



MAGNETISiM

Create Material

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'. On the left, a vertical 'TAB MENU' contains four icons: a core symbol (Ctrl+1), a winding symbol (Ctrl+2), a gear (Ctrl+3), and a magnet symbol (Ctrl+4). The main area is divided into two sections: 'Core Geometry' and 'Core Material'. The 'Core Geometry' section includes dropdown menus for 'Manufacturer', 'Geometry Core', and 'Core Reference', followed by input fields for dimensions A [mm] through I [mm] and 'Gap [mm]', all currently set to 0. The 'Core Material' section features a 'Material' dropdown, four tabs for 'Magnet', 'Power Loss', 'Electrical', and 'Thermal', and input fields for 'Real Permeability', 'Imag Permeability', and 'Conductivity', all set to 0. A button 'Add Permeability(f) Curve' and a checkbox 'Permeability(f) from Internal-Database' are also present. On the right, a 'MODELER WINDOW' shows a 2D plot with axes ranging from -0.6 to 0.6. At the bottom of the plot are buttons for 'Export', 'Refresh Plot', and 'Fit All'. A 'BAR TOOL' is indicated at the top right of the window.

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 will be released in September 2026.

More information in [Create Material](#)

Magnet Definition

Core Material

Material: 3C90

Magnet Power Loss Electrical Thermal

Real Permeability: 2300

Imag Permeability: 0

Conductivity: 0.2

Add Permeability(f) Curve

Permeability(f) from Internal-Database

Core Material

Material: 3C90

Magnet Power Loss Electrical Thermal

Real Permeability: 2300

Imag Permeability: 0

Conductivity: 0.2

Add Permeability(f) Curve

Permeability(f) from Internal-Database

SINGLE-FREQUENCY MATERIAL CHARACTERIZATION

- **Magnet**

$\mu_r' - j\mu_r''$ – Complex permeability

Conductivity – Electrical Conductivity

MULTI-FREQUENCY MATERIAL CHARACTERIZATION

- **Add Permeability Curve** or **From Internal-Database**
However, materials often vary with frequency. To capture this, click the "**Add Permeability(f) Curve**" button to define these parameters dynamically.

Permeability Curve Fitting

Permeability Curve Fitting

Excel File

Select Excel... No file.

Plot Digitizer

Select PNG... No file.

Manual Data Input

Add manual data.

Last Step

Fit and Plot

OK Cancel

Clicking the curve button opens the "**Permeability Curve Fitting**" window, which offers three methods:

- **Excel File**
- **Plot Digitizer**
- **Manual Data Input**

Permeability Curve Fitting – Excel File

Permeability Curve Fitting

Excel File

Select Excel... **PermeabilityVsFreq.xlsx**

Plot Digitizer

Select PNG... No file.

Manual Data Input

Add manual data.

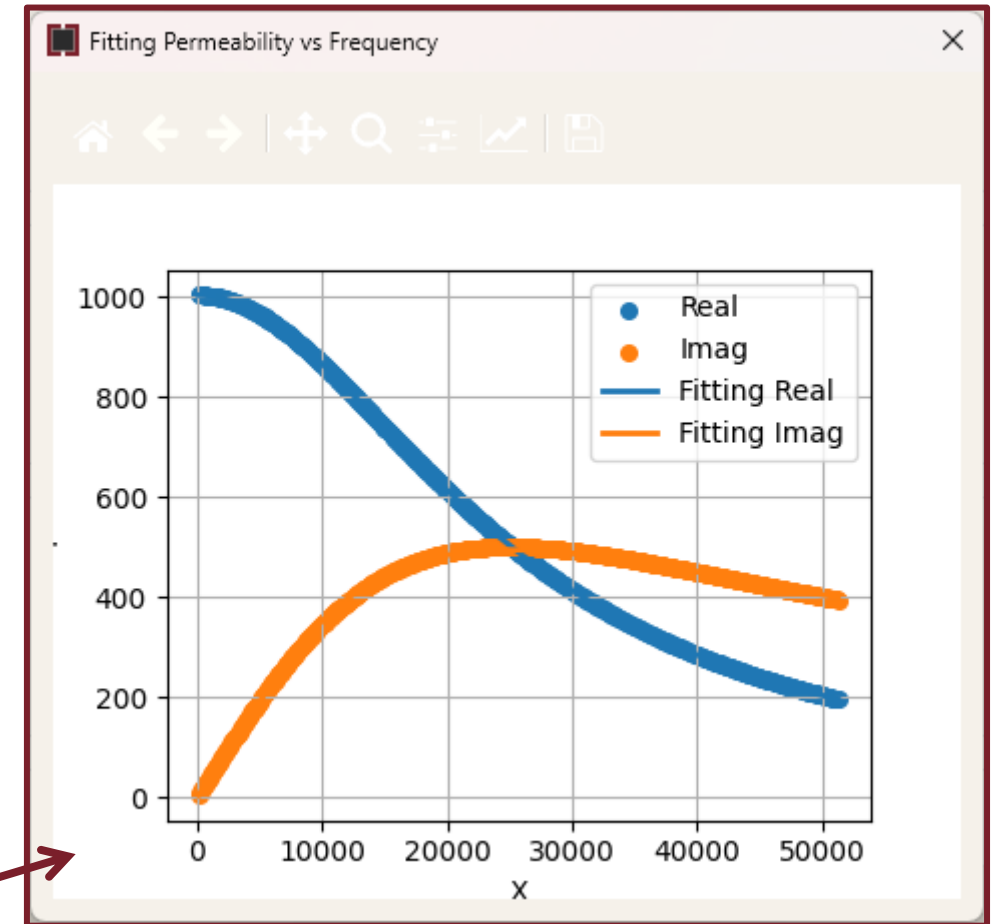
Last Step

Fit and Plot

OK Cancel

To use an existing dataset, select the "**Excel File**" option and load your .xlsx file containing the permeability vs. frequency data.

The tool will automatically map the data points and fit the real and imaginary curves for you.



[Open template in github](#)

Permeability Curve Fitting – Plot Digitizer

Fit $\mu(f)$ from image (log-log)

f min (X):

f max (X):

μ min (Y):

μ max (Y):

Load imagen...

Calibrate (3 clicks)

Capture μ' (toggle)

Capture μ'' (toggle)

Delete μ'

Delete μ''

