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Mechanical Testing and Design of the Magnetic Linear Test Apparatus

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MECHANICAL TESTING AND DESIGN OF THE MAGNETIC LINEAR TEST APPARATUS

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BOISE STATE UNIVERSITY

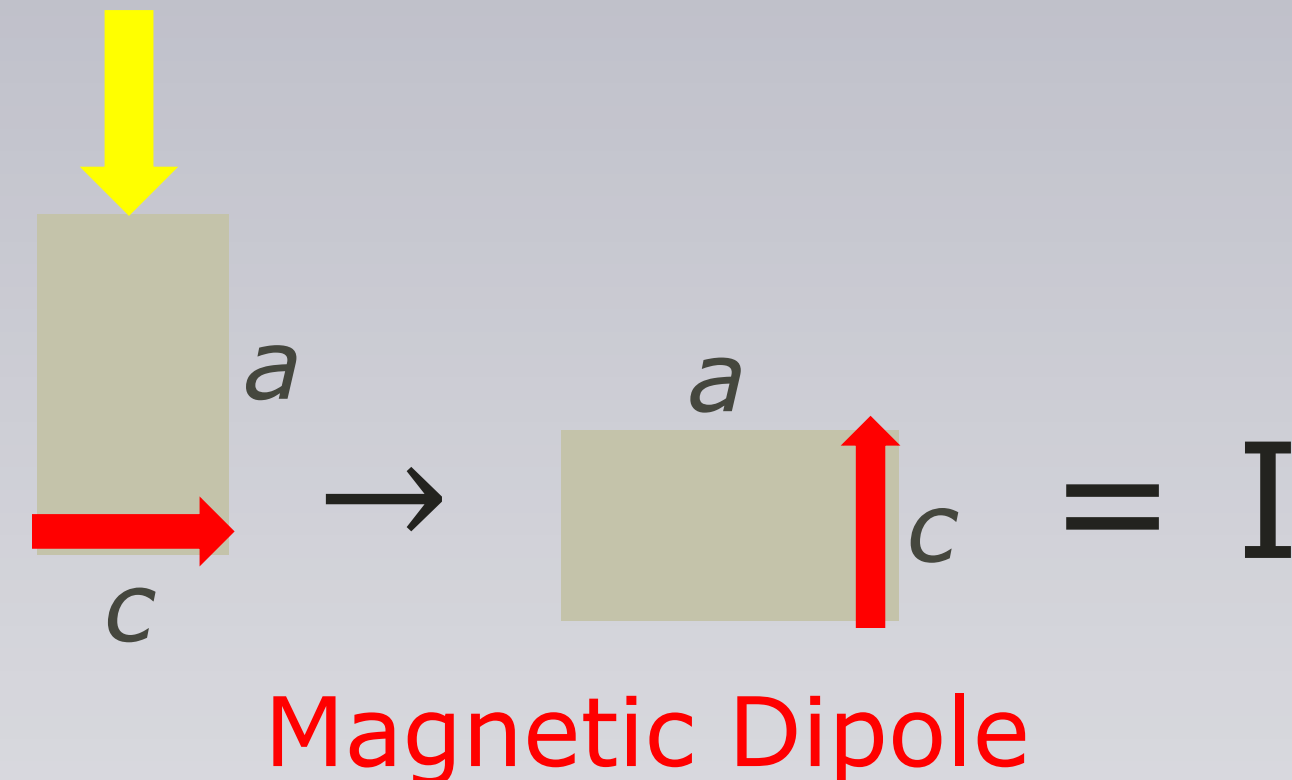
COLLEGE OF ENGINEERING

Department of Materials Science & Engineering

PURPOSE

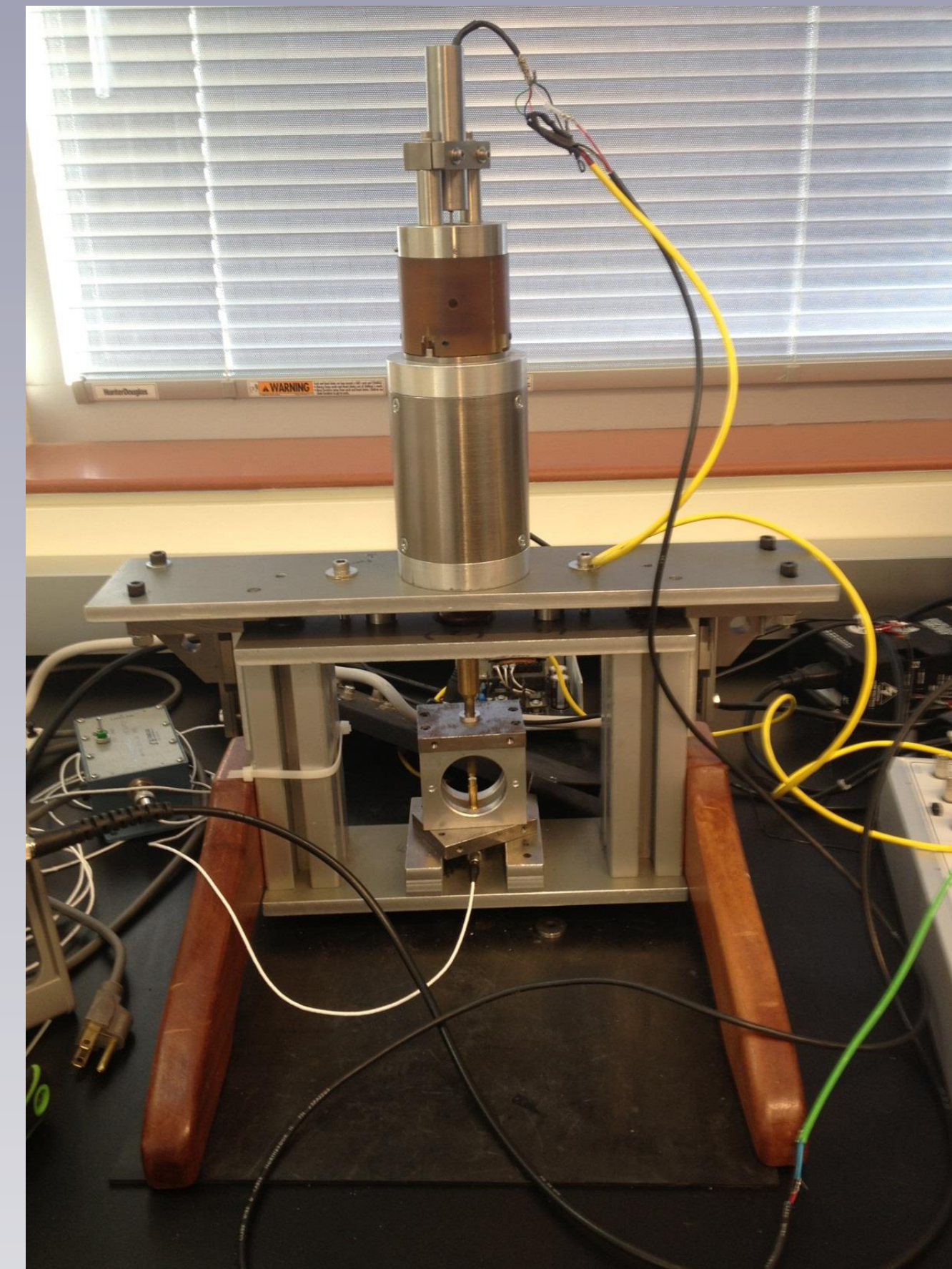
The Magnetic Linear Test Apparatus (MLTA) is used to test and study the fatigue and electrical characteristics of magnetic shape memory alloys (MSMA).

