

## Project Overview

Team NanoFlux designed a preliminary prototype induction system which aids in the understanding of the ENP's behavior under inductive loads and the analysis of the results.

## Motivation

Traditional induction heating methods takes minutes in order to melt metals. Sponsored by Dr. Xu's M<sup>3</sup> laboratory, this senior design project aims to design an induction heating system utilizing SDSU's Electro-Nano-Pulsing (ENP) power supply to melt metal powders in under a second.

## Meet the Team



**Khattab Ramadhan**  
ME Lead



**Thu Vu**  
ECE Lead



**Antonio Solis**  
ME



**Jena Hernandez**  
ME



**Arturo Galeana**  
ECE



**Kevin Vu**  
ME

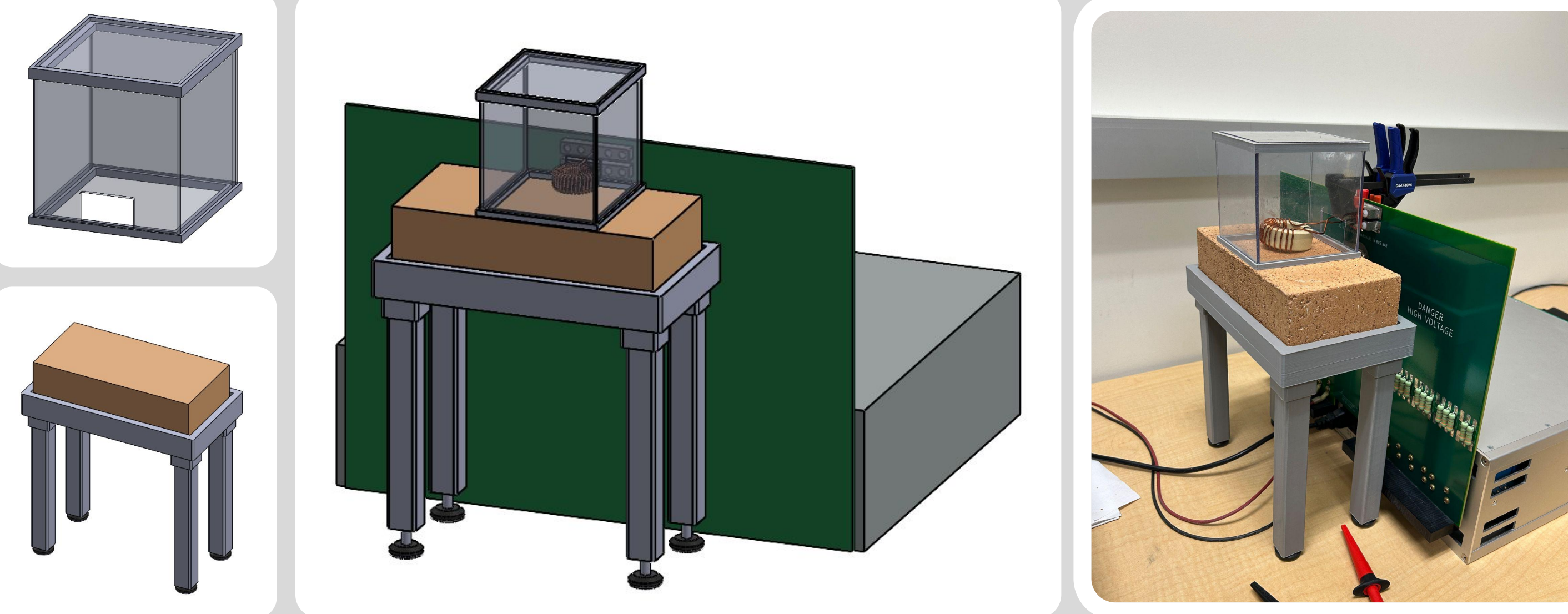


**Justin Nedd**  
ME

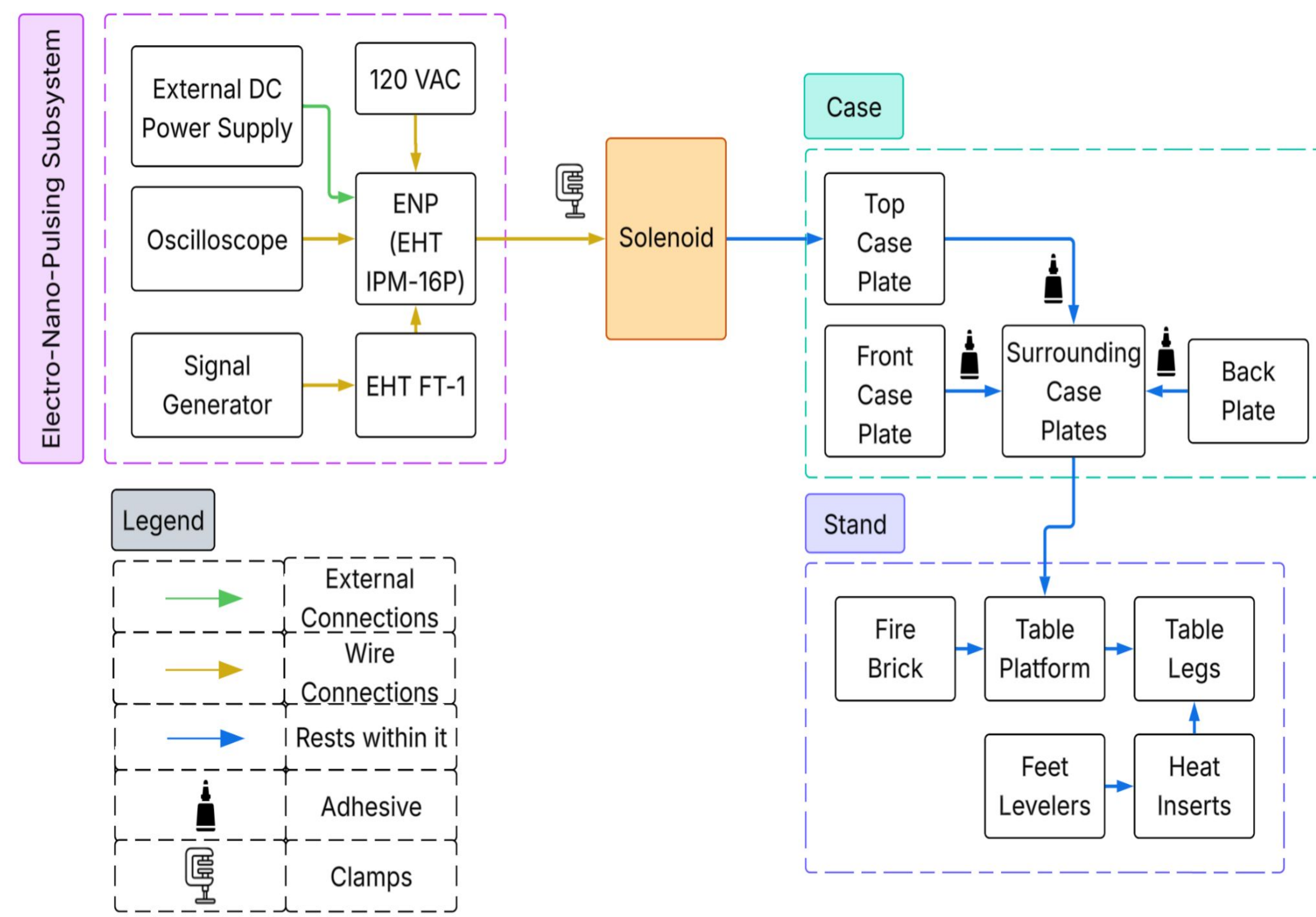
## Acknowledgements

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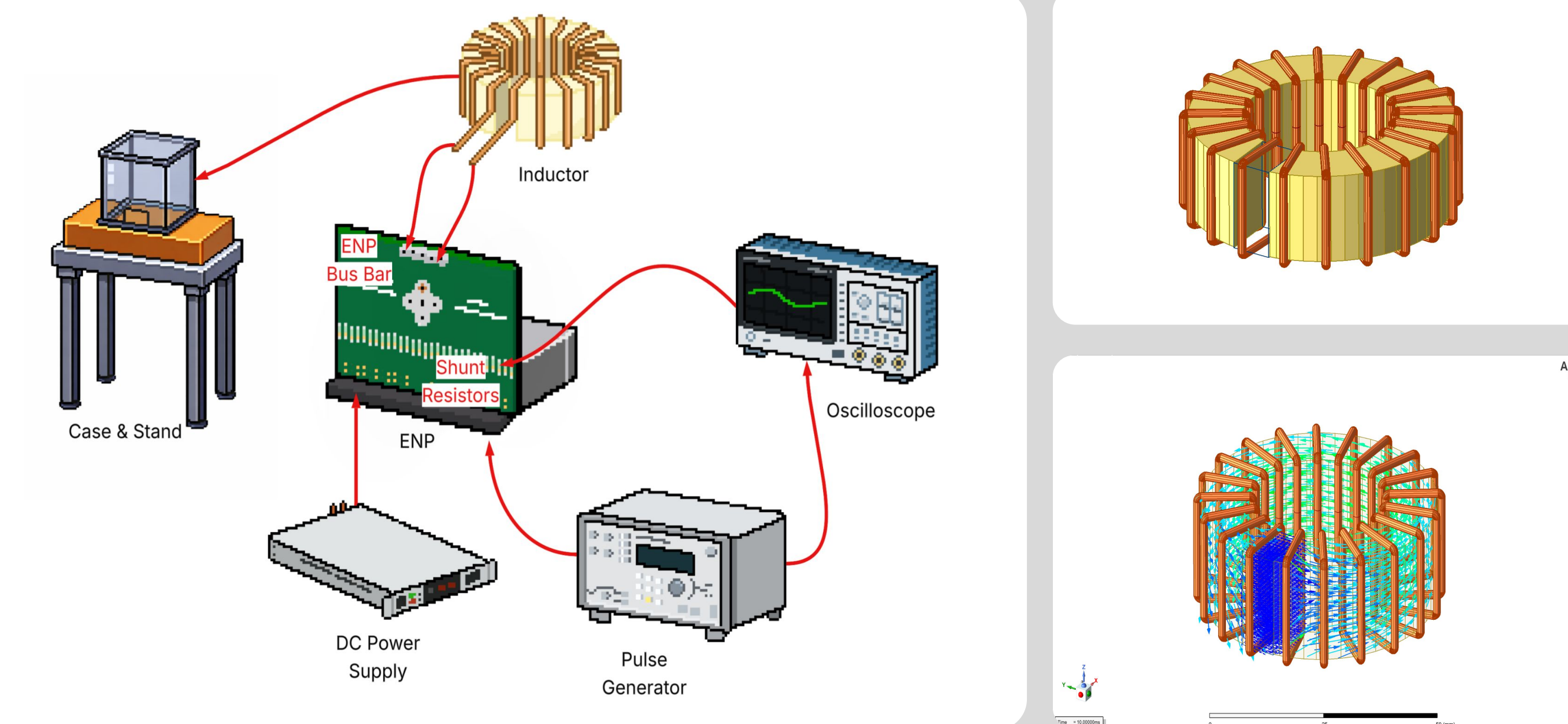