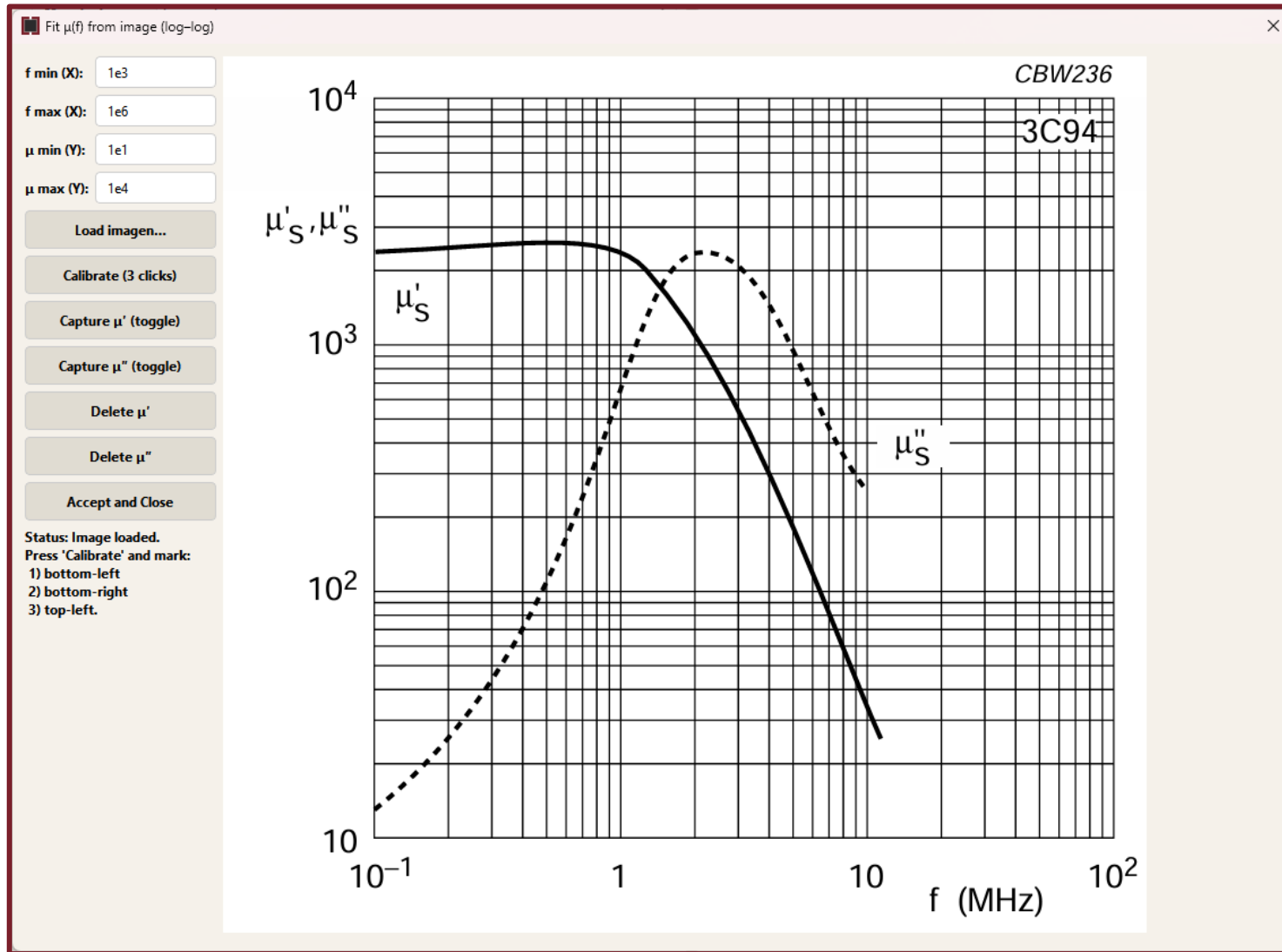
Accept and Close

Status: no image.

If you only have a datasheet image, use the **Plot Digitizer**.

[Open template in github](#)

Permeability Curve Fitting – Plot Digitizer

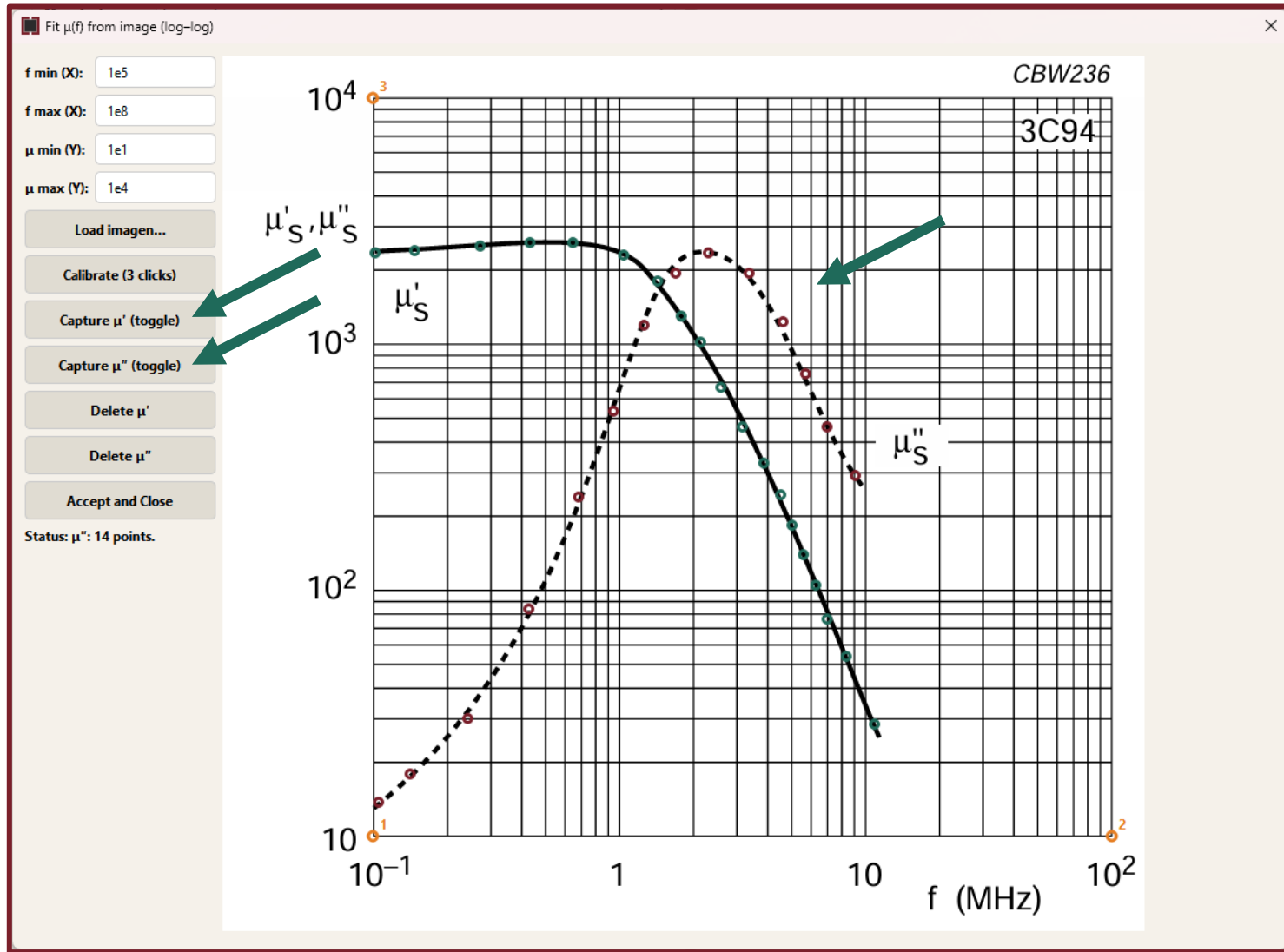


If you only have a datasheet image, use the **Plot Digitizer**.

Step 1: Click "Load imagen..." to import your log-log graph of permeability.

[Open template in github](#)

Permeability Curve Fitting – Plot Digitizer



If you only have a datasheet image, use the **Plot Digitizer**.

Step 1: Click "Load imagen..." to import your log-log graph of permeability.

