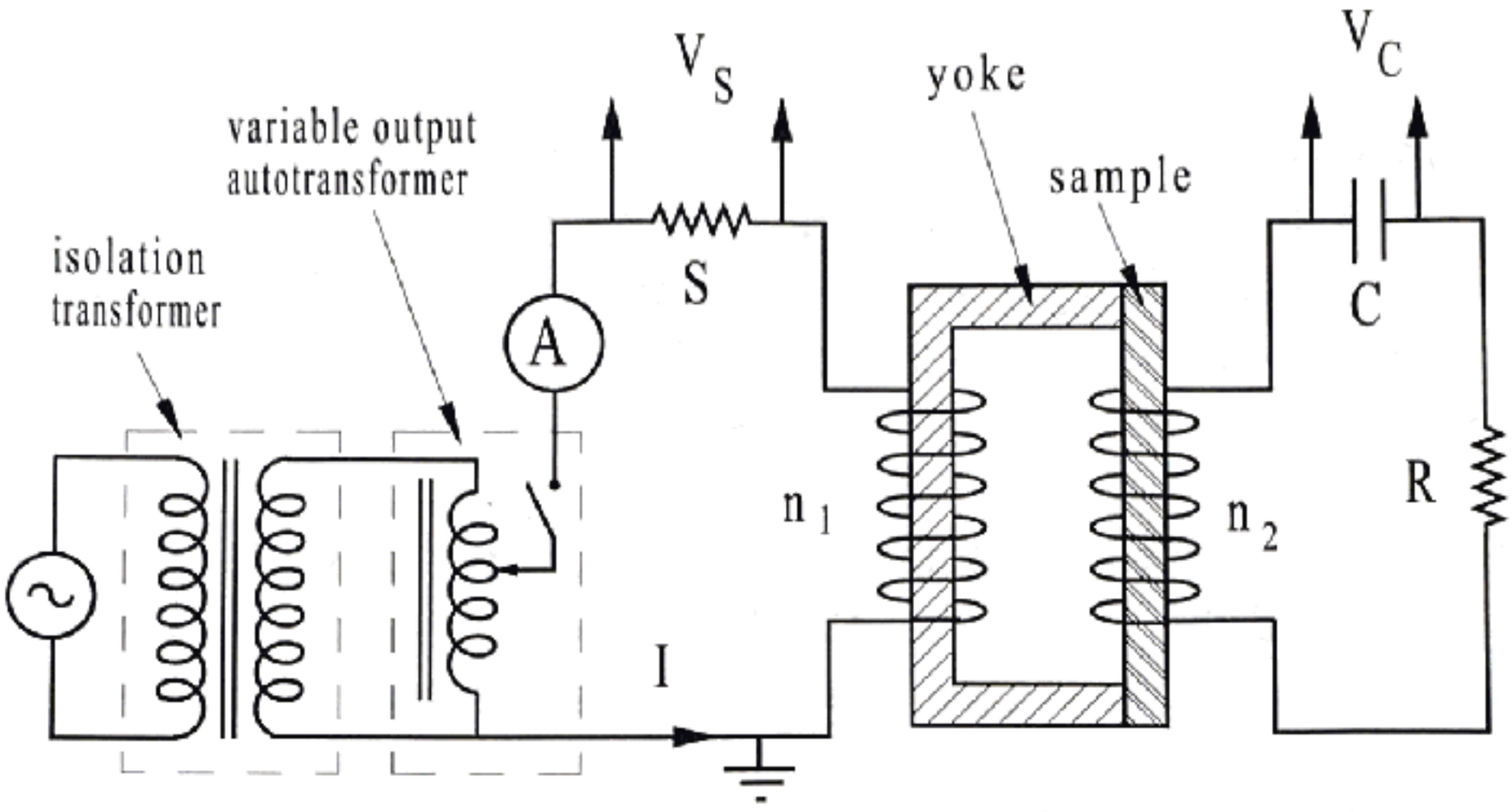
VIRAJ BANGARI 10186046

FERROMAGNETIC HYSTERESIS

EXPERIMENTAL SETUP



n1 = **160 turns**

n2 = **150 turns**

S = **0.1 +/- 5% Ohms**

R = **1e6 +/- 5% Ohms**

C = **0.5e-6 +/- 2% F**

SAMPLE DIMENSIONS

- Iron Magnetic Length: **333 +/- 5mm**
- Iron Cross Sectional Area:**759.08 +- 0.5 mm^2**
- Carbon Magnetic Length: **78 mm +/- 0.5 mm^2**
- Carbon Cross Sectional Area: **844.32 mm^2**