External Force



EXISTING DEVICE

- Design has functioned well and produced useable data
- Magnets must be removed to access the sample stage
- Sample mounting takes place in a difficult to access area
- Limited to fixed magnetic field strength
- Stability issues caused by vibration



DESIGN BUILD

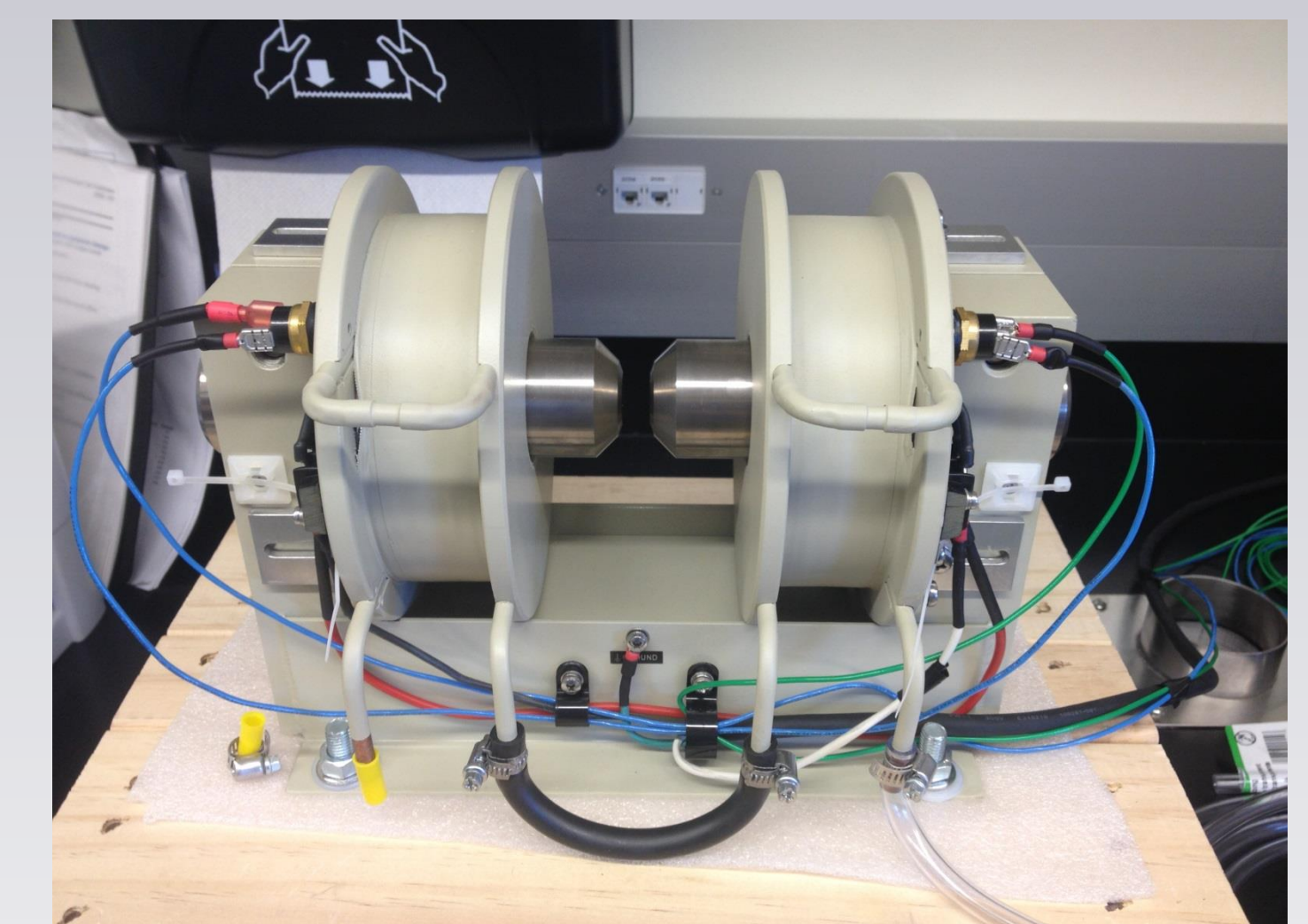
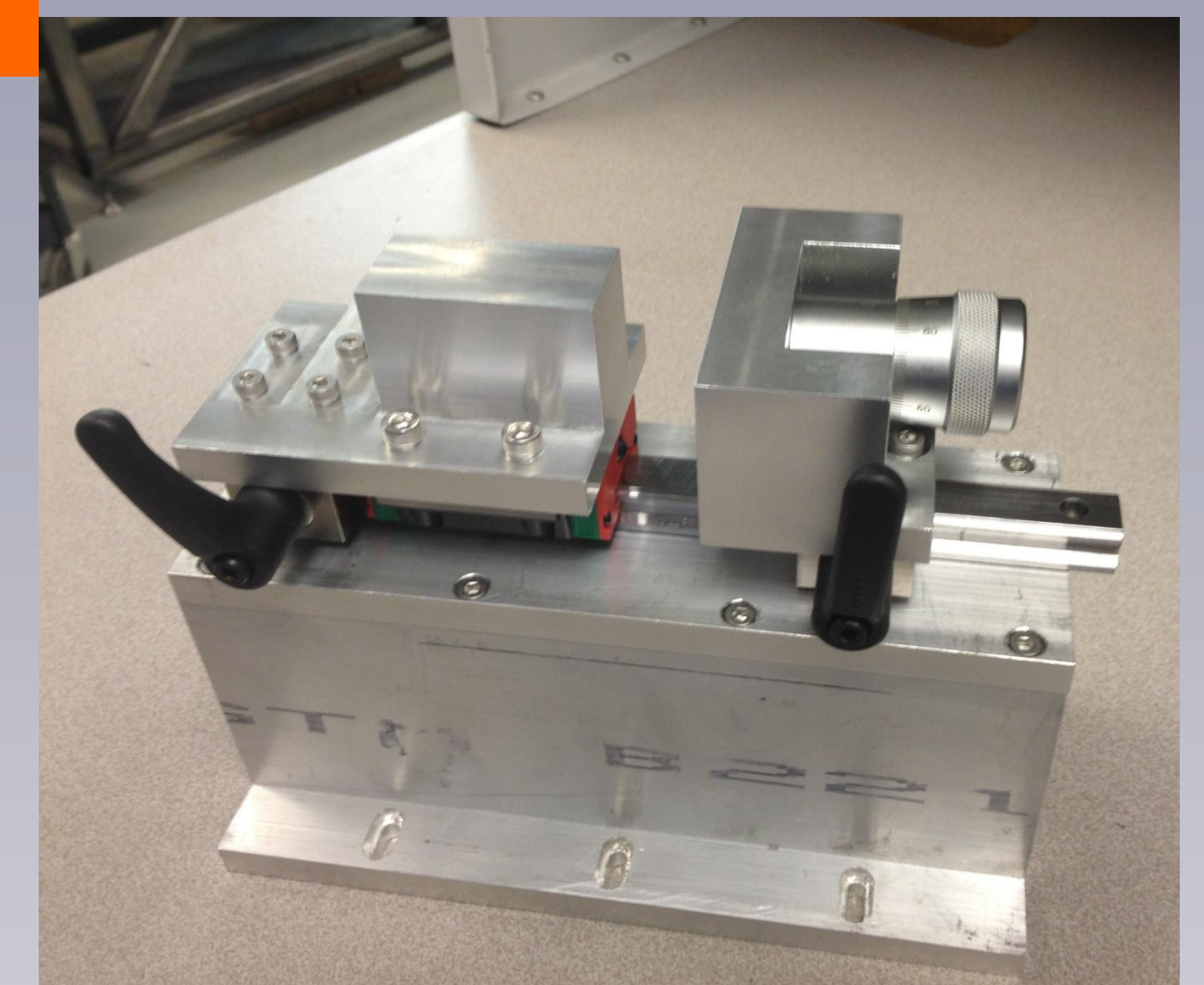
Design completed using Dassault Systemes Solidworks Modeling software