Step 2: Click "Calibrate" and select 3 reference points on the axes to set the scale.

Step 3: Capture the data by clicking along the curves on the image.

[Open template in github](#)

Permeability Curve Fitting – Plot Digitizer

Excel File

Select Excel... No file.

Plot Digitizer

Select PNG... Data extracted successfully.

Once captured, the system fits the curve to your digitized points.

(Note: The development team is currently improving the fitting for the real part to better capture the "mountain".)

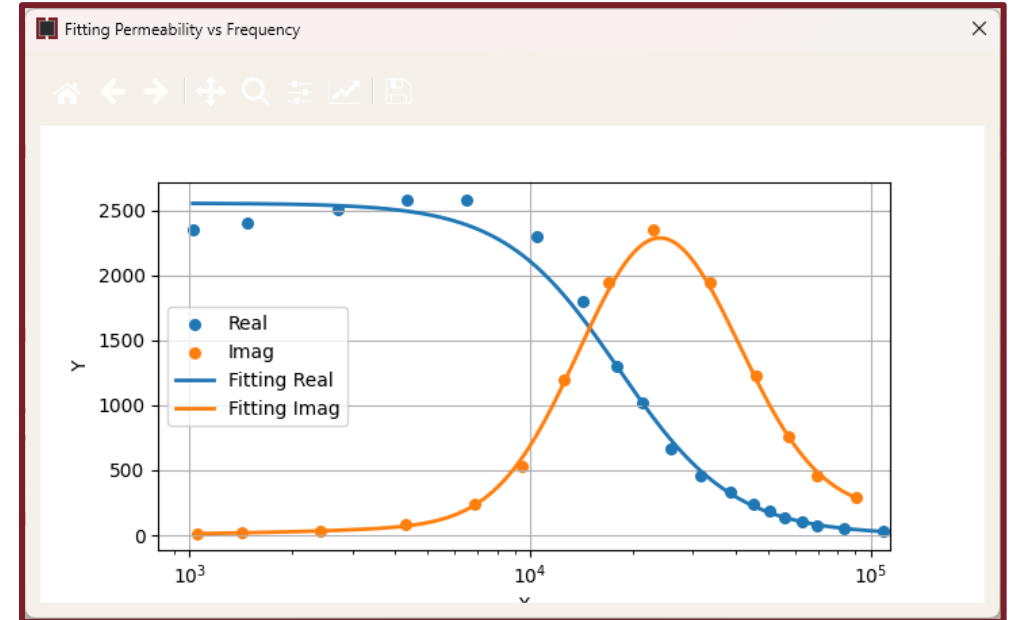
Manual Data Input

Add manual data.

Last Step

Fit and Plot

OK Cancel



[Open template in github](#)

Permeability Curve Fitting – Manual Input

Permeability Curve Fitting

Excel File
Select Excel... No file.

Plot Digitizer
Select PNG... No file.

Manual Data Input
 Add manual data.

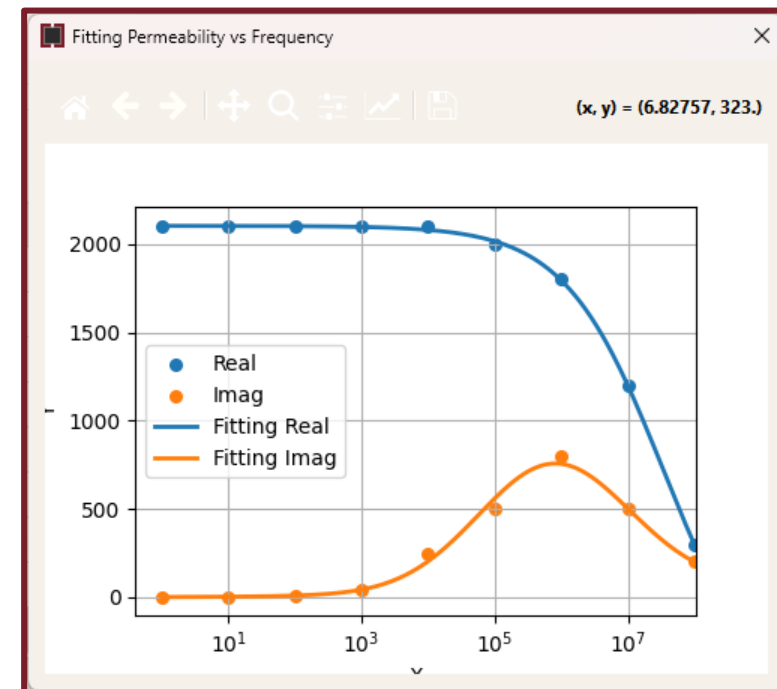
Frequency	Real part	Imaginary part
1	2100	1
10	2100	3
100	2100	10
1000	2100	40
1e4	2100	250
1e5	2000	500
1e6	1800	800
1e7	1200	500
1e8	300	200

Add row Remove row

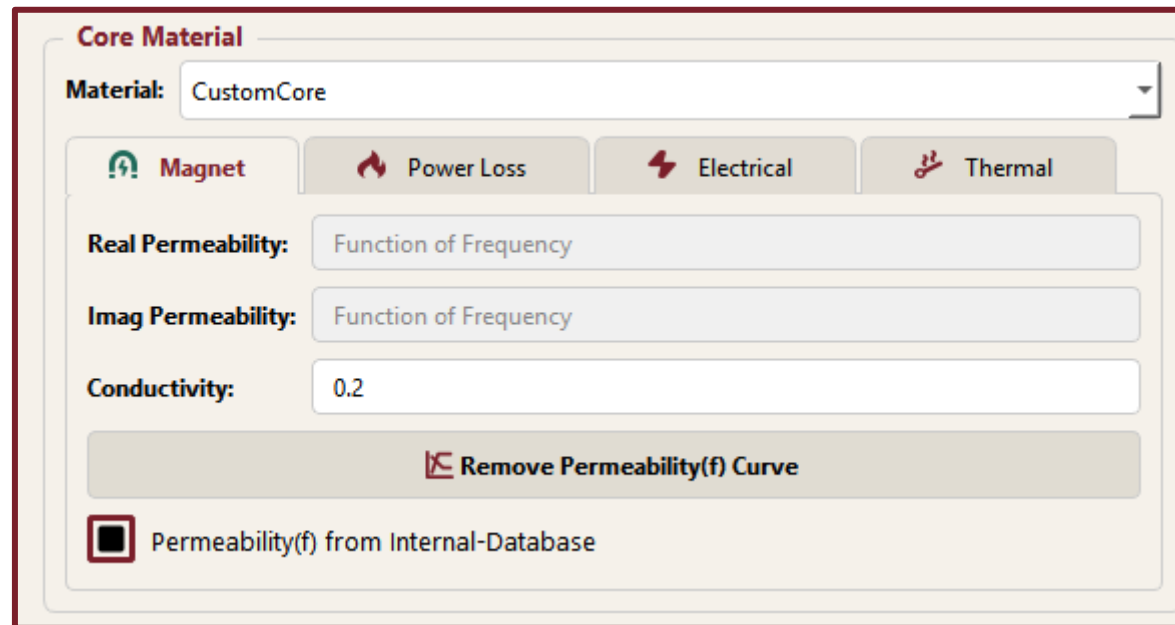
Last Step
Fit and Plot

OK Cancel

If you prefer to enter the data yourself, check the "**Add manual data**" box. You can add rows to a table and manually type in the Frequency, Real part, and Imaginary part values to generate the fitted curve.

