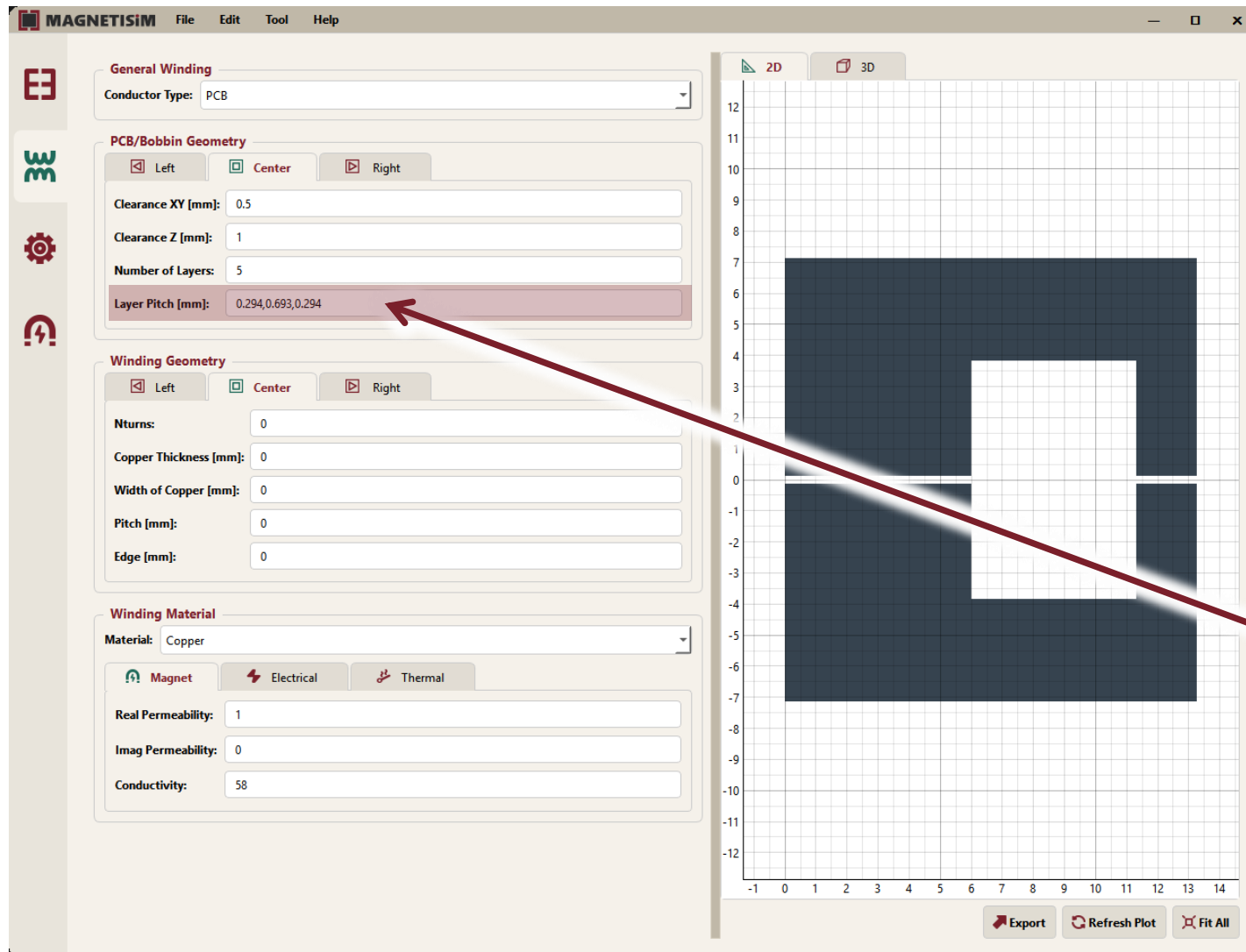
The screenshot shows the 'PCB Configuration Wizard' dialog box. It contains the following input fields and a button:

- PCB Thickness [mm]: 2.1
- Number of layers: 6
- Layer Pitch [mm]: 0.2940
- Copper Thickness [mm]: 0.105
- Calculate Missing Value (button)

Below the input fields is a section titled 'Representative Stackup Plot' which shows a cross-section of the PCB stackup with alternating layers of dark green and dark red.

Design Configuration

Vector Inputs



PCB/Bobbin Geometry	
Clearance XY [mm]	0.5
Clearance Z [mm]	1
Number of Layers	5
Layer Pitch [mm]	0.294, 0.693, 0.294



Design Configuration

Clearance Adjustment

The screenshot shows the MAGNETISIM software interface with the following configuration parameters:

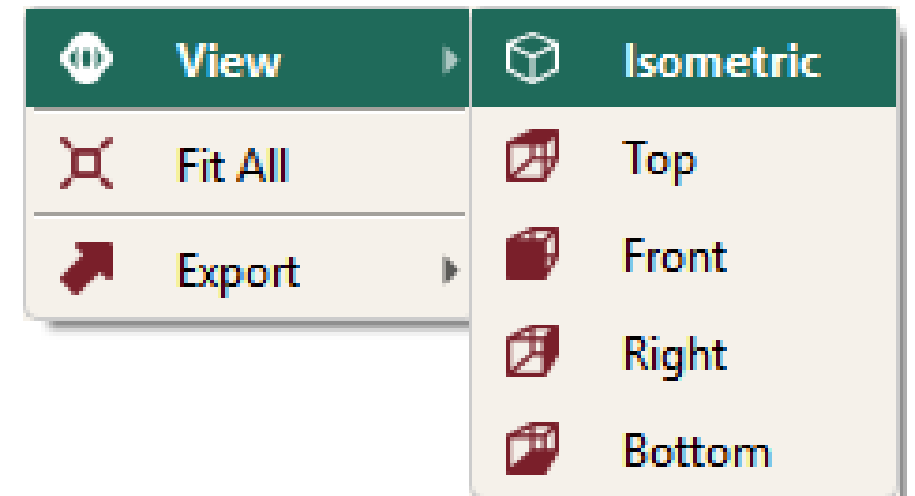
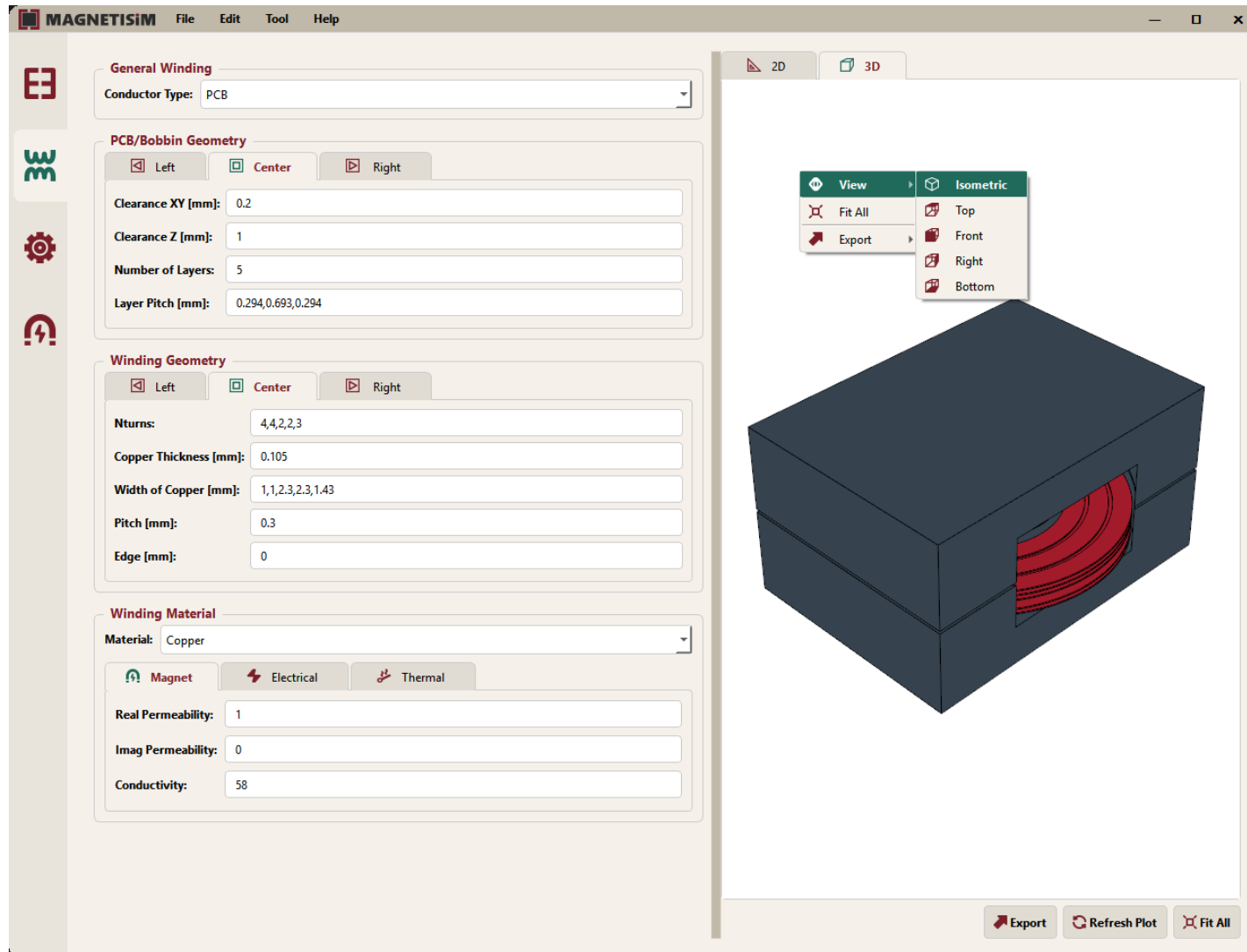
- General Winding:** Conductor Type: PCB
- PCB/Bobbin Geometry:**
 - Left: Center: Right:
 - Clearance XY [mm]: 0.2
 - Clearance Z [mm]: 1
 - Number of Layers: 5
 - Layer Pitch [mm]: 0.294, 0.693, 0.294
- Winding Geometry:**
 - Left: Center: Right:
 - Nturns: 4,4,2,2,3
 - Copper Thickness [mm]: 0.105
 - Width of Copper [mm]: 1,1,2,3,2,3,1,43
 - Pitch [mm]: 0.3
 - Edge [mm]: 0
- Winding Material:** Material: Copper
 - Magnet: Electrical: Thermal:
 - Real Permeability: 1
 - Imag Permeability: 0
 - Conductivity: 58

The central plot area shows a 2D grid with a white rectangular region containing red horizontal lines representing the winding geometry. The axes range from -8 to 4 on the y-axis and 4 to 12 on the x-axis.