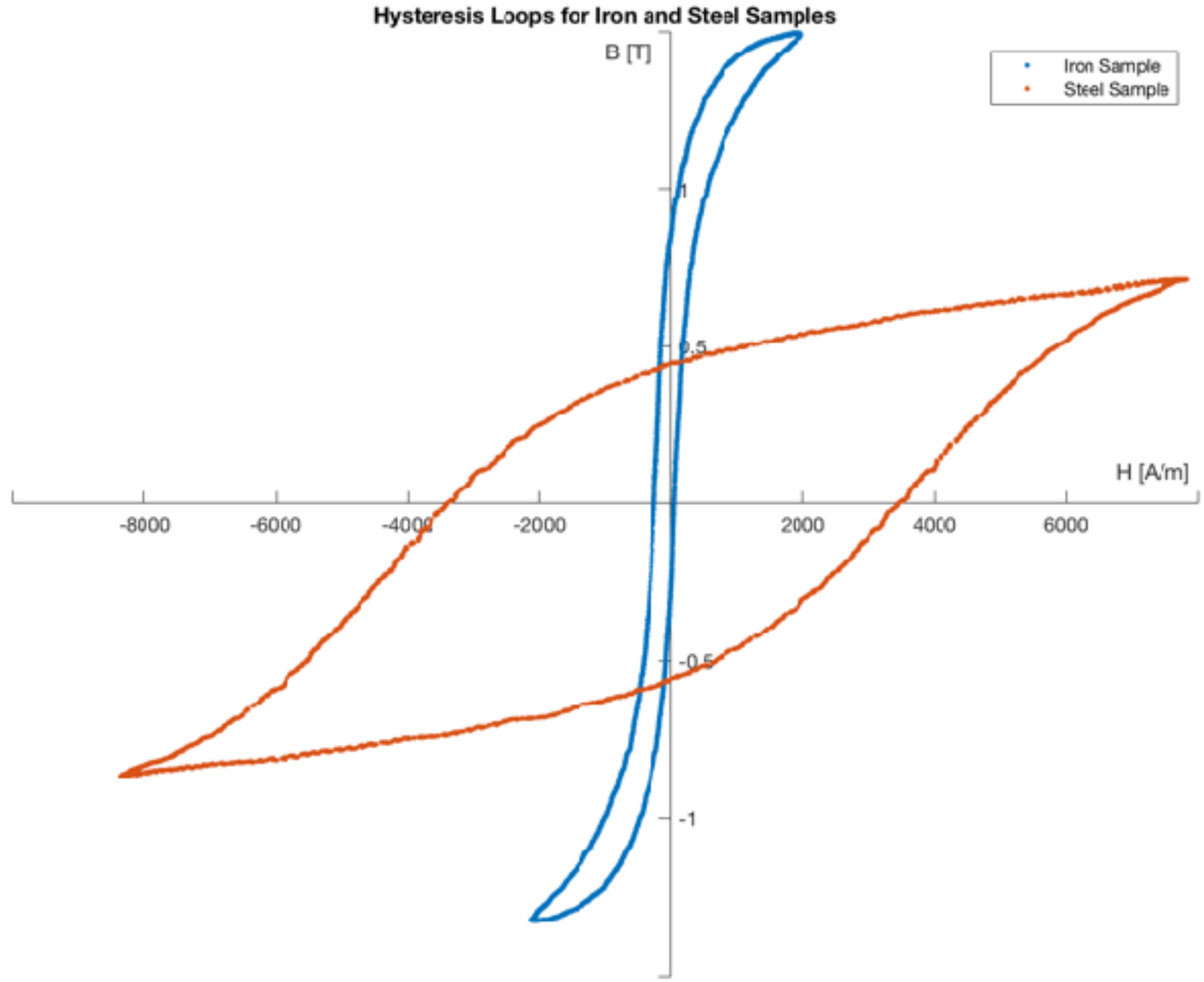
SERIES RESISTOR AND CAPACITOR VOLTAGE FOR IRON SAMPLE

Time [s]	Vs [V]	Vs [V]
-2.50E-02	3.42E-01	-3.4E-01
-2.50E-02	3.38E-01	-3.39E-01
-2.50E-02	3.34E-01	-3.39E-01
-2.49E-02	3.31E-01	-3.39E-01

$$H = n_1 (LS)^{-1} V_s$$

$$B = RC(n_2 A_c)^{-1} V_s$$

HYSTERESIS LOOP



REMANENCE AND COERCIVE FORCES

- Iron Remanence = **0.838 +/- 0.003 [T]**
- Iron Coercive Force = **-252 +/- 1 [A/m]**
- Steel Remanence = **0.440 +/- 0.002 [T]**
- Steel Coercive Force = **-3390 +/- 10 [A/m]**

MAGNETS AND MOTORS

- Remanence: The **magnetic field** after the **applied magnetic field** is **zero**
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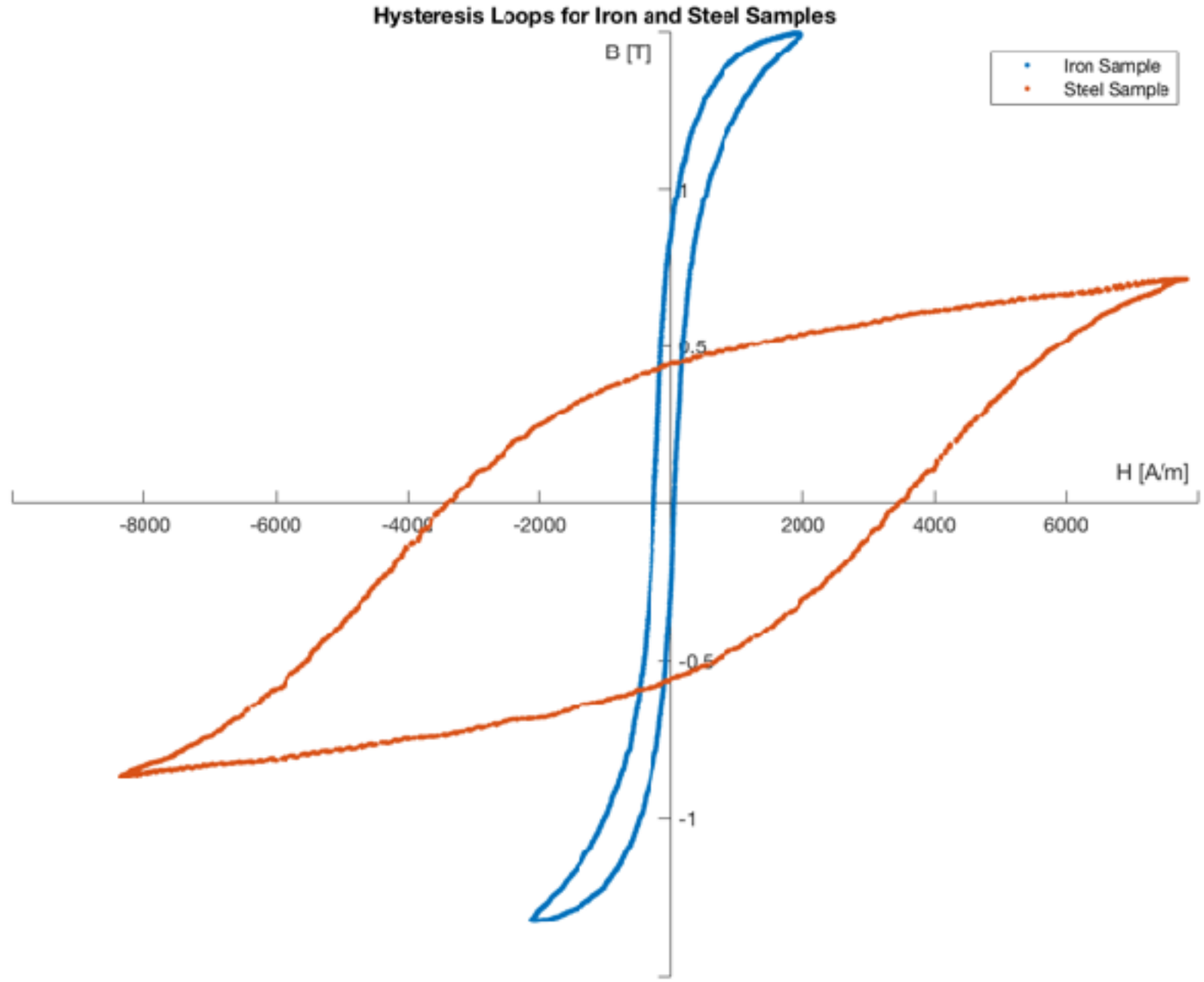
- Steel is better suited as a motor.