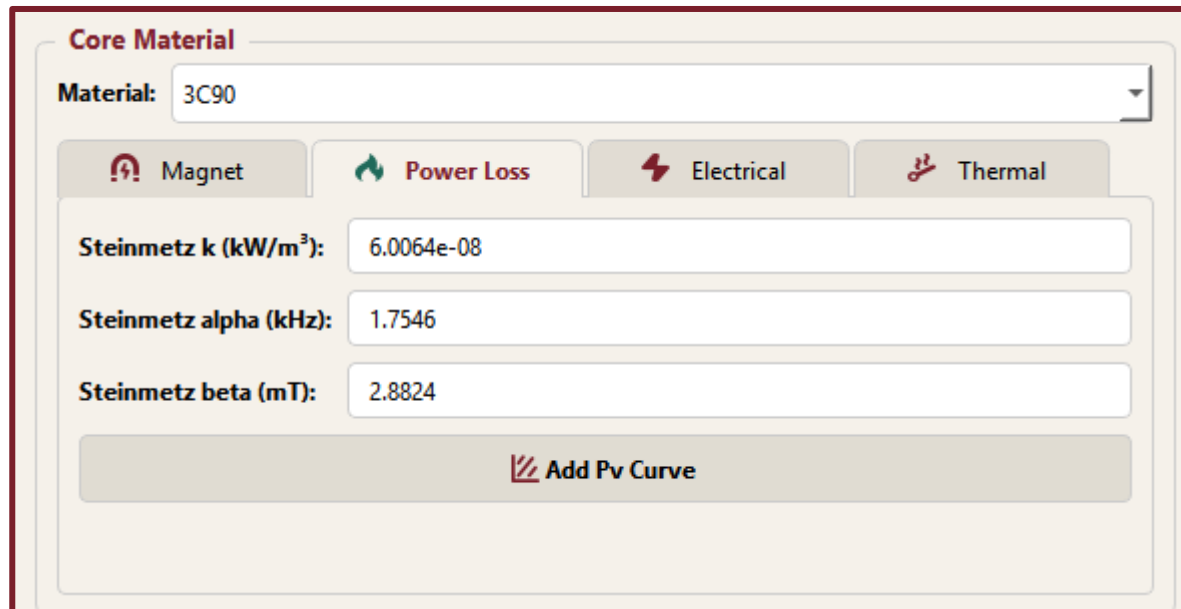


Once your permeability setup is complete, your custom material (e.g., "**CustomCore**") is saved, and the "**Magnet**" tab will update to show that permeability is now a "**Function of Frequency**".



The screenshot displays the "Core Material" configuration window. At the top, the "Material" dropdown menu is set to "CustomCore". Below this, there are four tabs: "Magnet" (selected), "Power Loss", "Electrical", and "Thermal". Under the "Magnet" tab, the "Real Permeability" and "Imag Permeability" fields are both set to "Function of Frequency". The "Conductivity" field is set to "0.2". A "Remove Permeability(f) Curve" button is located below these fields. At the bottom, there is a checkbox labeled "Permeability(f) from Internal-Database" which is currently unchecked.

Power Loss Definition



The screenshot shows a software interface for defining core material parameters. The title is "Core Material". Below the title, there is a dropdown menu for "Material:" with "3C90" selected. There are four tabs: "Magnet", "Power Loss", "Electrical", and "Thermal". The "Power Loss" tab is active. Under this tab, there are three input fields: "Steinmetz k (kW/m³):" with the value "6.0064e-08", "Steinmetz alpha (kHz):" with the value "1.7546", and "Steinmetz beta (mT):" with the value "2.8824". At the bottom of the tab, there is a button labeled "Add Pv Curve".

Next, switch to the "**Power Loss**" tab to define the core's thermal dissipation.

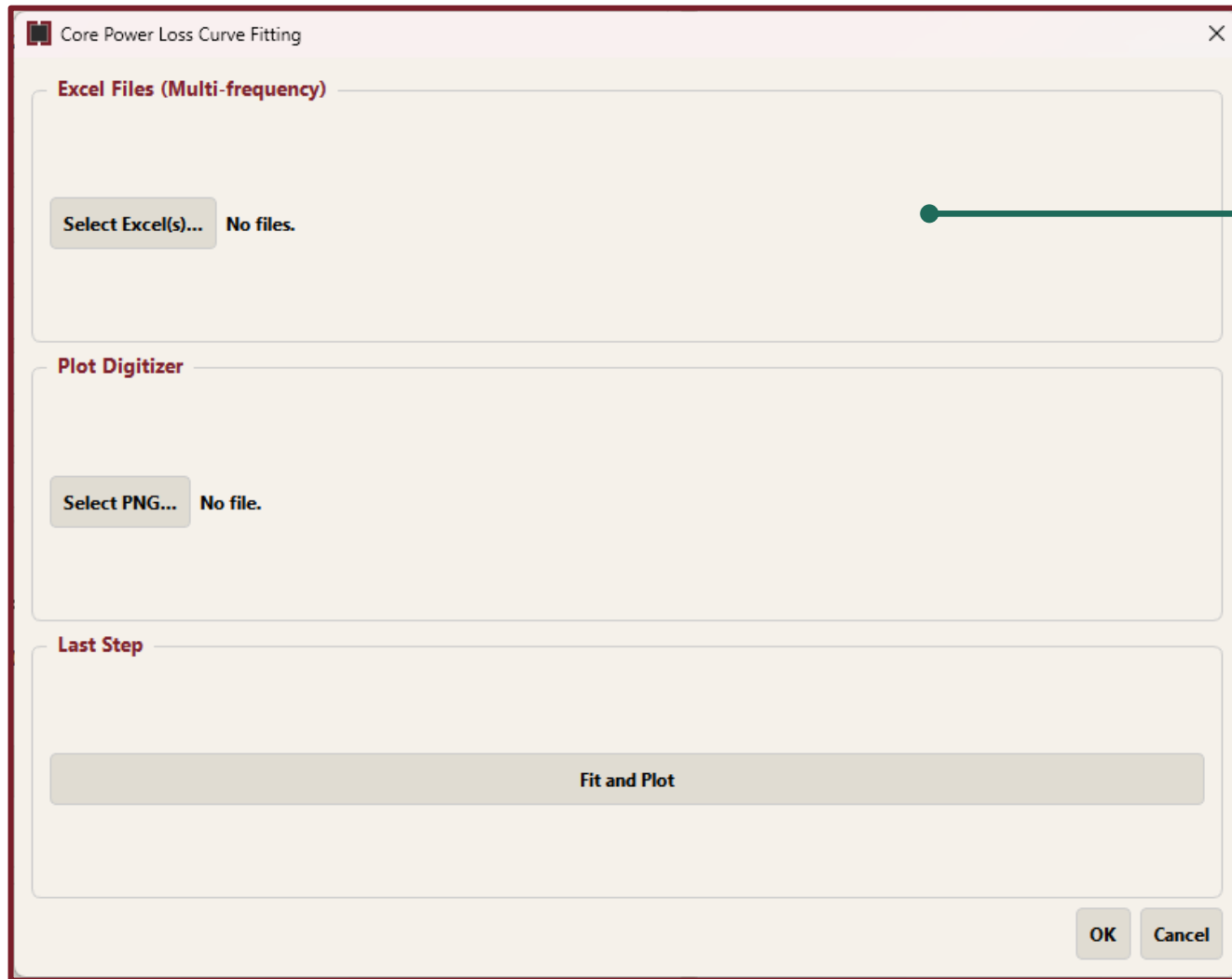
k , α & β

You can manually input the Steinmetz coefficients: k (kW/m^3), α (kHz), and β (mT).