PCB/Bobbin Geometry	
Clearance XY [mm]	0.2
Clearance Z [mm]	1
Number of Layers	5
Layer Pitch [mm]	0.294, 0.693, 0.294

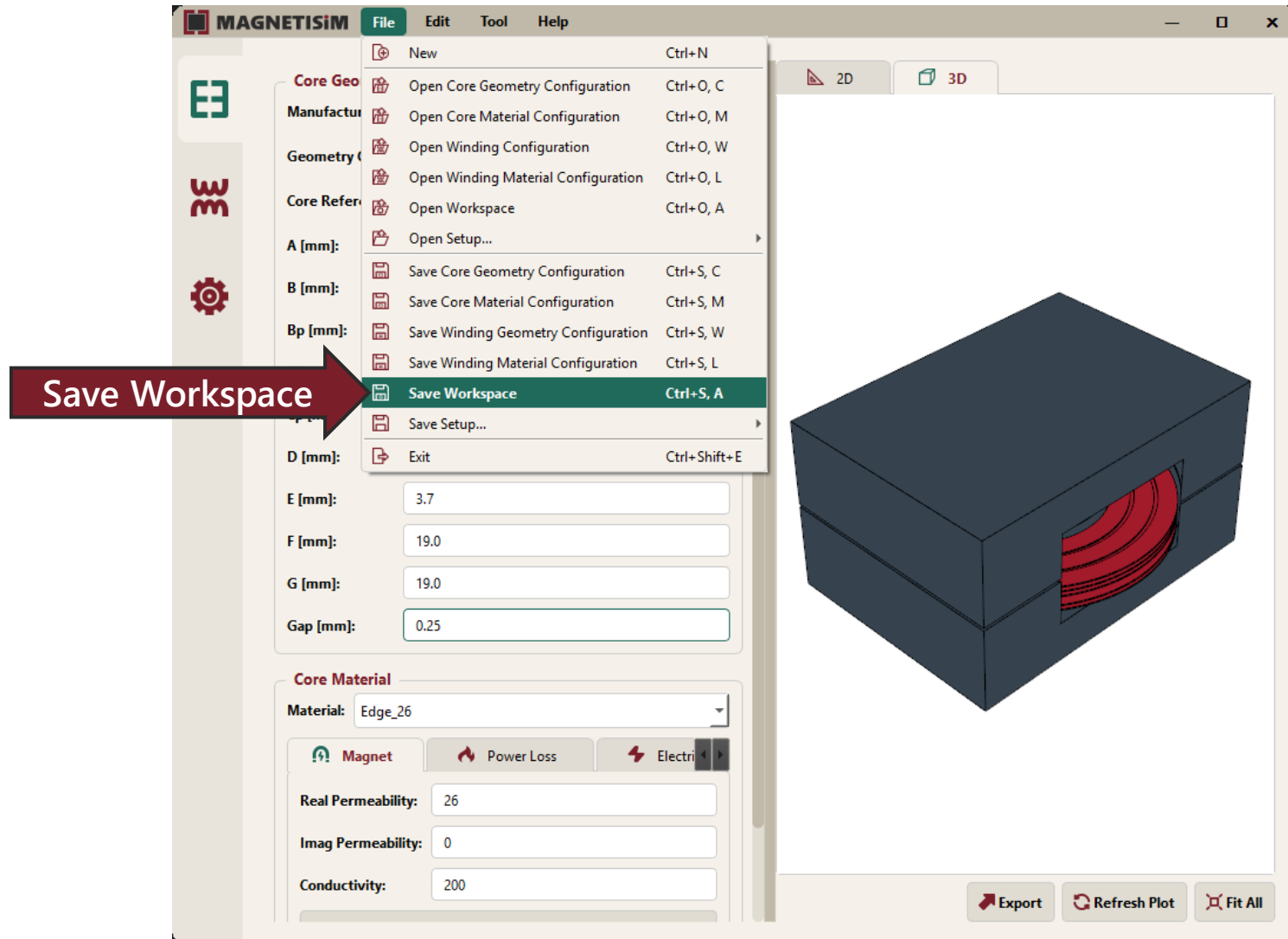
Design Configuration

3D Viewer Options



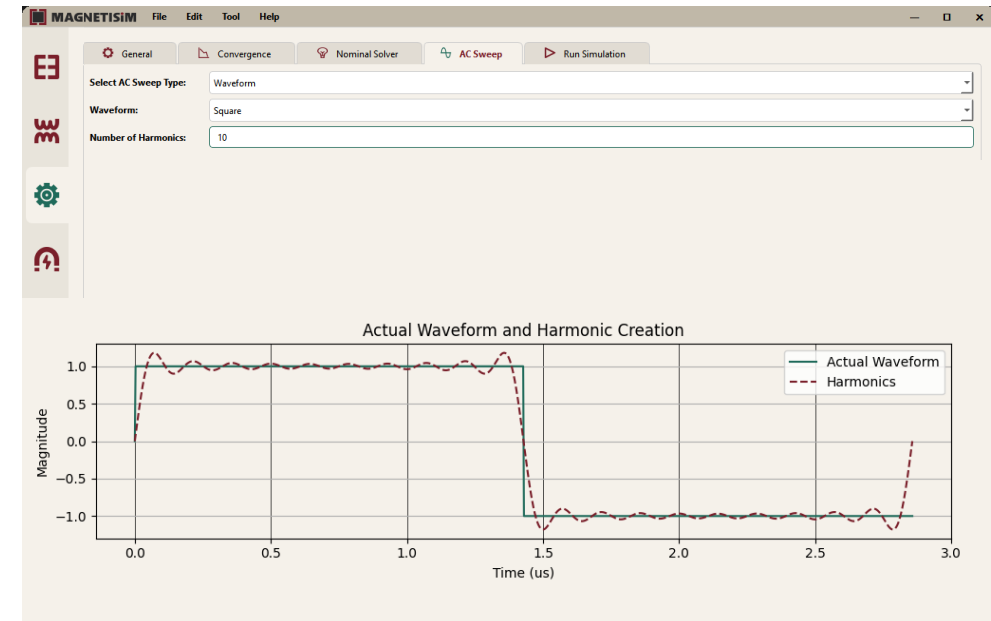
Design Configuration

Save the Design



Simulation Setup

The screenshot displays the MAGNETISIM software interface with three stacked windows. The top window shows the 'General' tab with 'Name Simulation' set to 'MAGNETISIM_file' and simulation type options: 'Magnetic Field Simulation' (checked), 'Electric Field Simulation', and 'Thermal Simulation'. The middle window shows the 'Convergence' tab for 'Magnetic Field Simulation' with 'Max Error [%]' set to '1e-08'. The bottom window shows the 'Nominal Solver' tab with 'Nominal Frequency [kHz]' set to '350'. A red arrow points to this field with the text '350 (kHz)'.



AC Sweep

Select AC Sweep Type	Waveform
Waveform	Square
Number of Harmonics	10

Simulation Setup

Harmonic Wizard (I)

The screenshot displays the MAGNETISIM software interface with the Harmonic Wizard tool active. The main window shows the 'General' tab with the following settings:

- Select AC Sweep Type: Harmonic Wizard
- Sim Sweep Type: List
- Vector of Frequencies [kHz]: 1,3,5
- Include Nominal Frequency:
- Frequency/Waveform Plot: Simulation Frequency

The 'Frequency/Waveform Plot' shows a plot of Simulation Frequency (kHz) from 0 to 250. A red dot is positioned at 0 kHz.

The 'Harmonic Wizard' dialog box is open, showing the following configuration:

- Waveform type: Square
- Nominal Freq.: 350,00 kHz
- Peak Voltage: 40,00 V
- Num. Harmonics: 6 harmonics
- Duty Cycle: 40,00 %

The dialog box contains two plots:

- Time Domain Signal (Superposition):** A plot showing the Ideal Waveform (green) and Reconstructed (red) signals over time (us). The Ideal Waveform is a square wave with a peak voltage of 40V and a duty cycle of 40%. The Reconstructed signal is a superposition of the ideal waveform and its harmonics, showing a smoother transition.
- Frequency Spectrum (6 Harmonics):** A plot showing the frequency spectrum of the reconstructed signal. The x-axis is Frequency [kHz] (0 to 2000) and the y-axis is Peak Amplitudes (V) (0 to 50). The spectrum shows a dominant peak at 350 kHz and six other harmonics at 700, 1050, 1400, 1750, and 2100 kHz.

The dialog box also displays the following data:

- Frequencies (kHz): 350.00, 700.00, 1050.00, 1400.00, 1750.00, 2100.00
- Peak Amplitudes (V): 48.4394, 14.9614, 9.9850, 12.1068, 0.0080, 8.0753

A 'Close' button is located at the bottom right of the dialog box.

Simulation Setup

Harmonic Wizard (II)