AREA OF THE HYSTERESIS LOOPS



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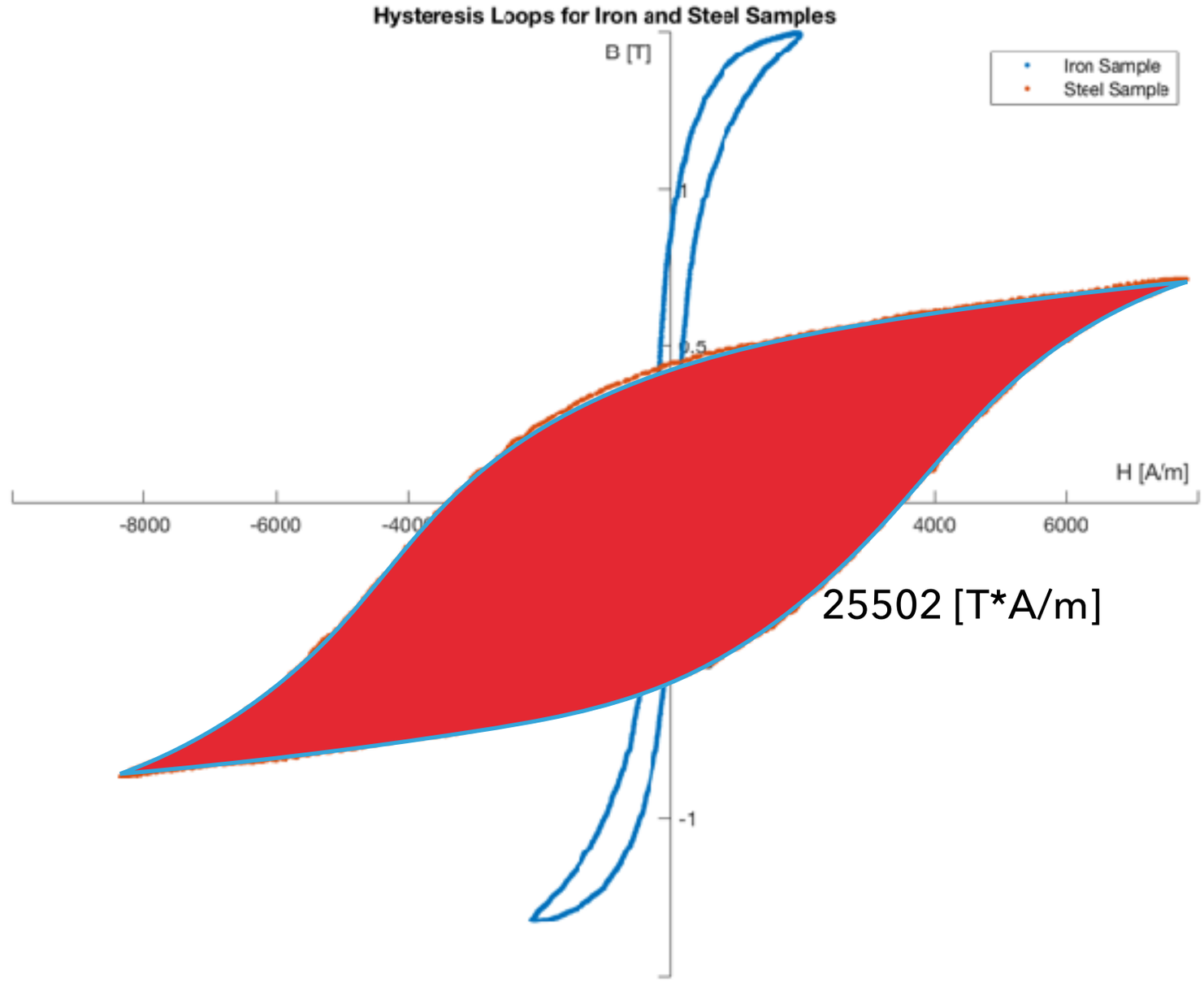