Add Pv Curve

Alternatively, click the "**Add Pv Curve**" button to fit these parameters from experimental data.

Core Power Loss Curve



In the "**Core Power Loss Curve Fitting**" window, you can use the "Excel Files (Multi-frequency)" option.

Core Power Loss Curve – Excel Files

Core Power Loss Curve Fitting

Excel Files (Multi-frequency)

Select Excel(s)... 3 files: 100khz_pv.xlsx, 200khz_pv.xlsx, 300khz_pv.xlsx

Plot Digitizer

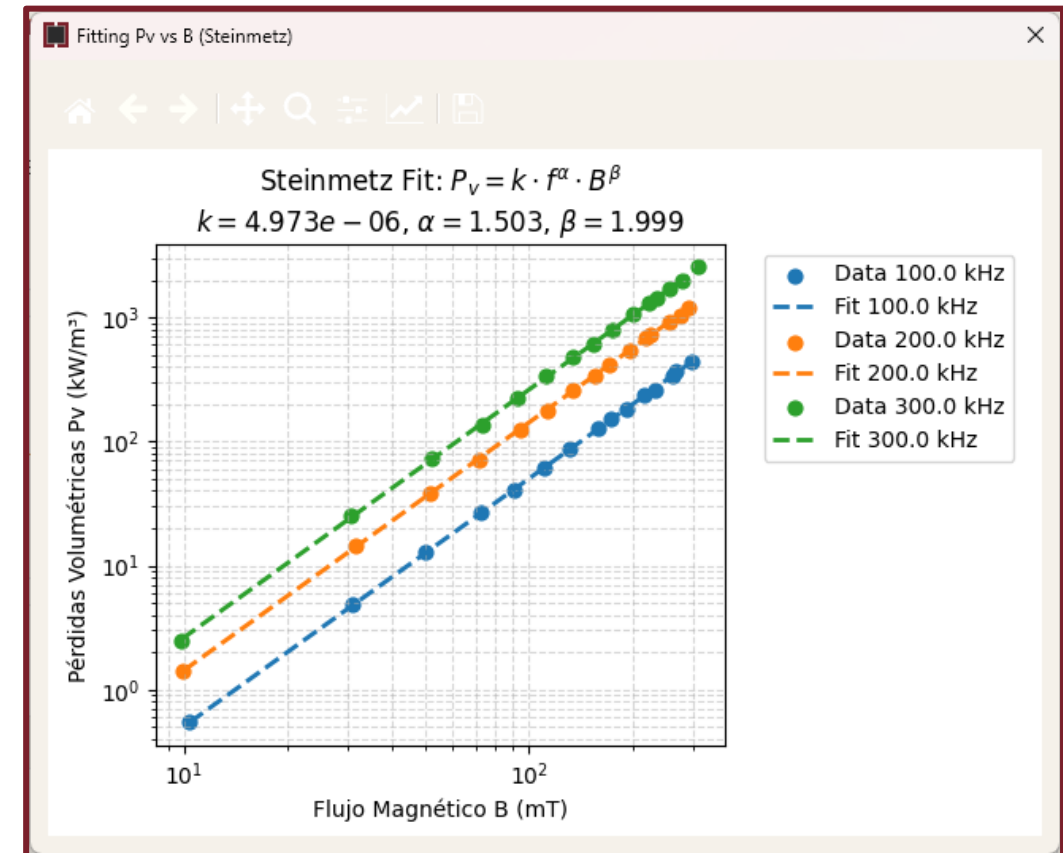
Select PNG... No file.

Last Step

Fit and Plot

OK Cancel

Select multiple Excel files—for example, data for 100 kHz, 200 kHz, and 300 kHz—and the tool will process them simultaneously to fit the global Steinmetz equation (P_v vs B).



[Open template in github](#)

Core Power Loss Curve – Plot Digitizer

Fit Pv(B) from image (log-log)

B min [mT] (X): 10

B max [mT] (X): 1000

Pv min [kW/m3] (Y): 10

Pv max [kW/m3] (Y): 10000

Load imagen...

Calibrate (3 clicks)

Add Curve (Freq)