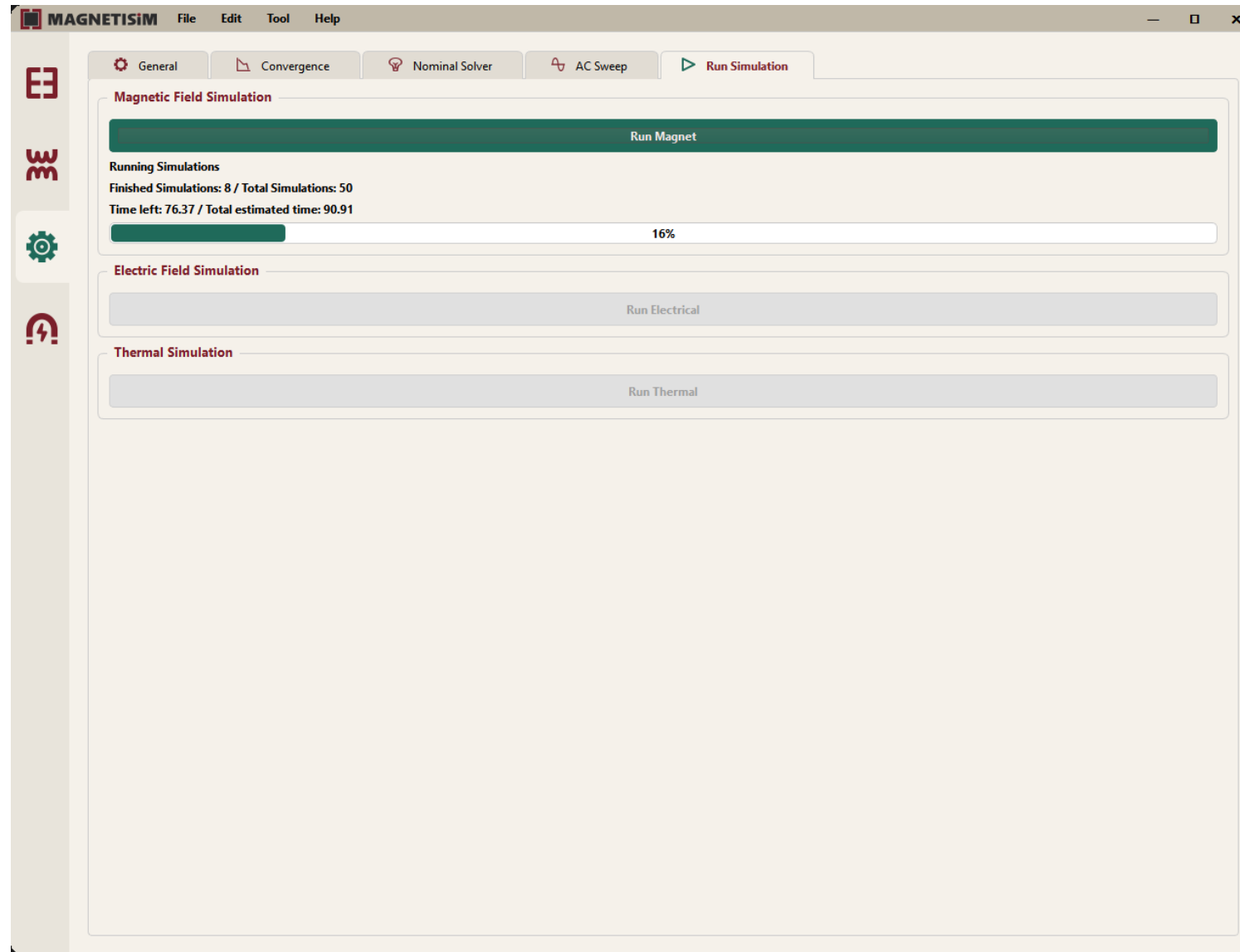
Also add: **1,10,100,150**

The screenshot shows the MAGNETISIM software interface with the Harmonic Wizard dialog box open. The dialog box is titled "Harmonic Wizard" and contains the following settings:

- Waveform Configuration:
 - Waveform type: Square
 - Nominal Freq.: 350,00 kHz
 - Peak Voltage: 40,00 V
 - Num. Harmonics: 6 harmonics
 - Duty Cycle: 40,00 %

The "Vector of Frequencies [kHz]" field in the main window contains the list: 1, 10, 50, 100, 150, 350.00, 700.00, 1050.00, 1400.00, 1750.00, 2100.00. A red arrow labeled "Ctrl+V" points to this field. The "Frequency/Waveform Plot" shows a plot of simulation frequency with red dots at the specified frequencies. The "Time Domain Signal (Superposition)" plot shows the ideal square wave (green) and the reconstructed signal (red). The "Frequency Spectrum (6 Harmonics)" plot shows the amplitude spectrum with peaks at the specified frequencies. A red arrow labeled "Ctrl+C" points to the "Frequencies (kHz)" field in the dialog box, which contains the list: 350.00, 700.00, 1050.00, 1400.00, 1750.00, 2100.00.

Run Magnet Simulation



Results Postprocessing

Matrix Viewer

The screenshot displays the MAGNETISIM software interface. On the left, the 'Winding Expression' panel shows five winding components labeled w1 through w5. The main area on the right is the 'Matrix Viewer' tab, which displays the following settings and results:

Matrix Results
Visualizer Mode: Matrix @ Freq
Selected Frequency: 350.00 kHz
Matrix Type: Z
Units: Ohm
N Decimals: 2

	w1	w2	w3	w4	w5
w1	(0.17+4.68j)	(0.13+4.55j)	(0.06+2.15j)	(0.06+2.1j)	(0.09+3.06j)
w2	(0.13+4.55j)	(0.17+4.6j)	(0.07+2.17j)	(0.06+2.12j)	(0.09+3.09j)
w3	(0.06+2.15j)	(0.07+2.17j)	(0.04+1.11j)	(0.03+1.08j)	(0.05+1.58j)
w4	(0.06+2.1j)	(0.06+2.12j)	(0.03+1.08j)	(0.04+1.1j)	(0.05+1.6j)
w5	(0.09+3.06j)	(0.09+3.09j)	(0.05+1.58j)	(0.05+1.6j)	(0.09+2.44j)

Buttons at the bottom right: Export CSV, SPICESIM Gen

Results Postprocessing

Winding Connections

The screenshot displays the MAGNETISIM software interface. The main window is titled "Winding Expression" and contains a "Reset" button and a large empty workspace. Below the workspace, five winding components labeled w1 through w5 are shown. A context menu is open over w3, offering "Define a Series connection" and "Define a Parallel connection".

The "Matrix Viewer" window is active, showing the following settings:

- Visualizer Mode: Matrix @ Freq
- Selected Frequency: 350.00 kHz
- Matrix Type: Z
- Units: Ohm
- N Decimals: 2

The matrix results are displayed in the following table:

	w1	w2	w3	w4	w5
w1	(0.17+4.68j)	(0.13+4.55j)	(0.06+2.15j)	(0.06+2.1j)	(0.09+3.06j)
w2	(0.13+4.55j)	(0.17+4.6j)	(0.07+2.17j)	(0.06+2.12j)	(0.09+3.09j)
w3	(0.06+2.15j)	(0.07+2.17j)	(0.04+1.11j)	(0.03+1.08j)	(0.05+1.58j)
w4	(0.06+2.1j)	(0.06+2.12j)	(0.03+1.08j)	(0.04+1.1j)	(0.05+1.6j)
w5	(0.09+3.06j)	(0.09+3.09j)	(0.05+1.58j)	(0.05+1.6j)	(0.09+2.44j)

Buttons for "Export CSV" and "SPICESIM Gen" are located at the bottom of the Matrix Viewer window.

Results Postprocessing

Matrix View @ Frequency

Winding Expression

Reset

w3 w4 w5 (w1+w2)

Matrix Results

Visualizer Mode: Matrix @ Freq

Selected Frequency: 350.00 kHz

Matrix Type: L

Units: uH

N Decimals: 2

	w3	w4	w5	(w1+w2)
w3	0.51	0.49	0.72	1.97
w4	0.49	0.5	0.73	1.92
w5	0.72	0.73	1.11	2.8
(w1+w2)	1.97	1.92	2.8	8.36

Export CSV SPICESIM Gen

Matrix Results

Visualizer Mode: Matrix @ Freq

Selected Frequency: 350.00 kHz

Matrix Type: R

Units: Ohm

N Decimals: 2

	w3	w4	w5	(w1+w2)
w3	0.04	0.03	0.05	0.13
w4	0.03	0.04	0.05	0.13
w5	0.05	0.05	0.09	0.19
(w1+w2)	0.13	0.13	0.19	0.61

Export CSV SPICESIM Gen

Results Postprocessing

Matrix View vs Frequency

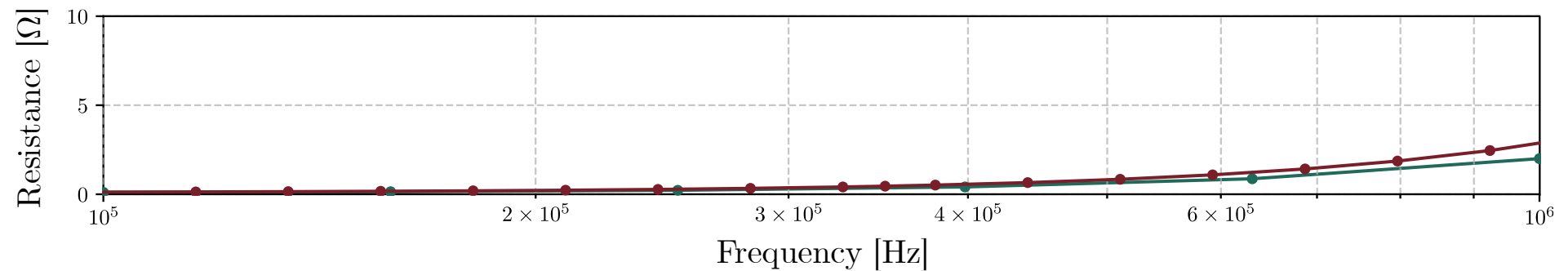
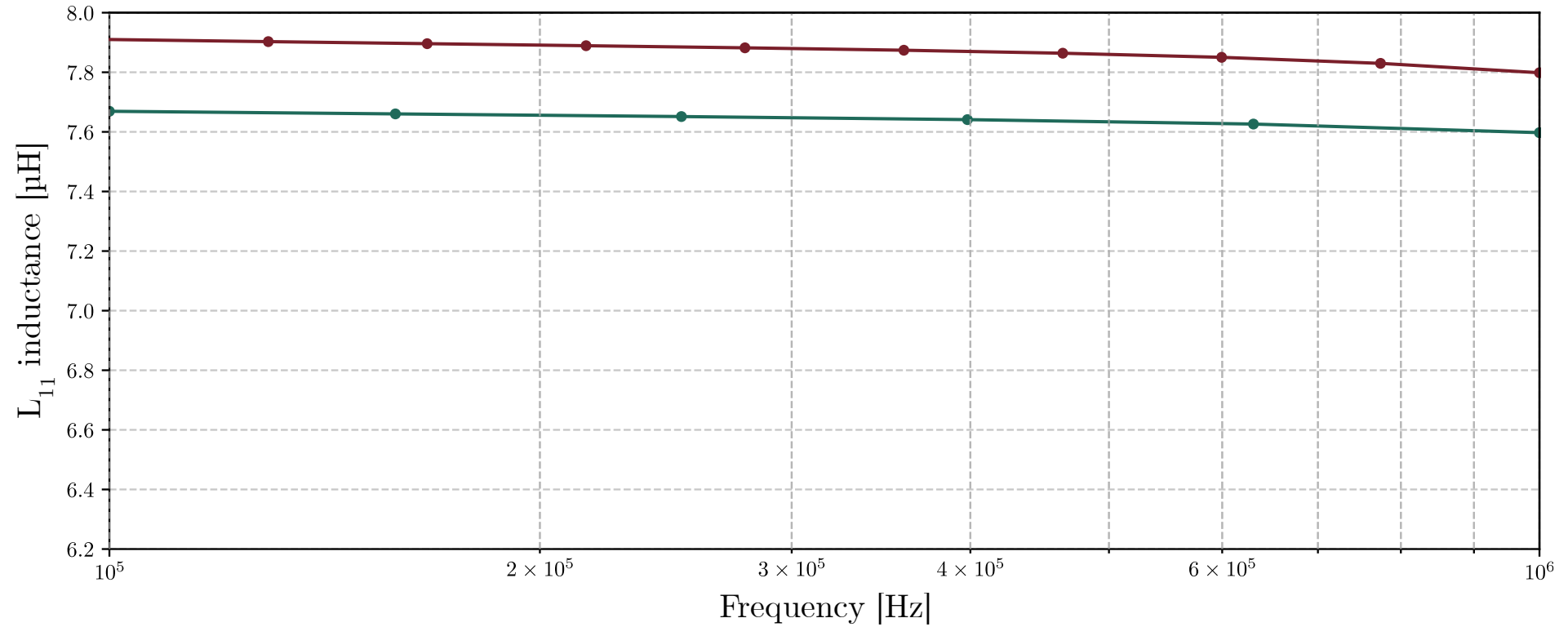
The screenshot displays the MAGNETISIM interface with the following components:

- Winding Expression:** A panel on the left with a 'Reset' button and a workspace containing four winding symbols labeled w2, w4, w5, and (w1+w2).
- Matrix Viewer (Left):** Shows 'Matrix Results' for 'Lmag' in 'uH' units. The plot shows 'Lmag_4_4' vs 'Freq [Hz] (x1e+06)'. The y-axis ranges from 6.0 to 8.0 uH, and the x-axis has a marker at 1M Hz. The curve starts at approximately 8.1 uH at 1M Hz and decreases to about 6.1 uH.
- Matrix Viewer (Right):** Shows 'Matrix Results' for 'Lik' in 'uH' units. The plot shows 'Lik_4_4' vs 'Freq [Hz] (x1e+06)'. The y-axis ranges from 0.64 to 0.70 uH, and the x-axis has a marker at 1M Hz. The curve starts at approximately 0.70 uH at 1M Hz and decreases to about 0.64 uH.