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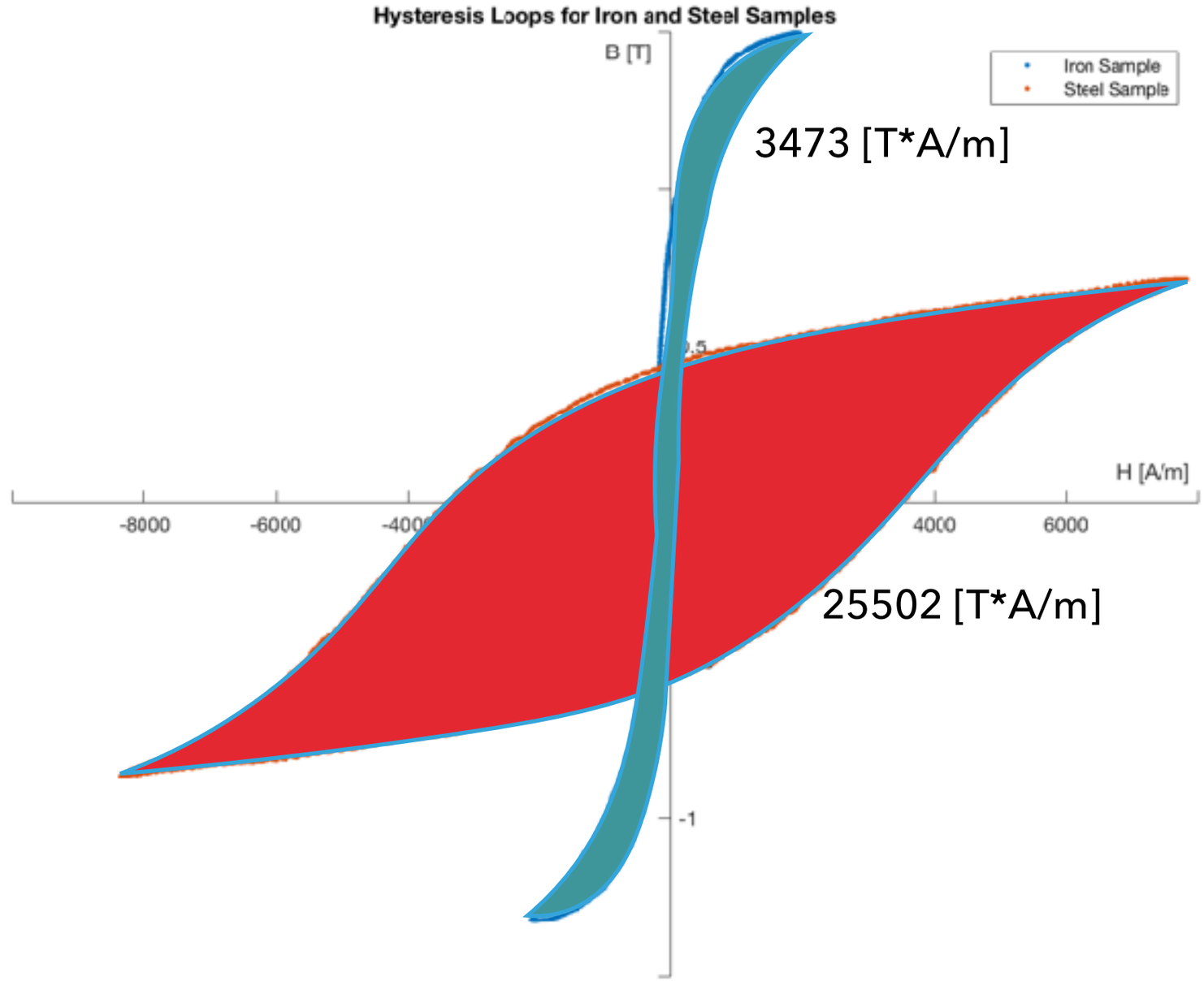