Delete Selected Curve

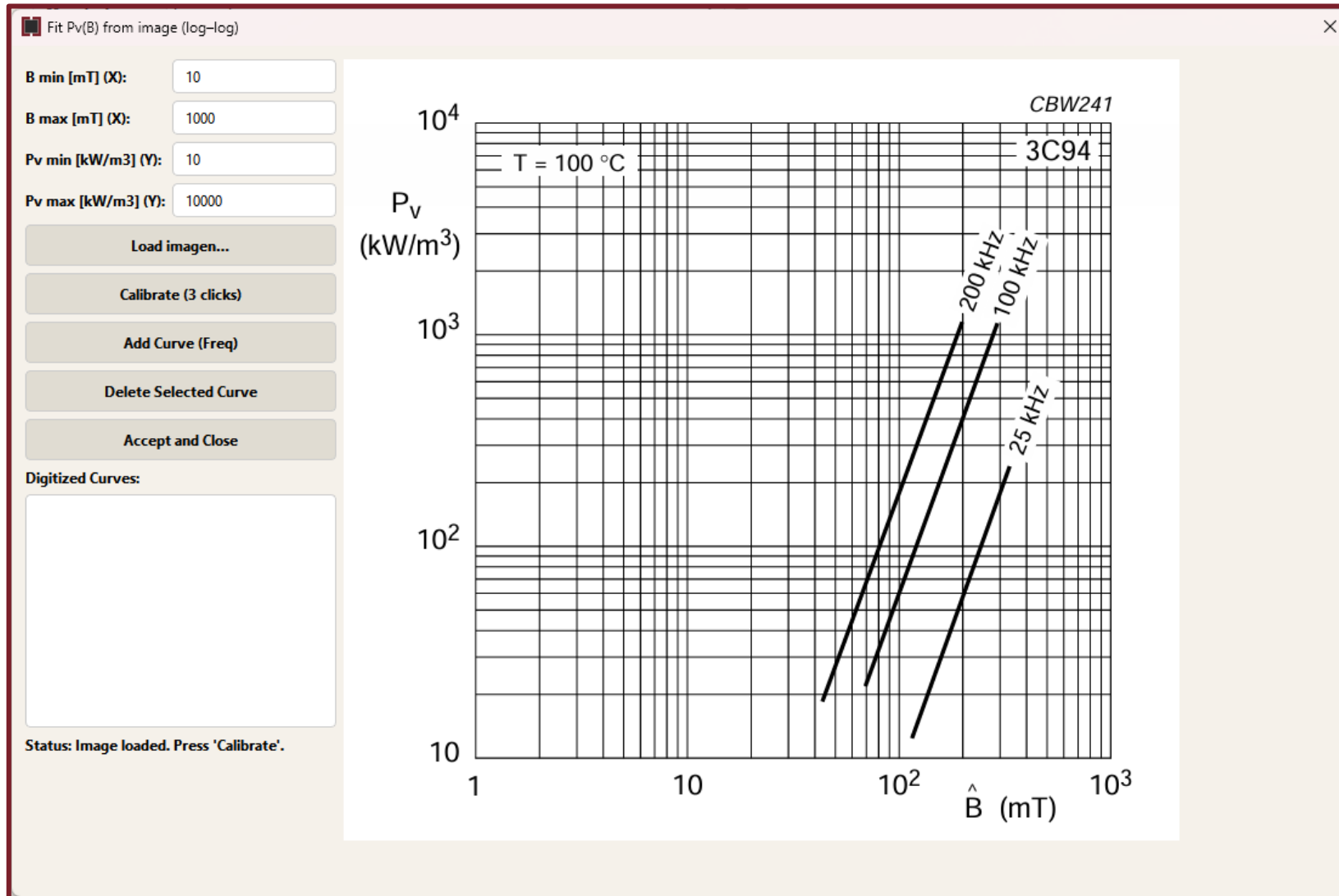
Accept and Close

Digitized Curves:

Status: no image.

If you only have a datasheet image, use the **Plot Digitizer**.

Core Power Loss Curve – Plot Digitizer

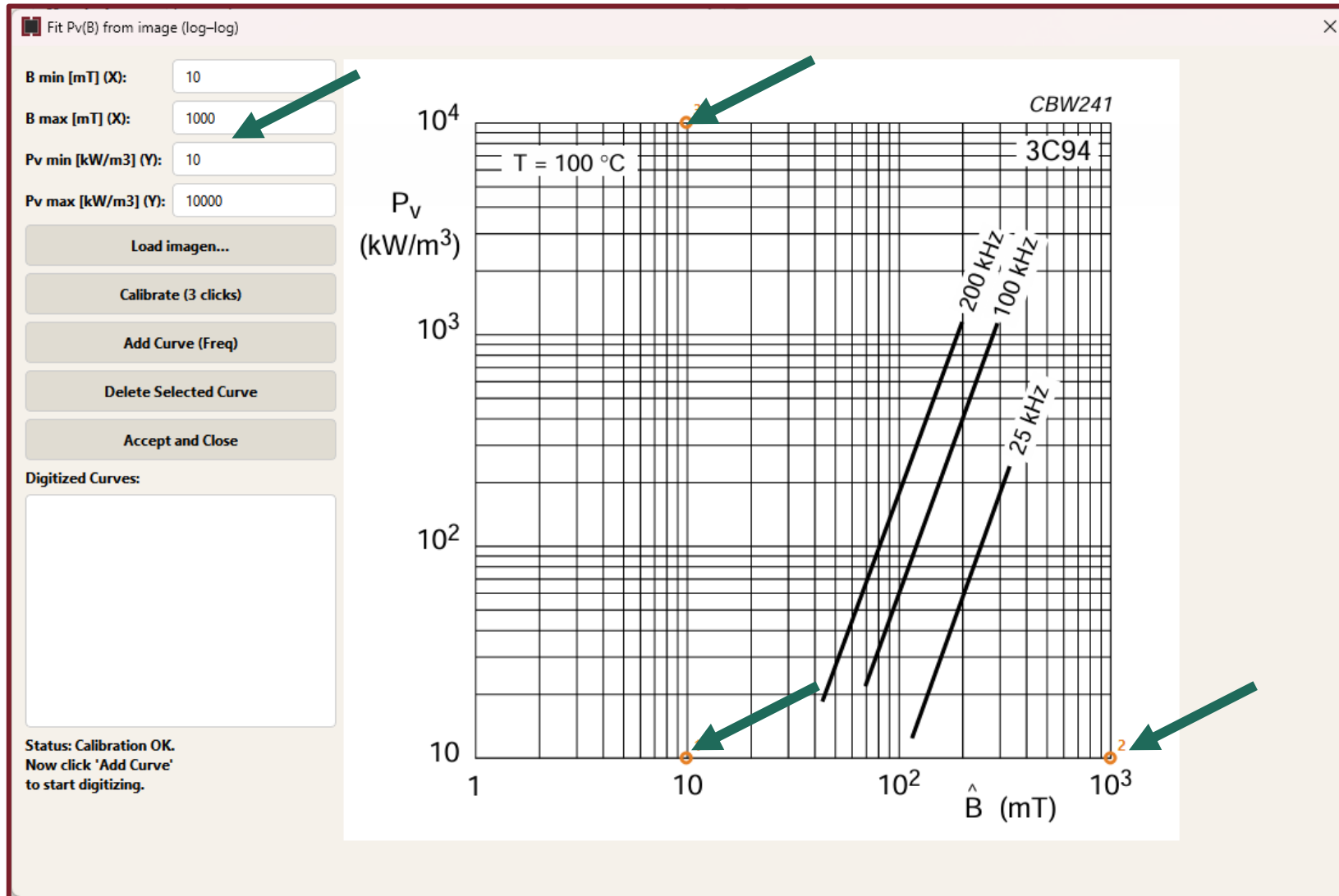


If you only have a datasheet image, use the **Plot Digitizer**.

Step 1: Click "Load imagen..." to import your log-log graph of permeability.

[MAGNETISiM/Template/Materials at main · aDelgado13/MAGNETISiM](#)