Results Postprocessing

MAGNETISiM vs Ansys

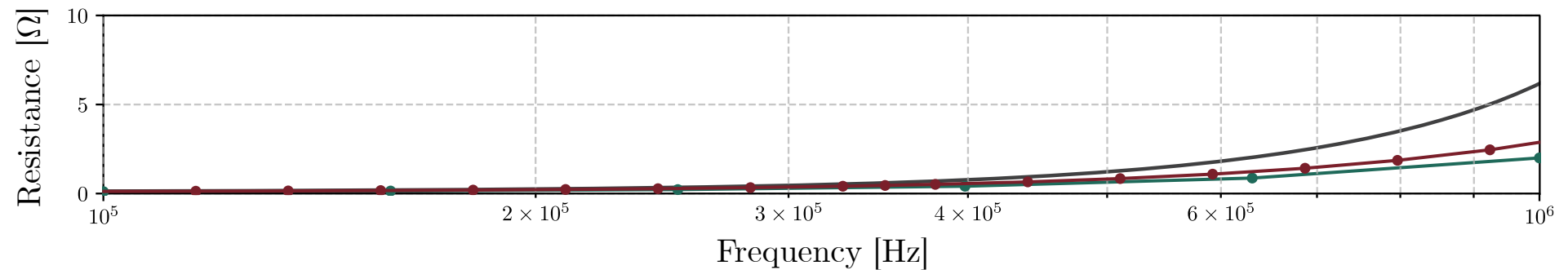
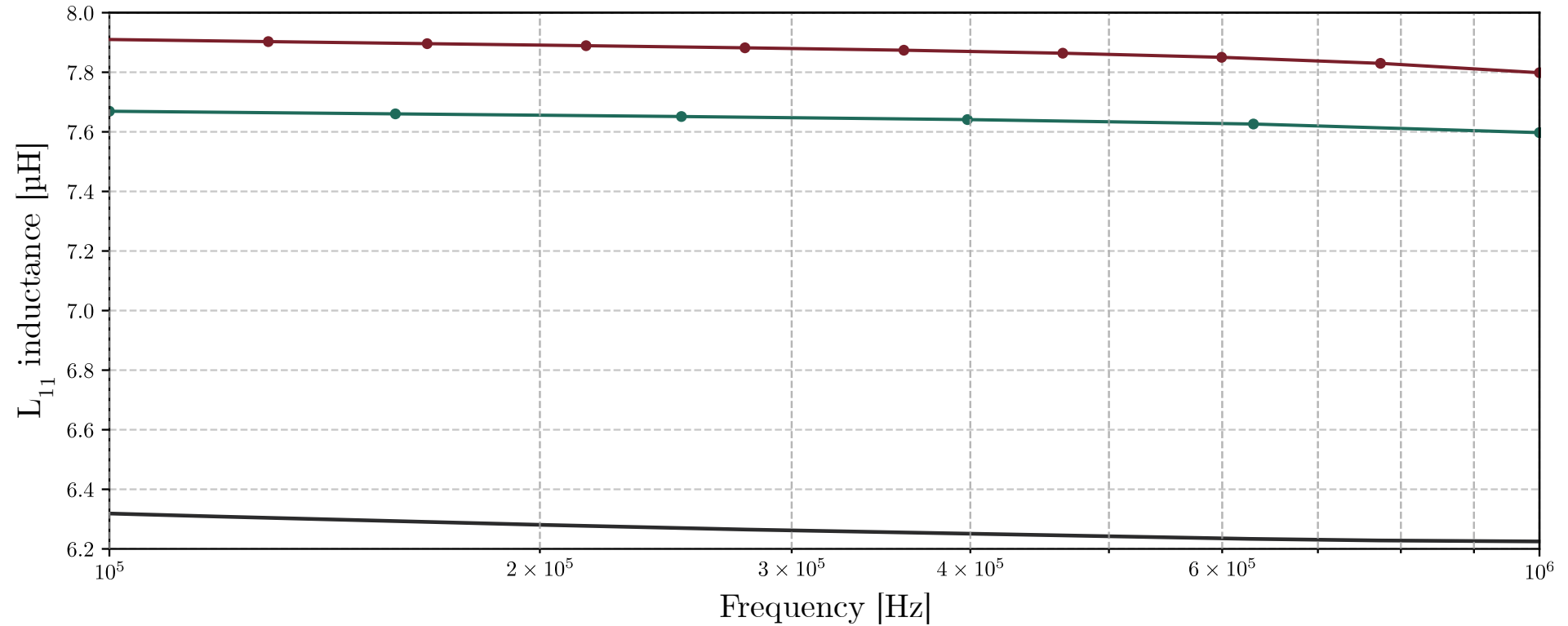
— MAGNETISiM (2D) — Ansys (3D)



Results Postprocessing

MAGNETISiM vs Prototype

— MAGNETISiM (2D) — Ansys (3D) — Experimental



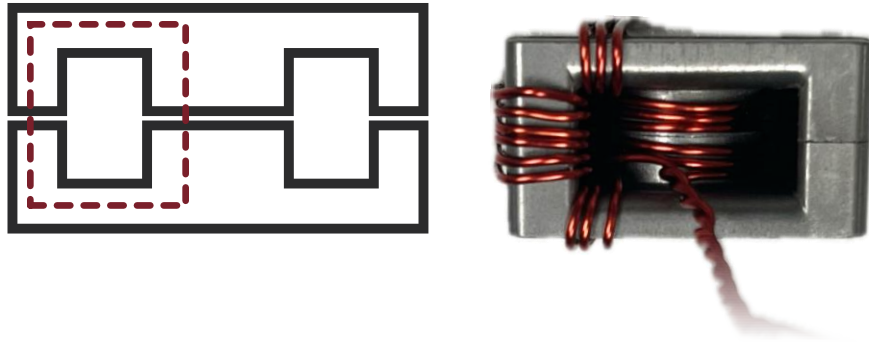
Prototype Validation

MAGNETISiM vs the World (II)



A. Ferrer López and A. Delgado Expósito, "Methodology for the Design of a Planar Transformer for an Active Clamp Flyback Converter," in *Proc. 32nd Annual Seminar on Automation, Industrial Electronics and Instrumentation (SAAEI 2025)*, Aranjuez, Spain, Jul. 2025.

PERMEABILITY MEASUREMENT



$$\mathcal{R} = \frac{l}{A \cdot \mu_0 \mu_r} \quad L = \frac{N^2}{\mathcal{R}}$$



- Force flux direction
- Equivalent reluctance model
- Permeability extraction

$$L_{11} @ \mu_r = 26$$

Simulation	7.87 μH
Measurement ($\mu_r=20$)	6.26 μH
	+26% error

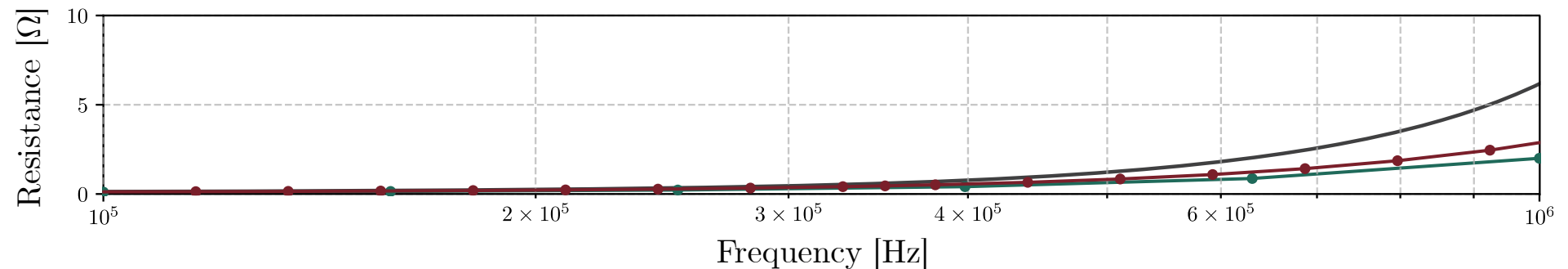
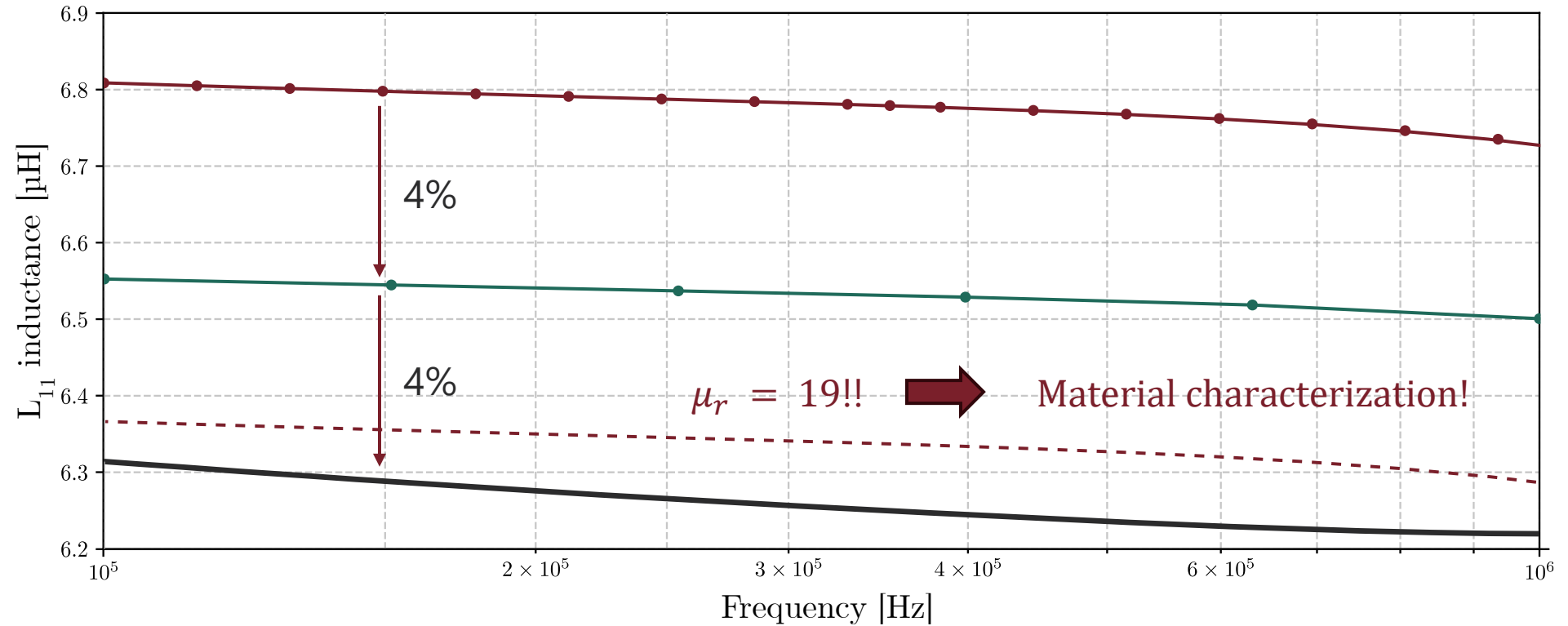
$$L_{11} @ \mu_r = 20$$