$$P = AVf$$

$$V = L * Area\ of\ sample\ face$$

- Power Dissipated by Steel: **100 +/- 6W**

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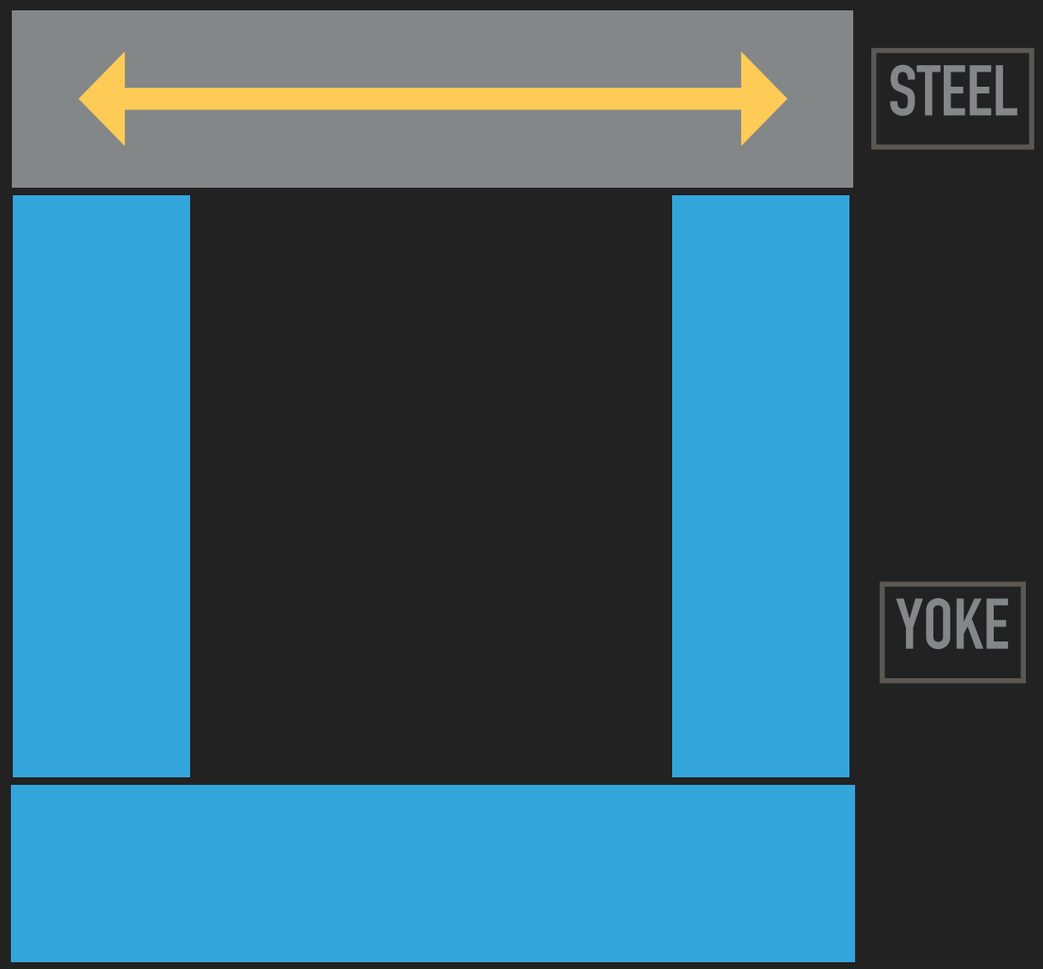
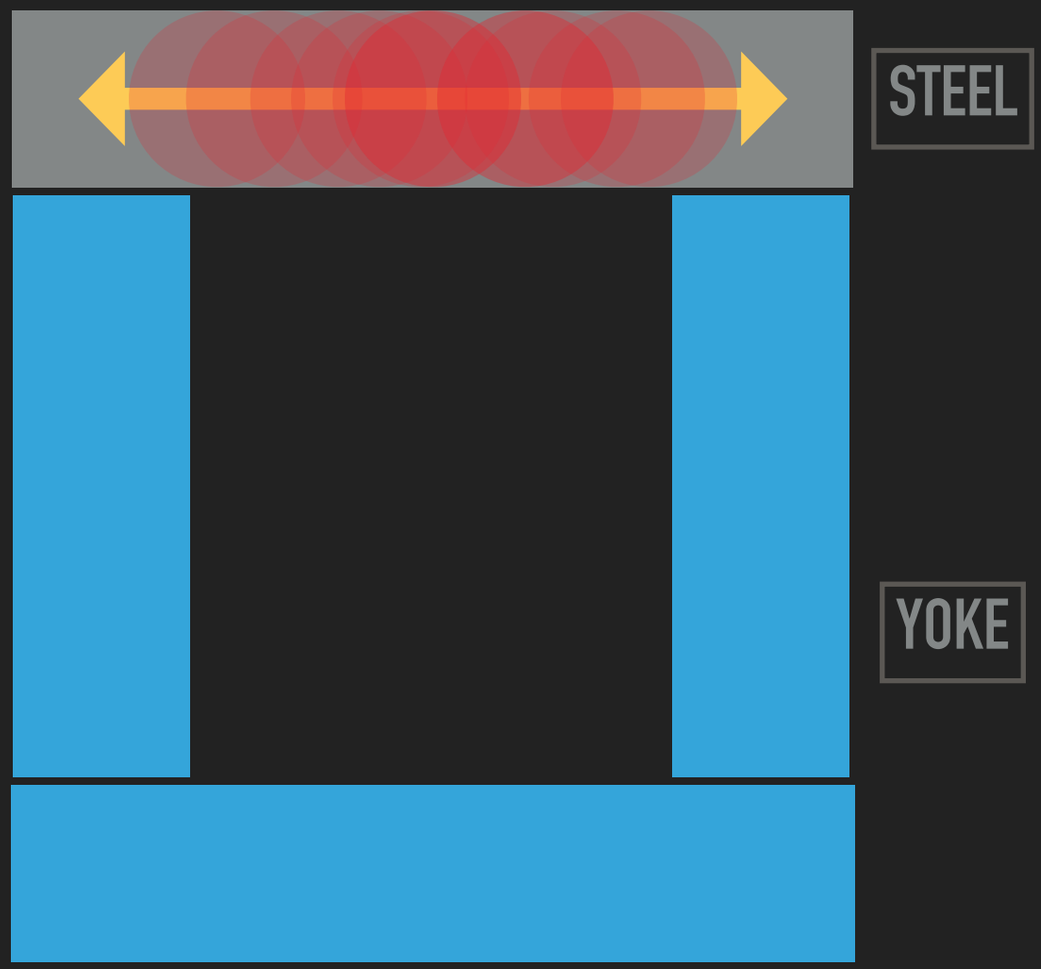
- We estimated: **60 W**



WHERE DID IT GO WRONG?



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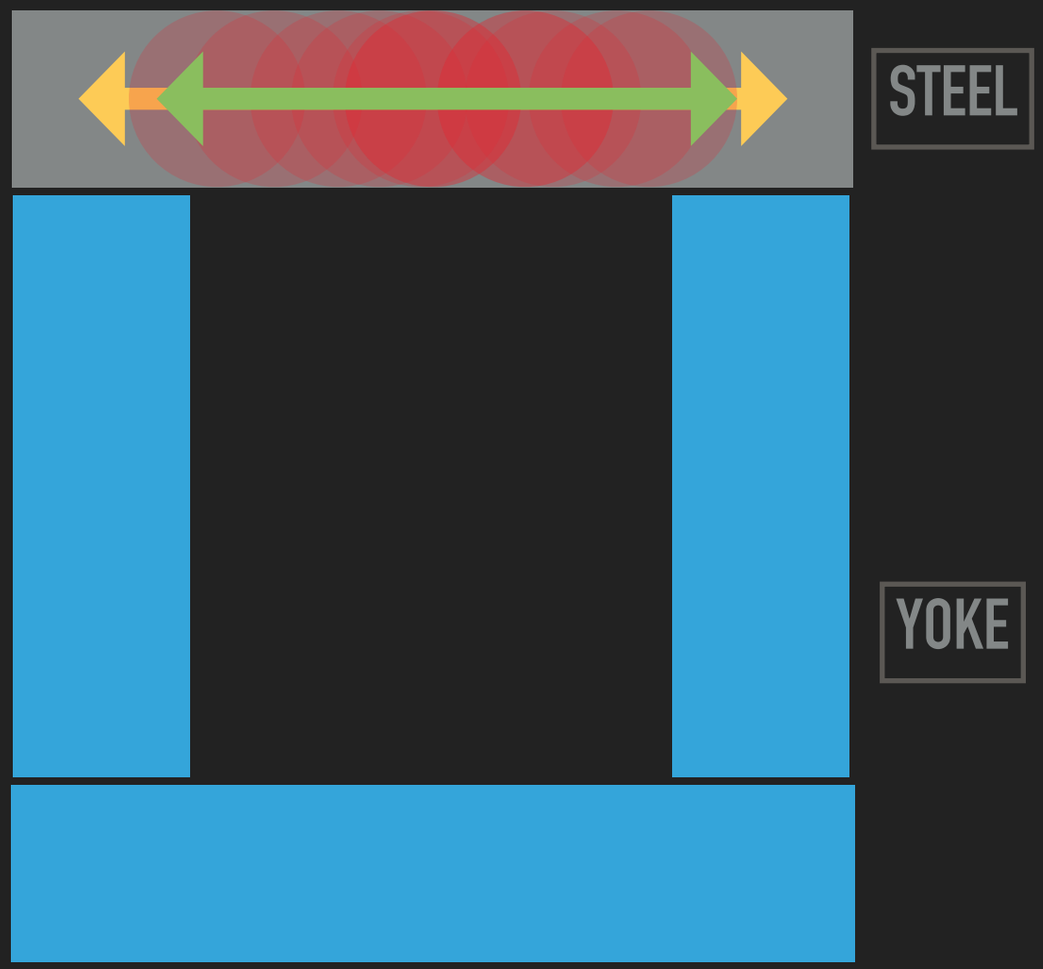