Core Power Loss Curve – Plot Digitizer

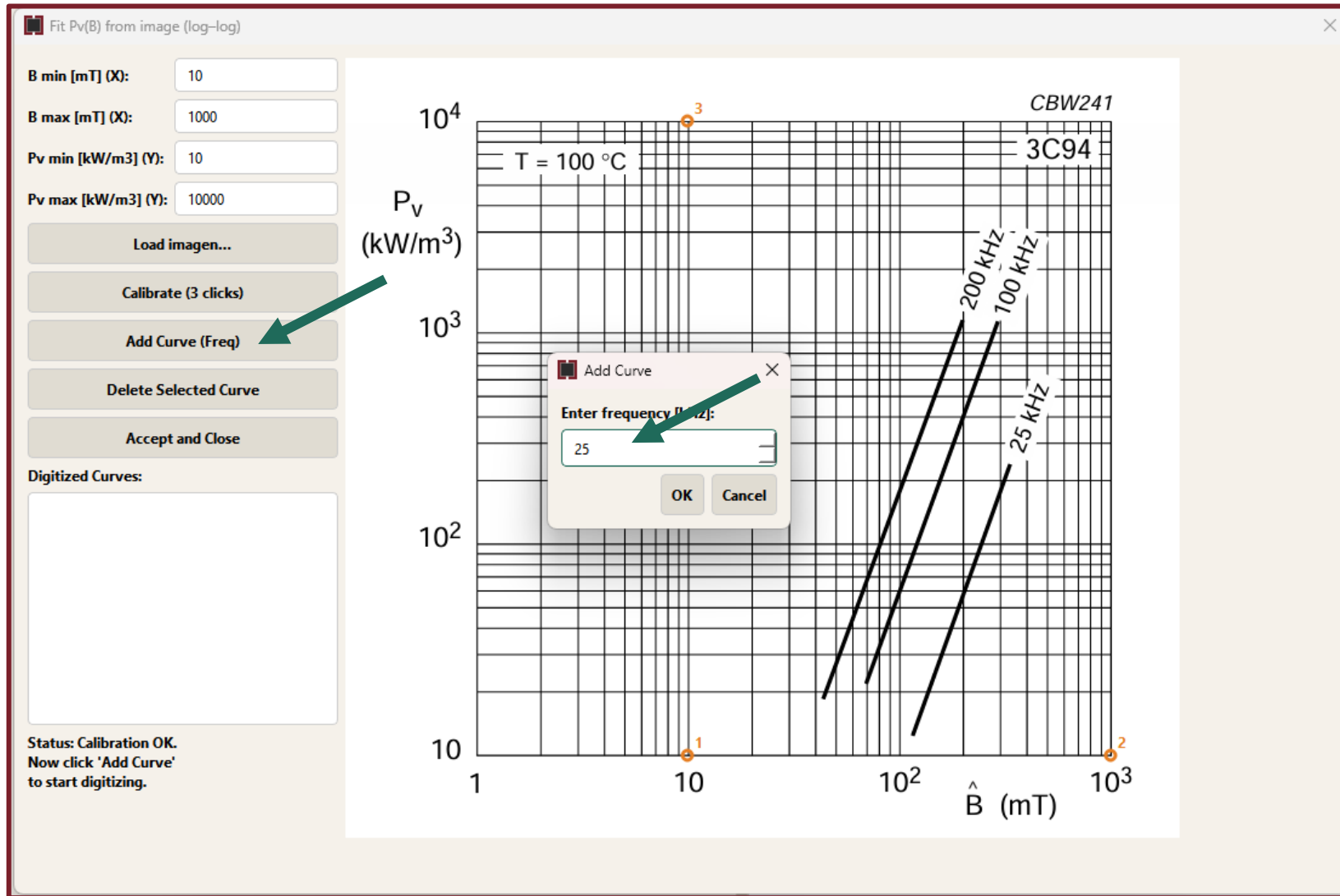


If you only have a datasheet image, use the **Plot Digitizer**.

Step 1: Click "Load imagen..." to import your log-log graph of permeability.

Step 2: Click "Calibrate" and select 3 reference points on the axes to set the scale.

Core Power Loss Curve – Plot Digitizer



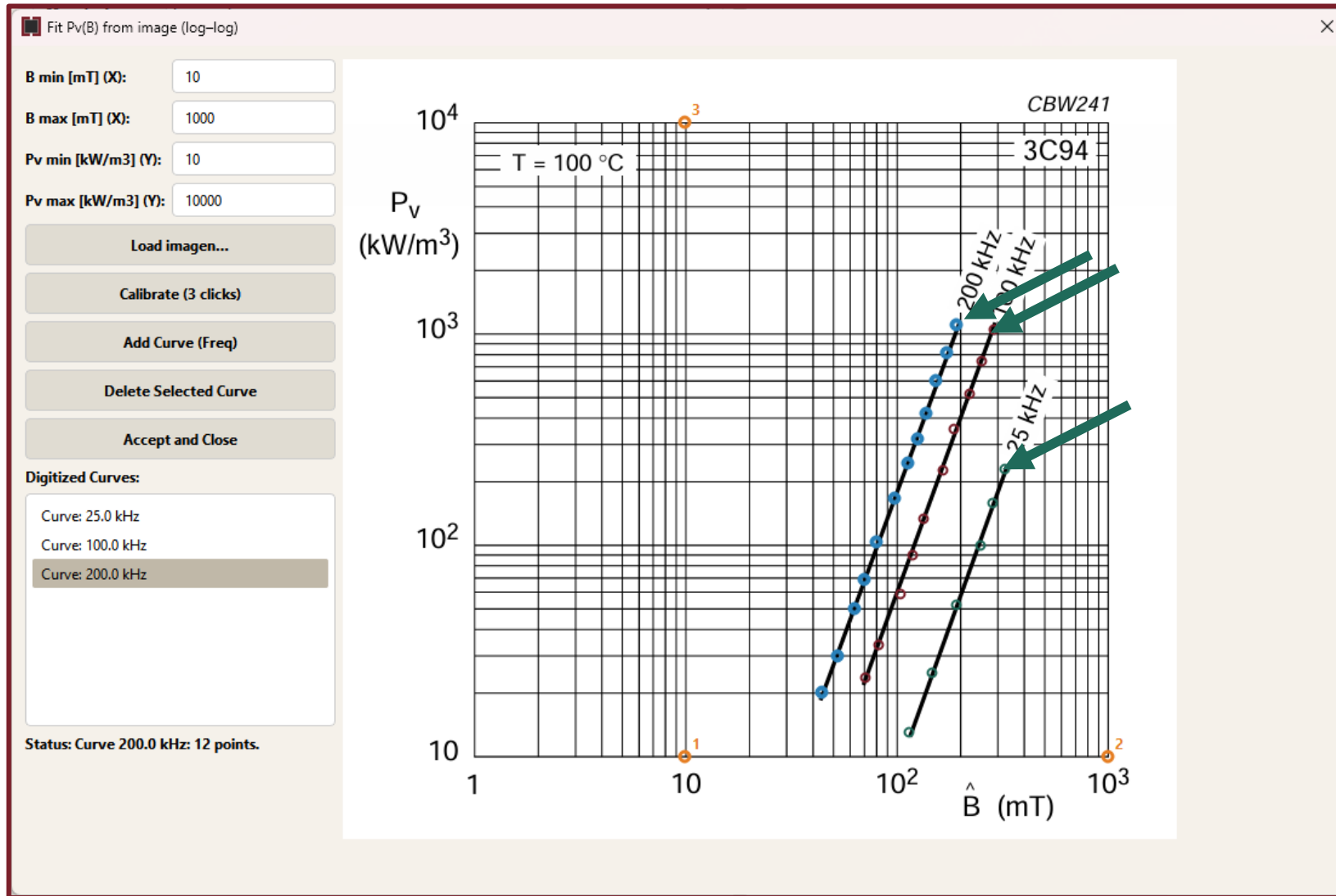
If you only have a datasheet image, use the **Plot Digitizer**.

Step 1: Click "Load imagen..." to import your log-log graph of permeability.

Step 2: Click "Calibrate" and select 3 reference points on the axes to set the scale.

Step 3: Click "Add Curve (Freq)" and enter a specific frequency (e.g., 25 kHz). Click along that specific line on the graph to digitize it.

Core Power Loss Curve – Plot Digitizer



If you only have a datasheet image, use the **Plot Digitizer**.

Step 1: Click "Load imagen..." to import your log-log graph of permeability.

Step 2: Click "Calibrate" and select 3 reference points on the axes to set the scale.

Step 3: Click "Add Curve (Freq)" and enter a specific frequency (e.g., 25 kHz). Click along that specific line on the graph to digitize it.

Step 4: Repeat for as many curves as you want to digitalize.

Core Power Loss Curve – Plot Digitizer

Core Power Loss Curve Fitting

Excel Files (Multi-frequency)

Select Excel(s)... No files.