Simulation	6.77 μH
Measurement	6.26 μH
	+8% error

Results Postprocessing

MAGNETISiM vs Ansys

— MAGNETISiM (2D) — Ansys (3D) — Experimental



Results Postprocessing

SPICESiM (I)

Matrix Results
Visualizer Mode:
Matrix @ Freq
Selected Frequency:
350.00 kHz
Matrix Type:
R
Units:
Ohm
N Decimals:
2

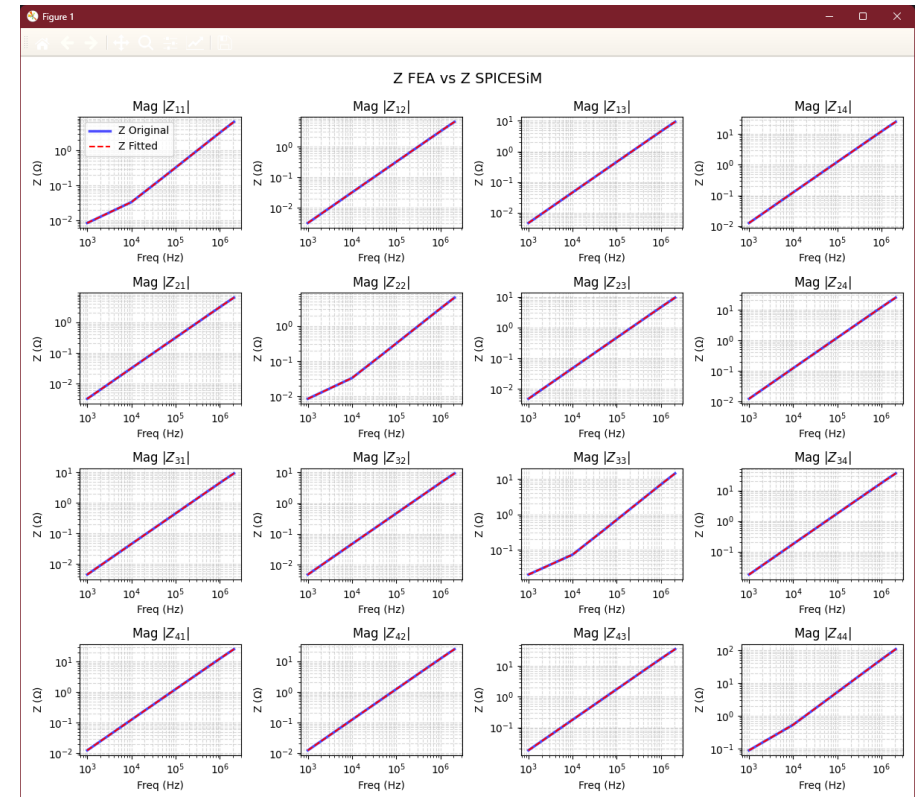
	w3	w4	w5	(w1+w2)
w3	0.04	0.03	0.05	0.13
w4	0.03	0.04	0.05	0.13
w5	0.05	0.05	0.09	0.19
(w1+w2)	0.13	0.13	0.19	0.61

SPICESiM Gen

Success

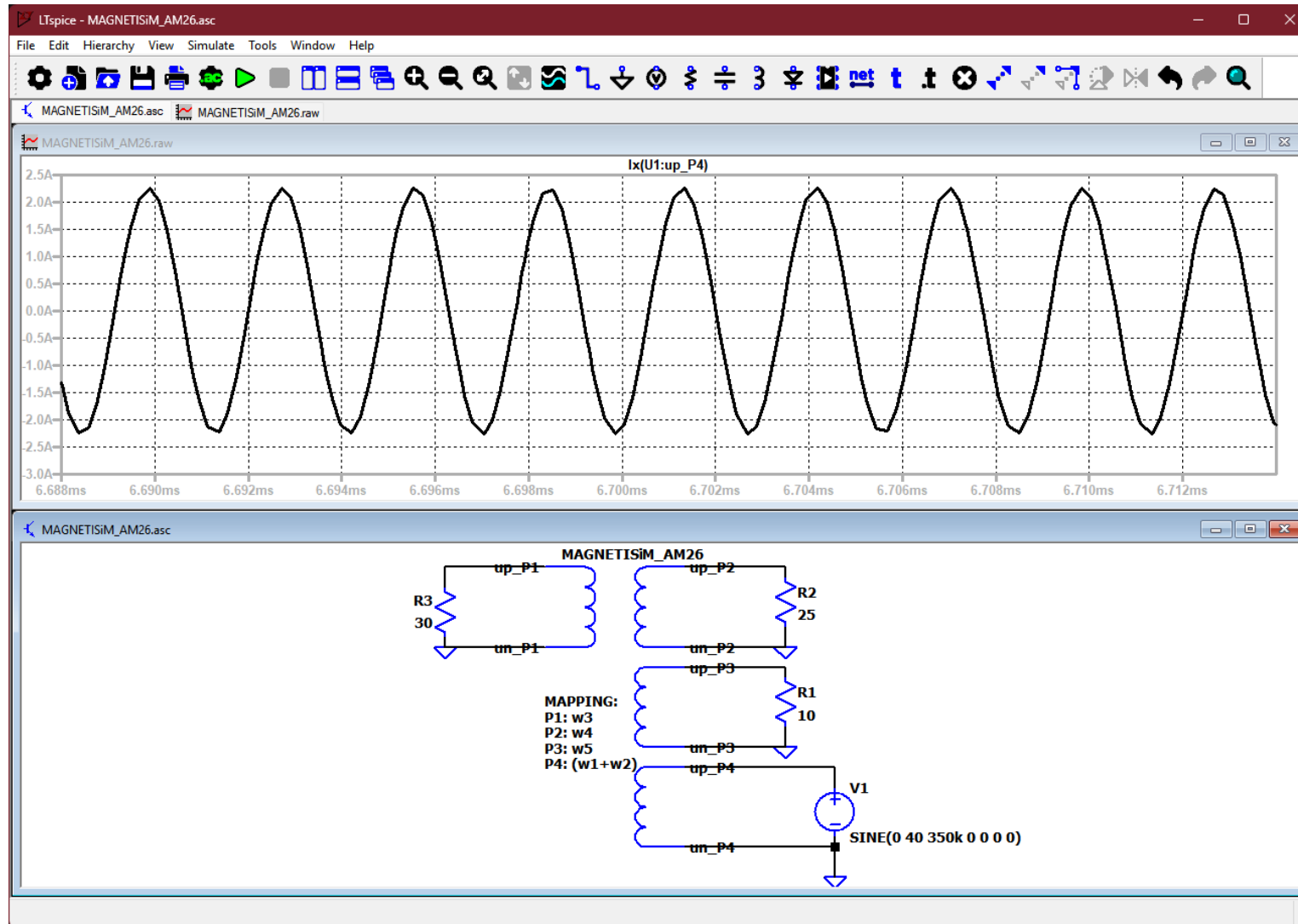
SPICESiM model 'MAGNETISiM_AM26' for LTSpice saved successfully in:
D:/OneDrive - Universidad Polit cnica de Madrid/04. Projects/
2026_MAGNETISiM/07_Doc/AnnualMeeting2026/DataNeeded