## Design



## System Level Diagram



## Testing and Analysis



### Expected Behavior:

- Shorter pulses → limited current rise
- Longer pulses → increased current
- Inductor → delayed current response

### Measured Behavior:

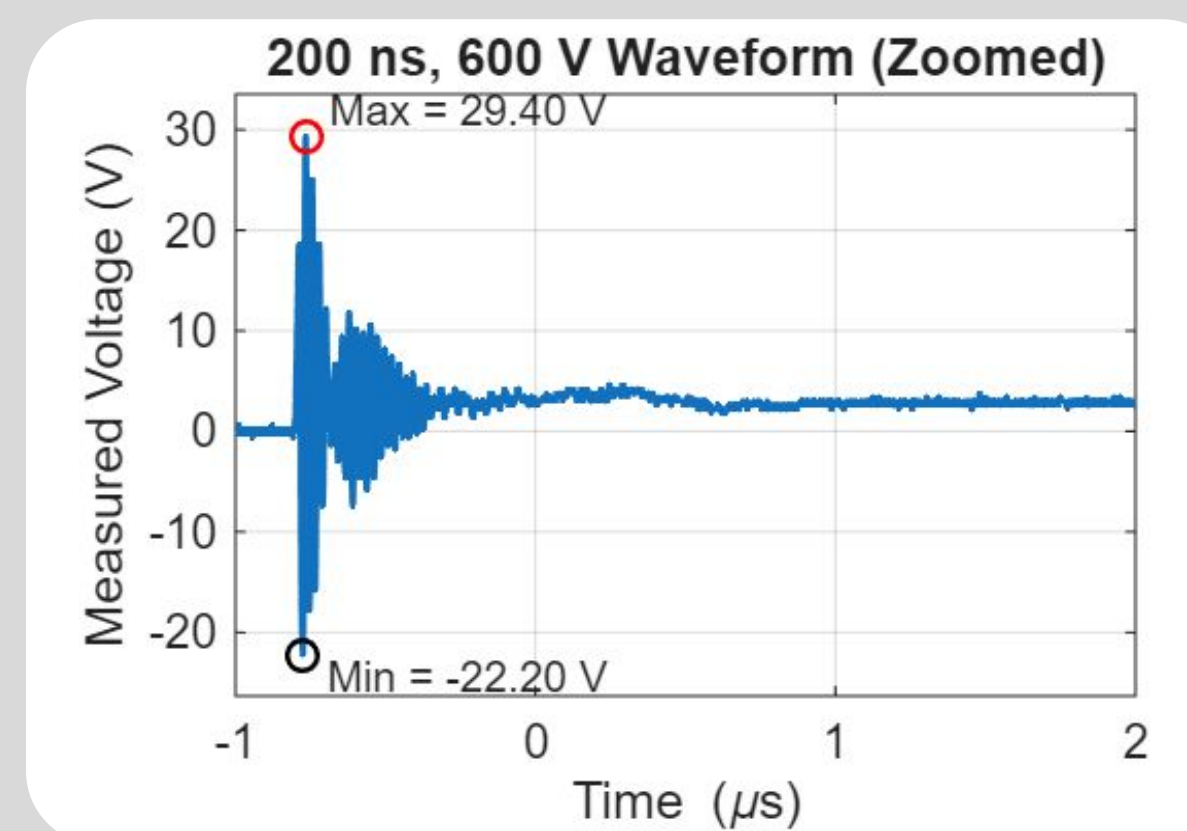
- Strong oscillations
- Underdamped response
- Transient spikes and ringing
- Deviation from ideal RL predictions