Plot Digitizer

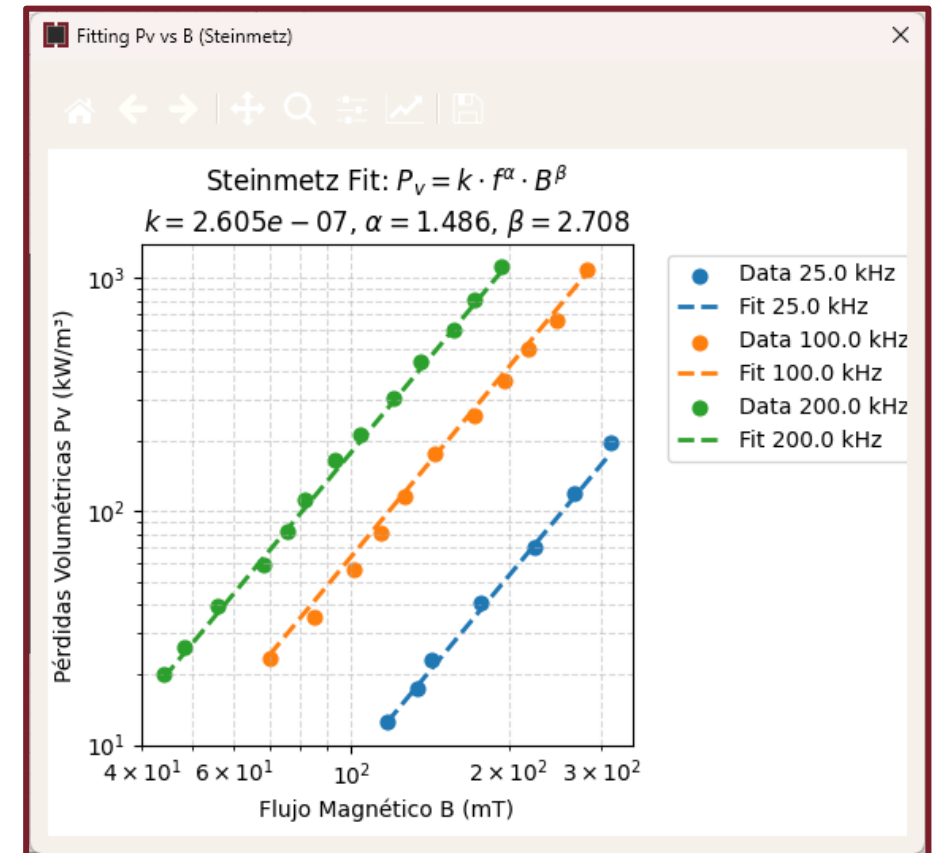
Select PNG... Data extracted successfully.

Last Step

Fit and Plot





OK Cancel

Finally, click "**Fit and Plot**" to generate the precise Steinmetz coefficients (k , α , β) based on your digitized points.



Core Material


Material: CustomCore

 Magnet  Power Loss  Electrical  Thermal

Steinmetz k (kW/m³): 2.6051760238247825e-07

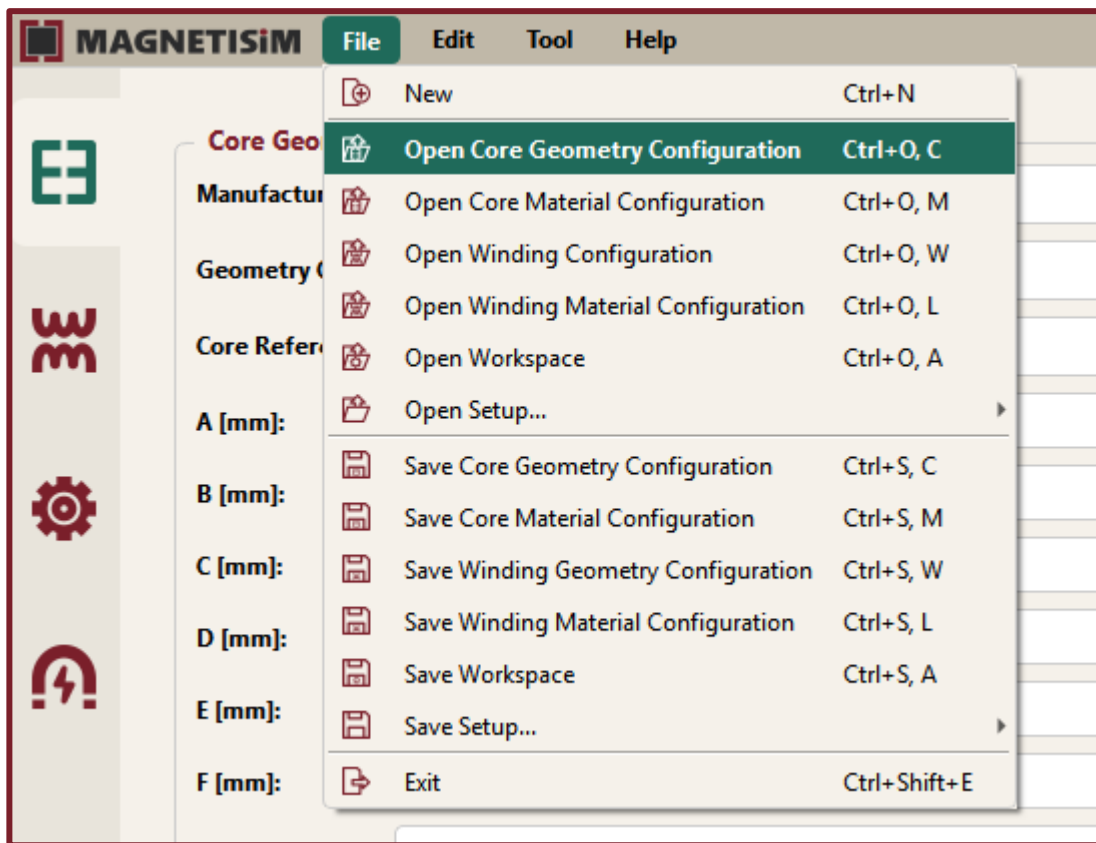
Steinmetz alpha (kHz): 1.4858893367370052

Steinmetz beta (mT): 2.7079999800842356

 Remove Pv Curve

Magnetic Material – *.json

Behind the scenes, MAGNETISiM saves all this custom magnetic material data in a structured *.json format, capturing properties like the Debye parameters and Steinmetz coefficients. You can easily share, save, or load these configurations using the "File" menu (e.g., "**Save Core Material Configuration**"). You can also find material templates on the [MAGNETISiM GitHub repository](#).



```
{
  "Material": "3C96",
  "muR": 2000.0,
  "muI": 0.0,
  "Cond": 0.3333333333333333,
  "FreqCurveMu": false,
  "DebyeParameter": {
    "Real": {
      "y0": 20.0997,
      "A": 2080.4864,
      "k": 8.1745,
      "xc": 0.2667
    },
    "Imag": {
      "a1": 2097.2423,
      "b1": 0.3215,
      "c1": 0.2308,
      "a2": 377.4976,
      "b2": 0.5864,
      "c2": 0.5162
    }
  },
  "Phi": 0,
  "Bmax": 0.38,
  "Steinmetzk": 3.5097e-07,
  "SteinmetzA": 1.5322,
  "SteinmetzB": 2.7182,
  "Steinmetz": {
    "k": 3.5097e-07,
    "alpha": 1.5322,
    "beta": 2.7182
  }
}
```



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