OK



Results Postprocessing

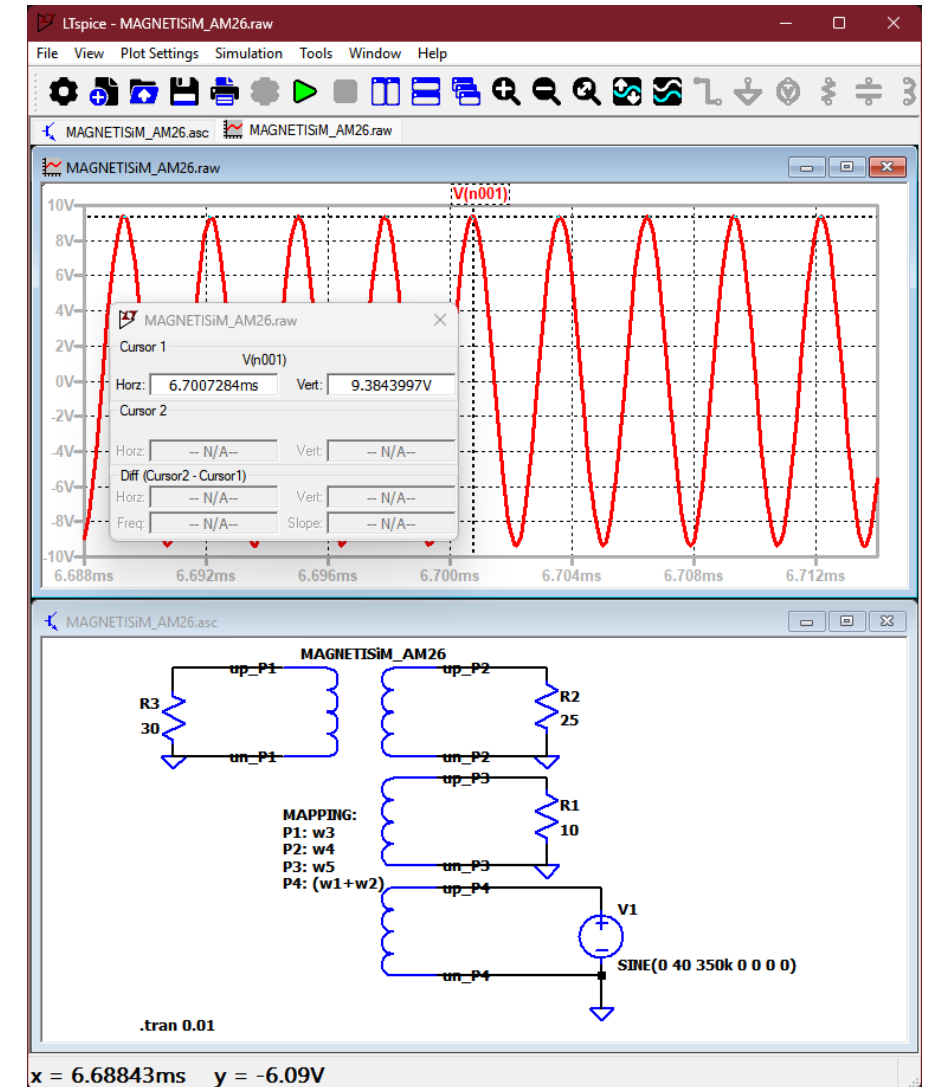
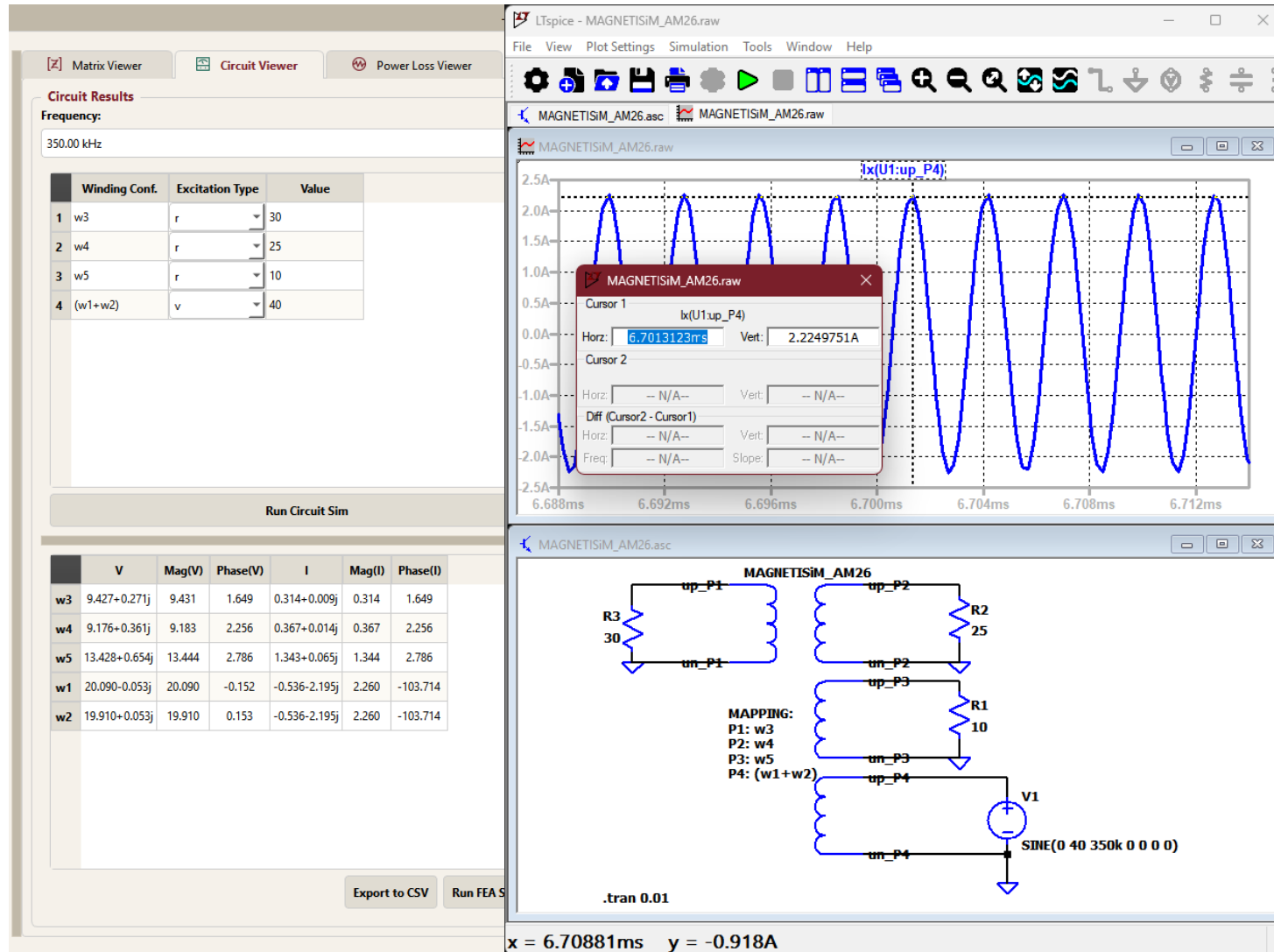
SPICESiM (II)



- AC analysis
- Transient analysis

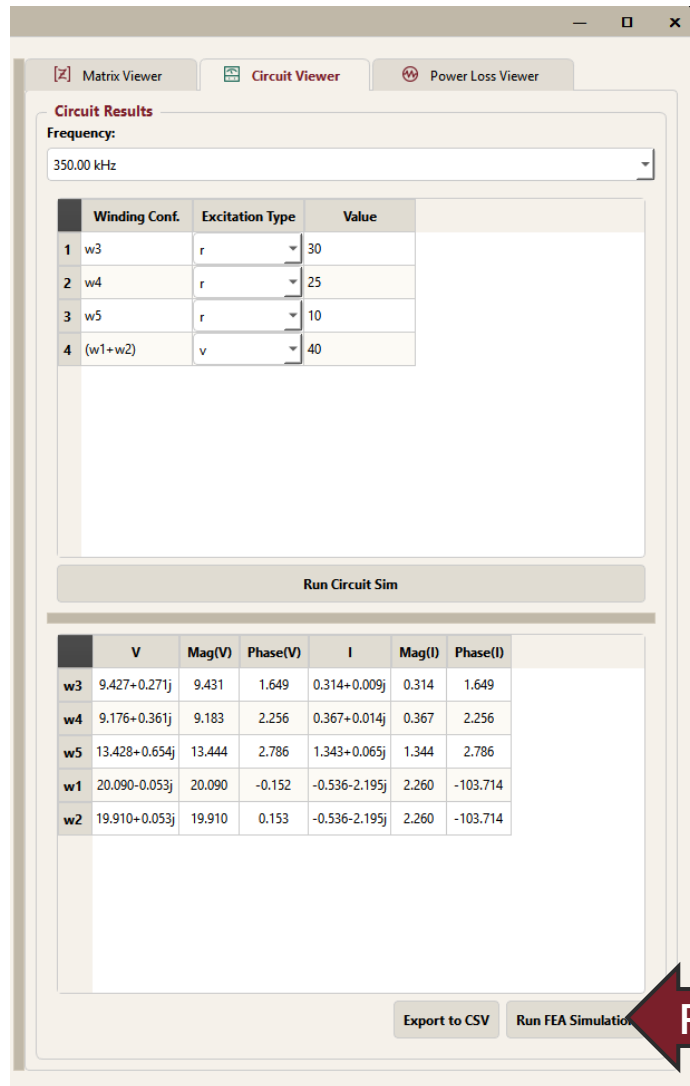
Results Postprocessing

Circuit Viewer (I)

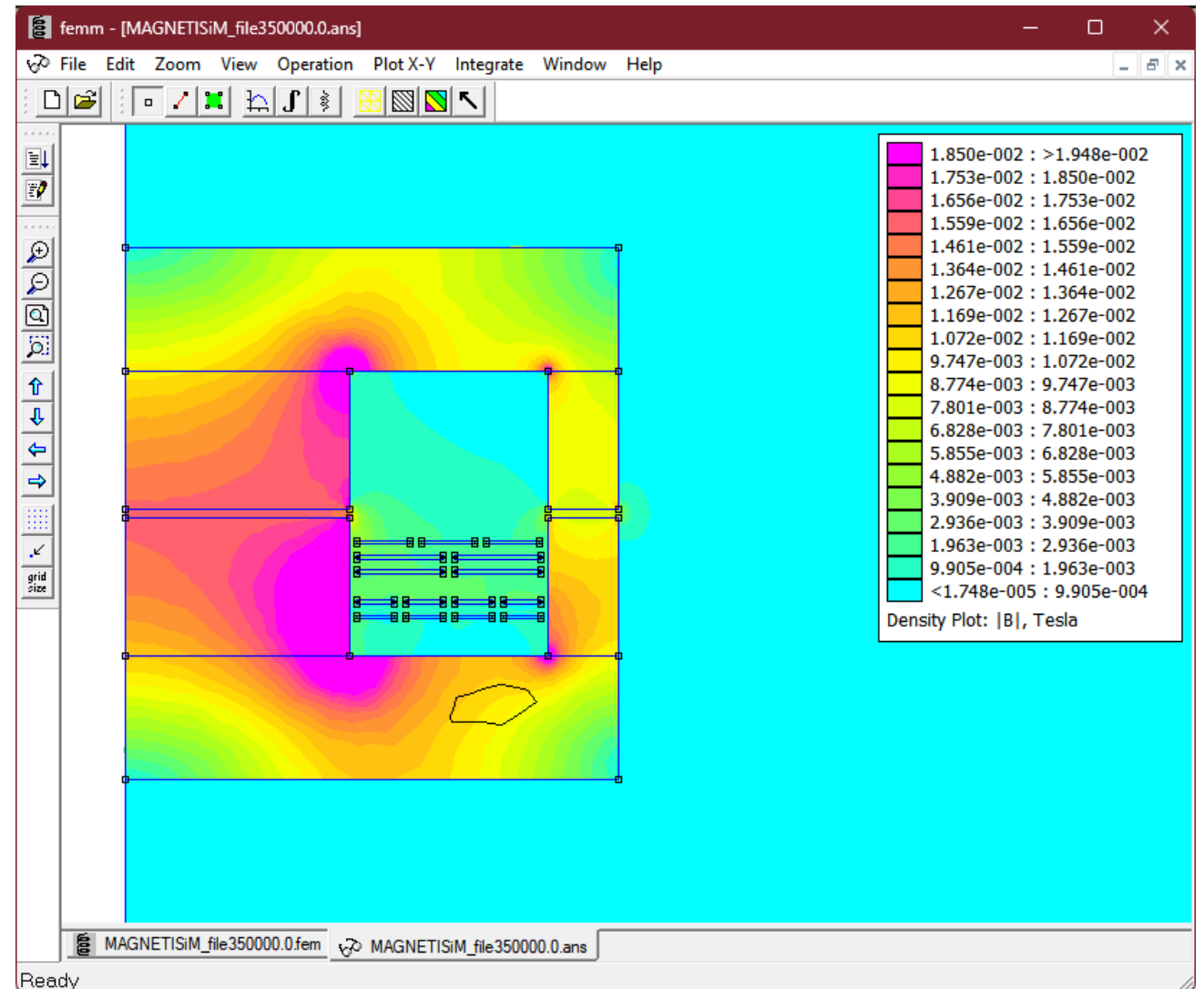


Results Postprocessing

Circuit Viewer (II)