## Results

### Test Case

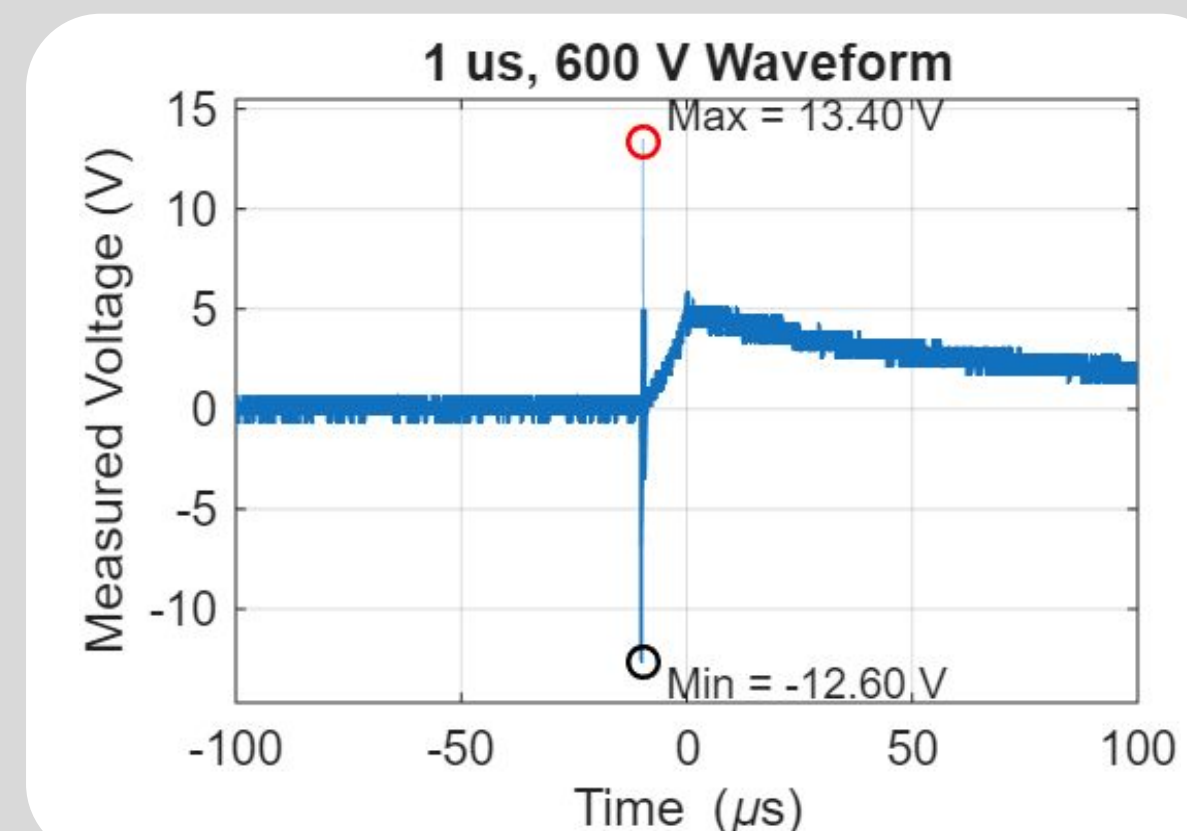
#### 200 ns, 600 V

- Strong oscillation; underdamped response
- **Max: 29.4 V, Min: -22.2 V**



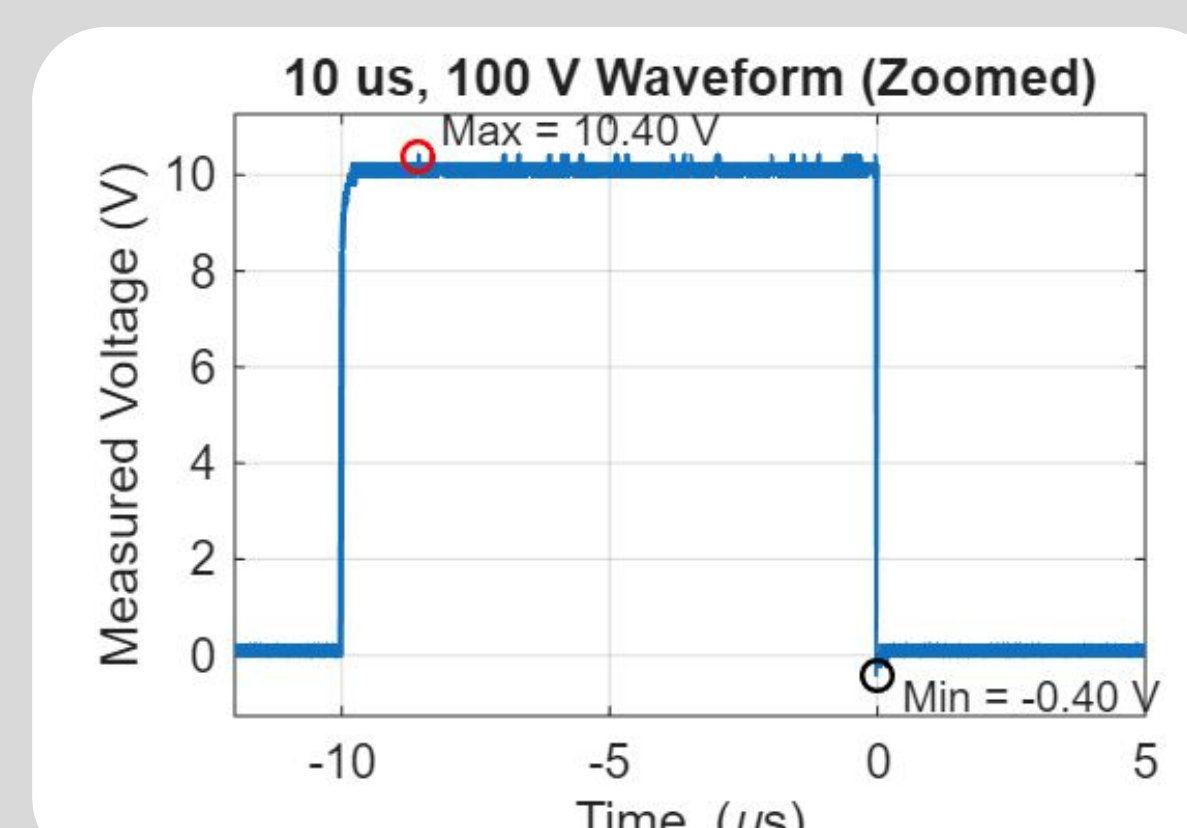
#### 1 μs, 600 V

- Transient spike followed by gradual decay
- **Max: 13.4 V, Min: -12.6 V**



#### 10 μs, 100 V

- More sustained pulse; reduced visible ringing
- **Max: 10.4 V, Min: -0.4 V**



## Manufacturing and Assembly



**Bandsaw**

**Dremel**

**3D Printing**

**Winding**

## Conclusion

### Key Findings

- ENP produces unstable and oscillatory responses with inductive loads
- Short pulse widths require impractically high voltage to drive current
- Output is not sufficiently controllable for induction heating applications