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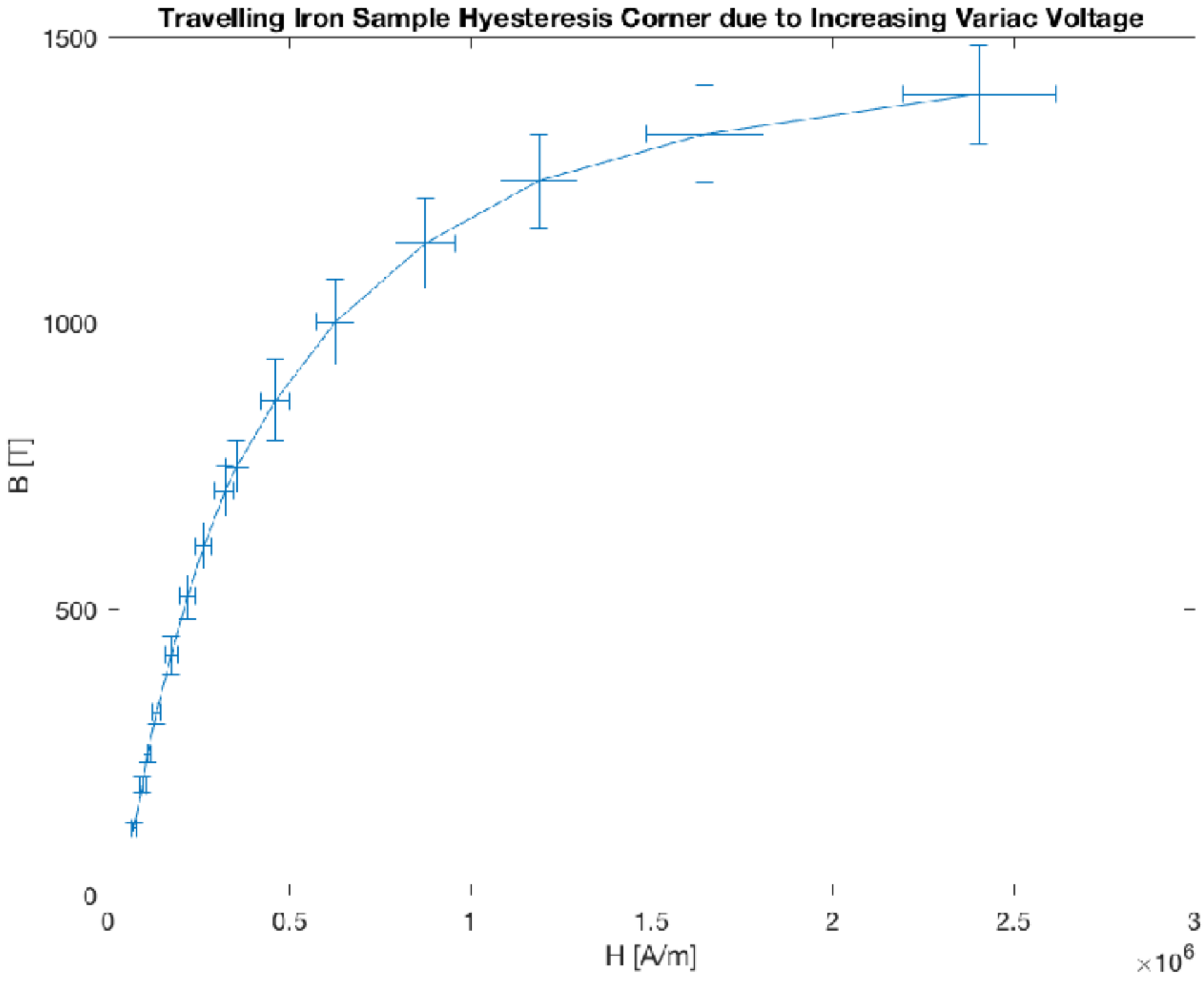
CHANGE IN HYSTERESIS POSITION (SAMPLE)