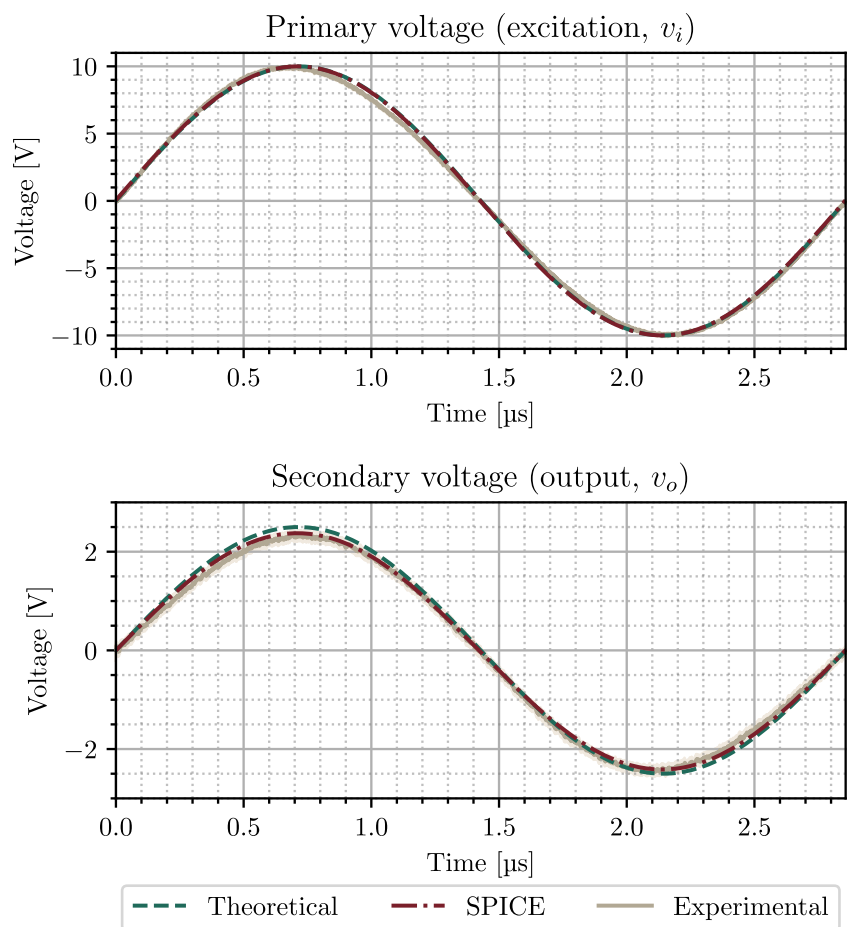
Run FEA Simulation



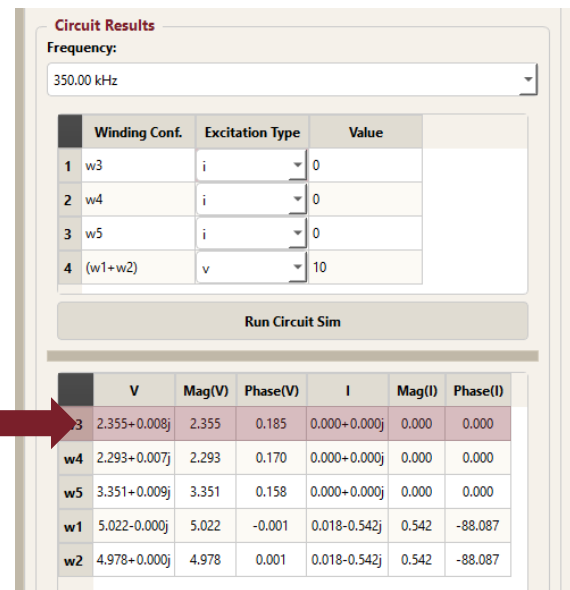
Circuit Viewer vs SPICESiM

MAGNETISiM vs Ansys

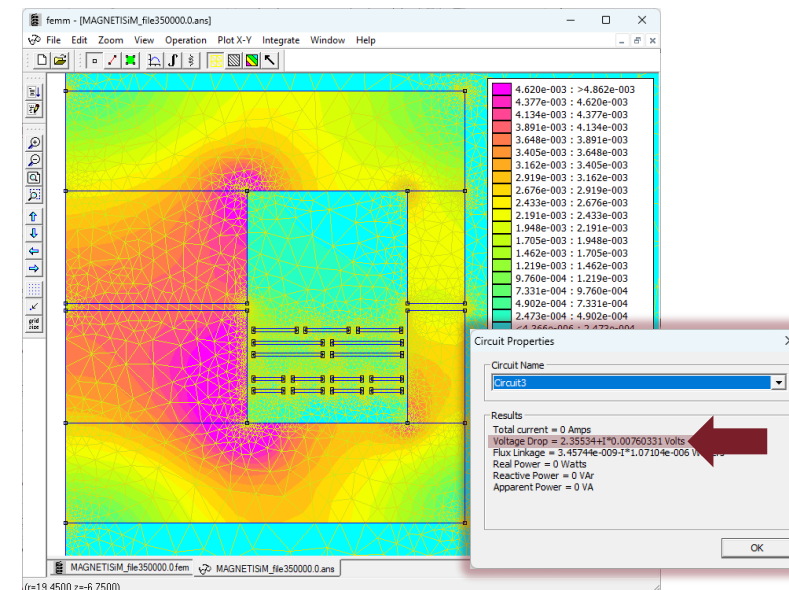
(a) Theoretical vs (d) SPICESiM vs (e) Prototype



(b) MAGNETISiM analytical



(c) MAGNETISiM simulation



Source	Value [V]	Deviation
(a) Theoretical	2.50	1.11
(b) MAGNETISiM analytical	2.36	1.05
(c) MAGNETISiM simulation	2.36	1.05
(d) SPICESiM (LTspice)	2.30	1.02
(e) Prototype	2.25	1.00

Results Postprocessing

Power Loss Viewer (I)

Power Loss Viewer

Frequency: 350.00 kHz

Winding Conf.	Excitation Type	Value
1 w3	r	30
2 w4	r	25
3 w5	r	10
4 (w1+w2)	v	40

ANALYTICAL → Analytical Power Loss Simulate Power Loss

	Power Loss (W) @ 350.00 kHz
w1	-5.323375+22.068012j
w2	-5.391885+21.841592j
w3	1.482402+0.000000j
w4	1.686466+0.000000j
w5	9.036480+0.000000j
Total Winding Loss	1.490088
Bpk (mT)	11.597169
Core Loss	0.186964

Export to CSV

Power Loss Viewer

Frequency: 350.00 kHz

Winding Conf.	Excitation Type	Value
1 w3	r	30
2 w4	r	25
3 w5	r	10
4 (w1+w2)	v	40

SIMULATION → Simulate Power Loss

	Power Loss (W) @ 350.00 kHz
w1	-5.323375+22.068012j
w2	-5.391885+21.841592j
w3	1.482402+0.000000j
w4	1.686466+0.000000j
w5	9.036480+0.000000j
Total Winding Loss	1.490088
Bpk (mT)	11.600226
Core Loss	0.187076

Export to CSV

LTspice - MAGNETISiM_AM26.raw

Waveform: $V(N001)*I_x(U1:up_P1)+V(N002)*I_x(U1:up_P2)+V(N003)*I_x(U1:up_P3)+V(N004)*I_x(U1:up_P4)$

Interval Start: 6.688ms
Interval End: 6.714ms
Average: 1.8355W
Integral: 47.723μJ

MAPPING:
P1: w3
P2: w4
P3: w5
P4: (w1+w2)

SINE(0 40 350k 0 0 0 0)

.tran 0.01

Right-Click to edit expression. Control-Left-Click to integrate. Alt-Left-Click

Results Postprocessing

Power Loss Viewer (II)

Harmonic Wizard

Waveform Configuration

- Waveform type: Square
- Nominal Freq.: 350,00 kHz
- Peak Voltage: 40,00 V
- Num. Harmonics: 6 harmonics
- Duty Cycle: 40,00 %

Time Domain Signal (Superposition)

Frequency Spectrum (6 Harmonics)

Frequencies (kHz): 350.00, 700.00, 1050.00, 1400.00, 1750.00, 2100.00

Peak Amplitudes (V): 48.4394, 14.9614, 9.9850, 12.1068, 0.0080, 8.0753

Close

Matrix Viewer | Circuit Viewer | **Power Loss Viewer**

Power Loss Results

Frequency: All

Winding Conf.	Excitation Type	Value
1 w3	r	30
2 w4	r	25
3 w5	r	10
4 (w1+w2)	v	0,0,0,0,48.4394, 14.9614, 9.9850, 12.1068, 0.0080, 8.0753

Ctrl+V

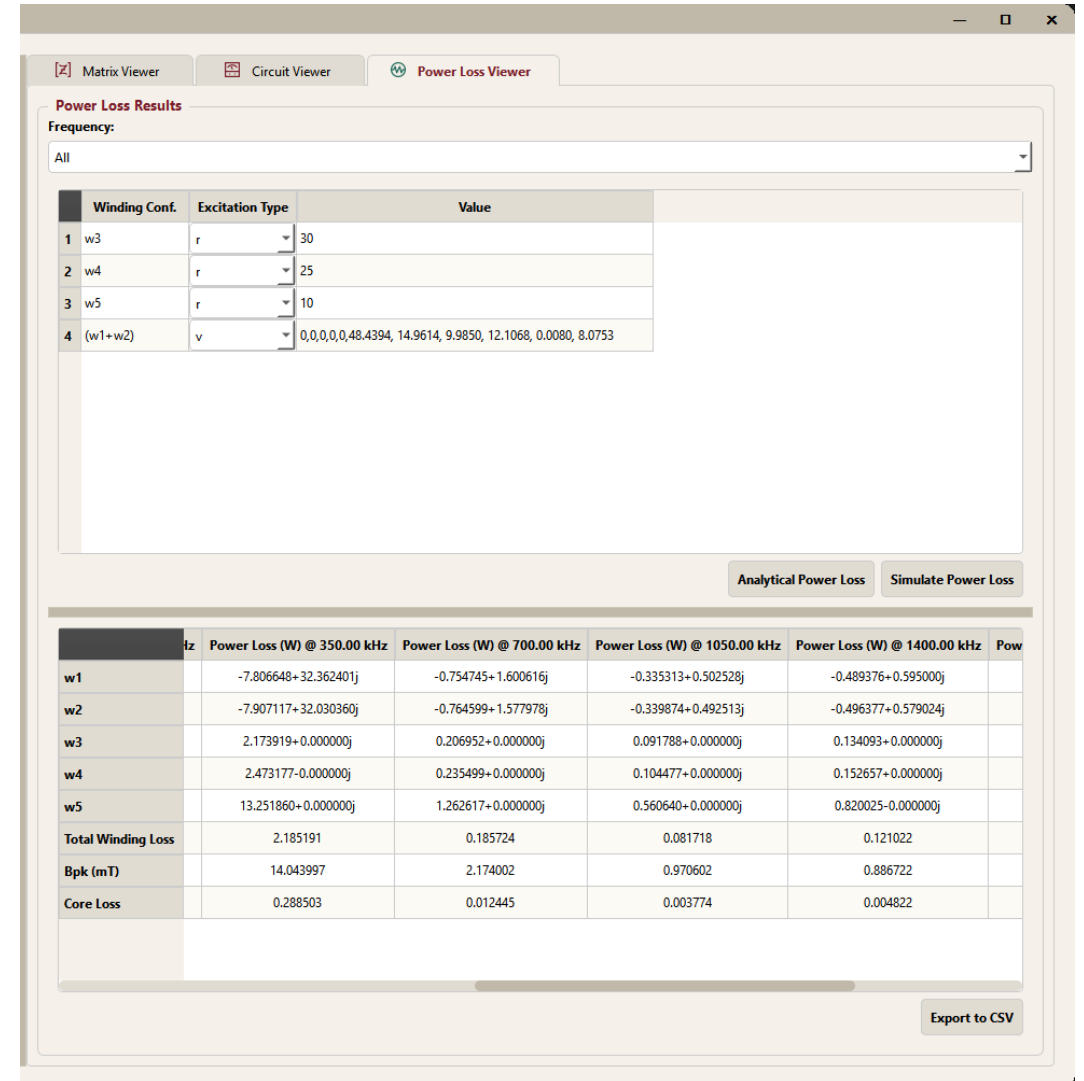
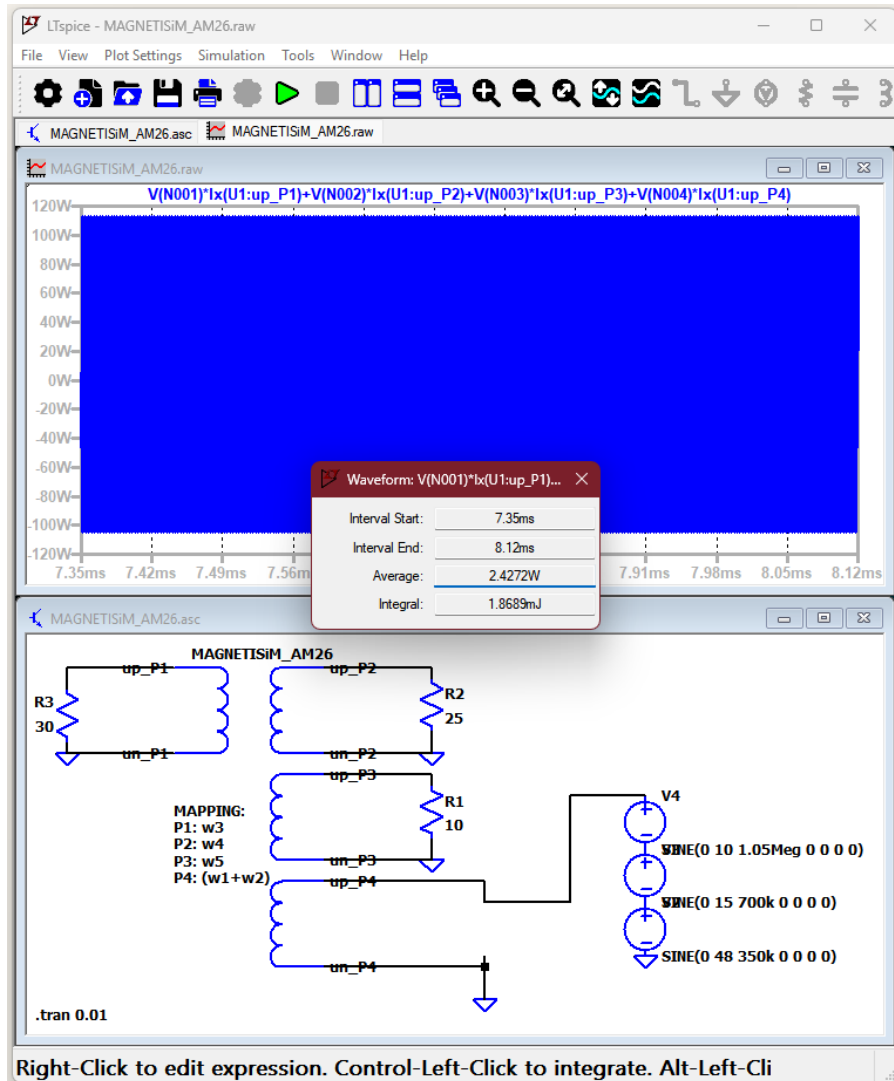
Analytical Power Loss | Simulate Power Loss

Winding	Power Loss (W) @ 350.00 kHz	Power Loss (W) @ 700.00 kHz	Power Loss (W) @ 1050.00 kHz	Power Loss (W) @ 1400.00 kHz	Pow
w1	-7.806648+32.362401j	-0.754745+1.600616j	-0.335313+0.502528j	-0.489376+0.595000j	
w2	-7.907117+32.030360j	-0.764599+1.577978j	-0.339874+0.492513j	-0.496377+0.579024j	
w3	2.173919+0.000000j	0.206952+0.000000j	0.091788+0.000000j	0.134093+0.000000j	
w4	2.473177-0.000000j	0.235499+0.000000j	0.104477+0.000000j	0.152657+0.000000j	
w5	13.251860+0.000000j	1.262617+0.000000j	0.560640+0.000000j	0.820025+0.000000j	
Total Winding Loss	2.185191	0.185724	0.081718	0.121022	
Bpk (mT)	14.043997	2.174002	0.970602	0.886722	
Core Loss	0.288503	0.012445	0.003774	0.004822	

Export to CSV

Results Postprocessing

Power Loss Viewer (III)



04 And That's a Wrap

- Roadmap
- Where to Find Us
- The Team

MAGNETISiM Roadmap

2D & 3D
Thermal
Simulation



EXPERTISiM
Magnetic
Design
Wizard

CAPACITISiM

Electrical
Field
Analyzer



ANN for
Thermal
Analysis

Automatic
PCB Winding
Generation



Bobbin
3D-File
Generation

Full Documentation to Help You

https://www.magnetisim.com/documentation

MAGNETISiM

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Documentation

All you need to know to use MAGNETISiM

All the resources,
in the same place

13
MANUALS
&
TUTORIALS

3
PAPERS

2
USE-CASES

Platform Download

The screenshot shows a web browser window with the address bar displaying `https://www.magnetisim.com/download`. The page features the MAGNETISiM logo in the top left and a navigation menu with links for [Download](#), [Blog](#), [Documentation](#), [Get Involved](#), and [About Us](#). The main content area has a background image of a red crane against a blue sky. The word "Download" is written in large white letters, with the subtitle "Get access to the latest platform version" below it. Further down, the text "Current stable version: 1.0.0" is displayed in a dark red font, followed by "Windows only — for now." in a smaller grey font. At the bottom of the page, there are two empty rounded rectangular boxes.



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The Real Team



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Electromagnetic Elmer
2D/3D Simulation



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Model Preparation and
Thermal Elmer Simulation



Alessio

Electromagnetic Elmer
2D/3D Simulation



Daniel

Artificial Neural Networks
for Thermal Analysis



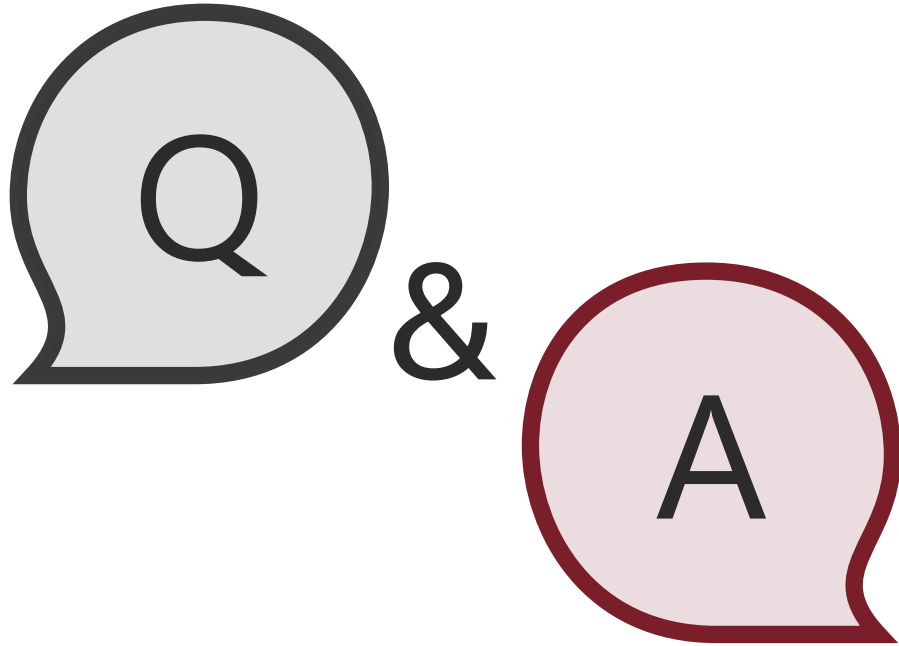
Santiago

Core Power Loss Modeling
and FEMM Simulation



Jesús

Project Consulting and
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