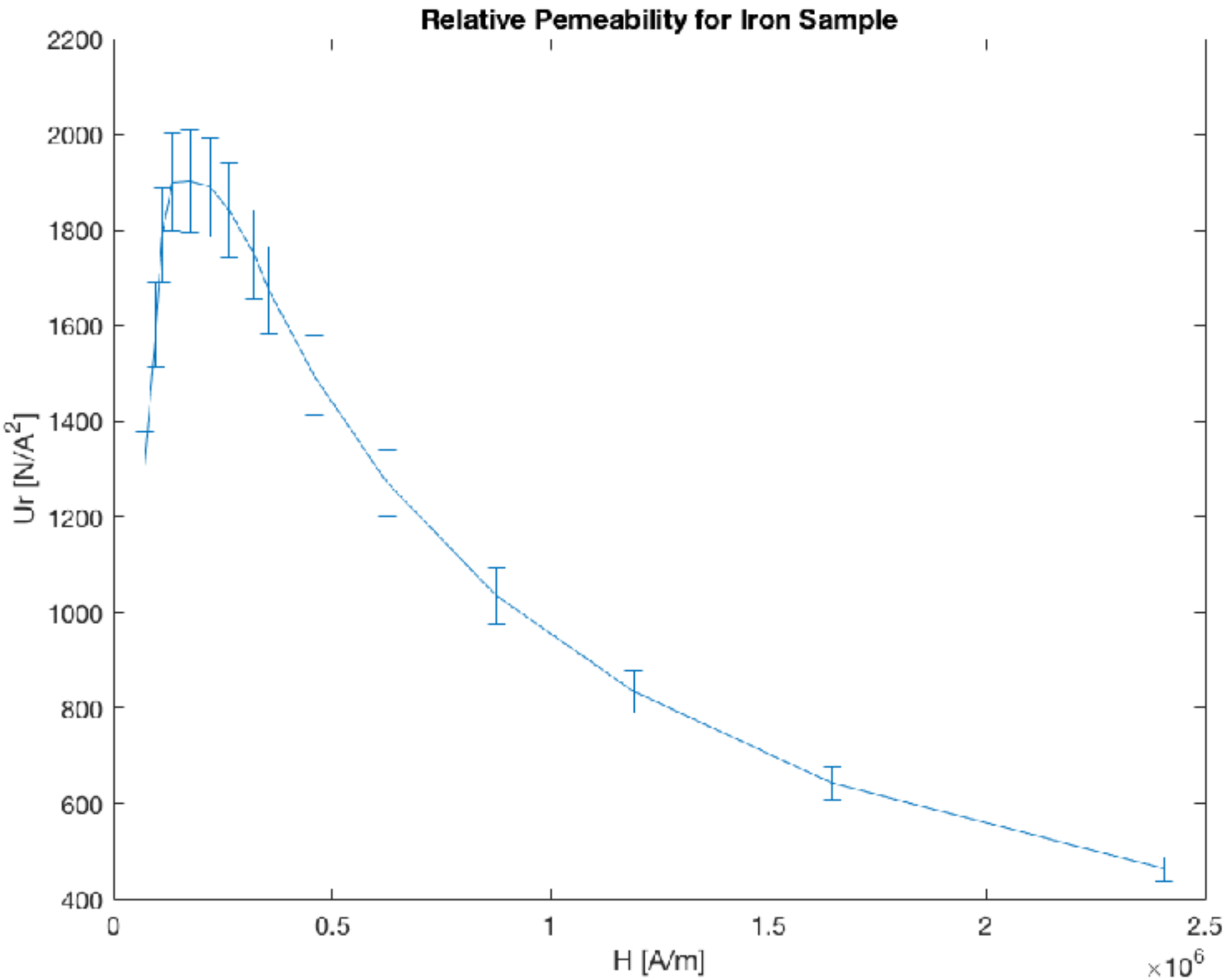
Variac Voltage [V]	Top-right corner X [mV]	Top-right corner Y [mV]	x scale [mV/div]	y scale [mV/div]
3	13.75	26.87	5	10
5	18.25	43.75	5	20
7	21	56.25	5	20
10	25.5	72.5	5	20


Travelling Iron Sample Hyesteresis Corner due to Increasing Variac Voltage
1500
1000
500
0
B [T]
0
0.5
1
1.5
2
2.5
3
H [A/m]
×10^6

$$\mathbf{B} = \mu_0 \mu_r \mathbf{H}$$

$$\mu_0 = 4\pi * 10^{-7}$$

Source for permeability of free space: http://physics.info/constants/


Relative Pemeability for Iron Sample
Ur [N/A^2]
2200
2000
1800
1600
1400
1200
1000
800
600
400
0
0.5
1
1.5
2
2.5
H [A/m]
×10^6

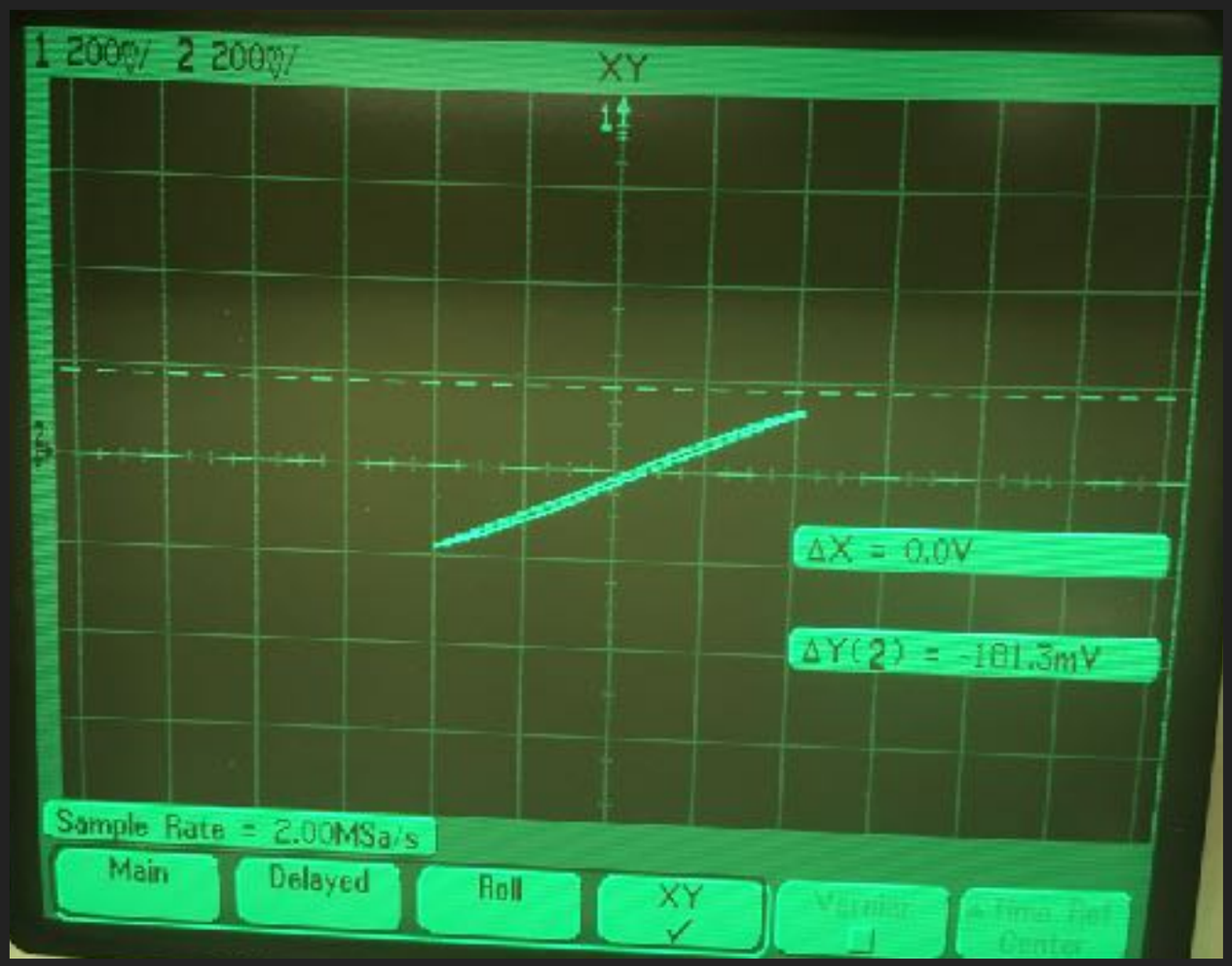
- Relative permeability: **1900 +/- 200 H/m**
- Actual value is:
  - **200000** for **99.8%** pure Iron
  - **5000** for **99.8%** pure Iron

Source for relative permeability: http://www.engineeringtoolbox.com/permeability-d_1923.html

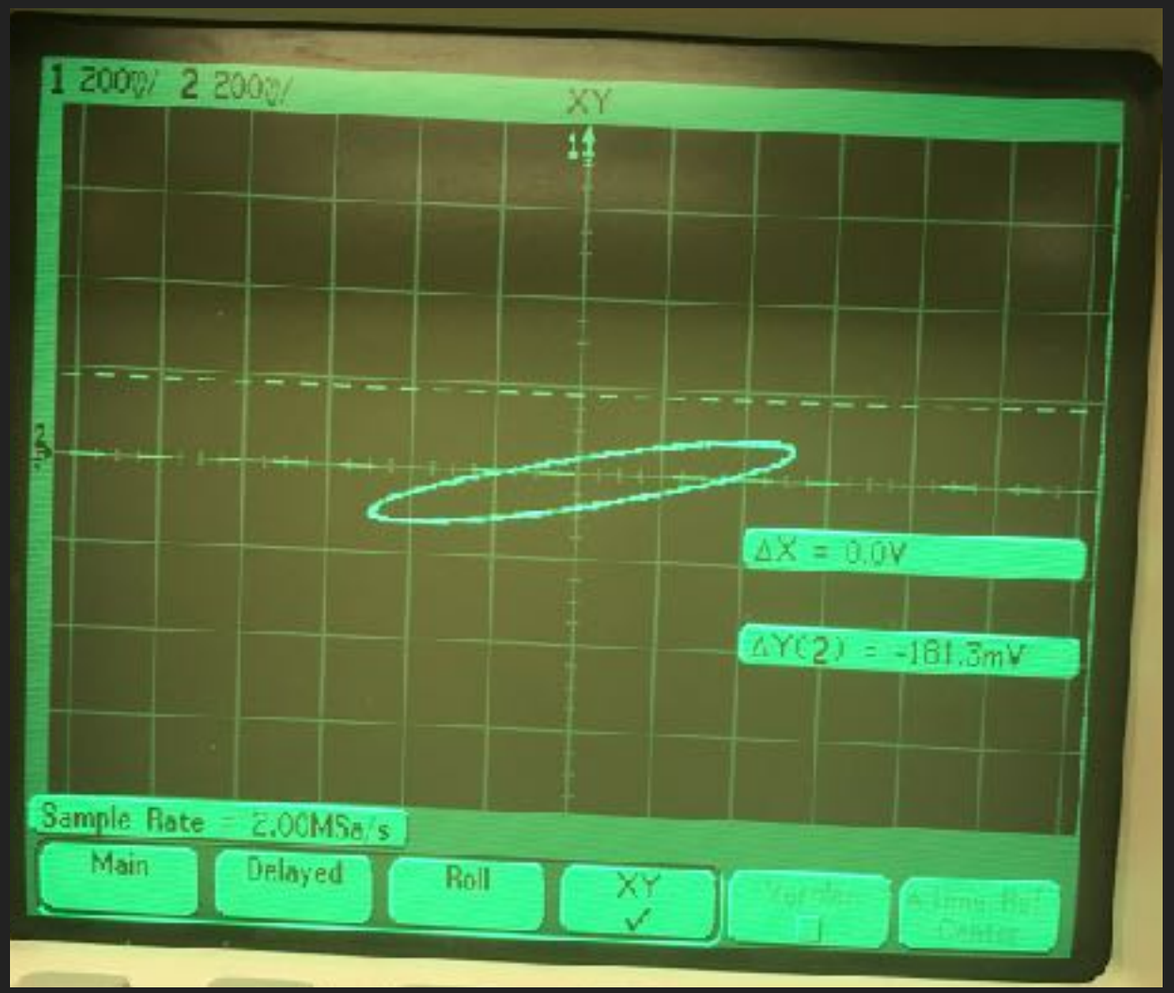
$$\text{flux density} = H\mu_r$$

- Calculated as: **333000 +/- 6000 N/(Am)**

ENPHYS 253 ORAL REPORT



PLASTIC



COPPER

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- Relative permeability was calculated: **1900 +/- 200 H/m**
  - **200000** for **99.8%** pure Iron
  - **5000** for **99.8%** pure Iron

SOURCES OF ERROR

- Magnetic Length
- Unknown purity of Iron

THANK YOU FOR YOUR TIME