Parts fabricated in COEN Student Machine Shop by undergraduate researchers

Electromagnet characterized and prepared in COEN Magnetic Materials Lab

Electromagnet wired with temperature sensitive switches to prevent overheating

Electromagnet plumbed for process cooling water to sustain large magnetic fields



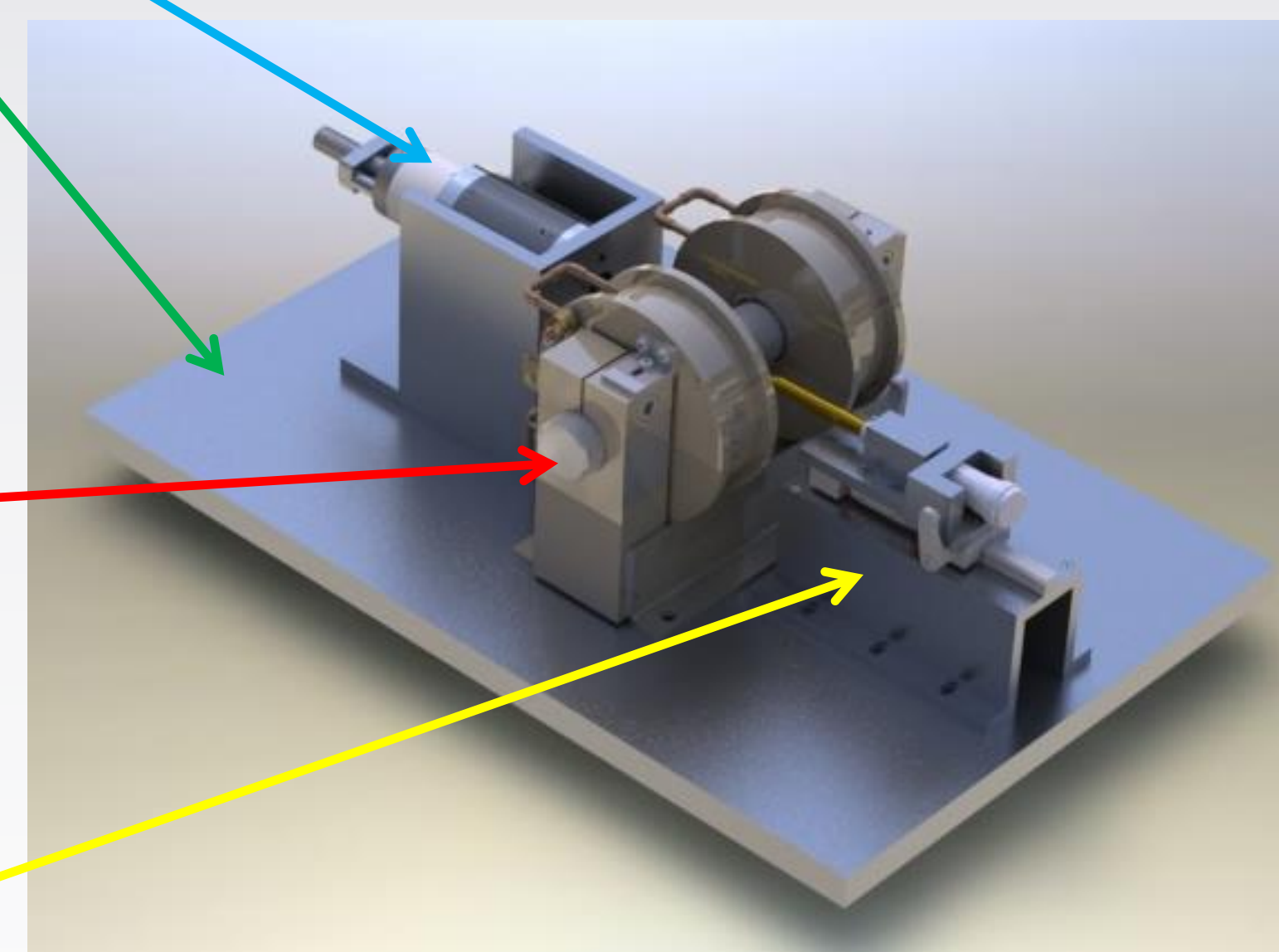
DESIGN REQUIREMENTS

- Stable platform able to withstand constant vibration
- Provide a controlled, variable magnetic field of up to 1 Tesla confined to a small space
- Easily accessible sample stage
- Precision fixed compression displacement of sample (± 0.002 mm)
- Utilize as much of existing apparatus as practical in order to reduce cost
- Closed-loop control system and 1 μ Hz data acquisition

FINAL DESIGN

Design completed entirely by COEN undergraduate students

1. Linear actuation motor
2. Heavy MIC6 aluminum base plate with rubber feet
3. Variable field electromagnet
4. Linear compression stage with micrometer compression adjustment



ACKNOWLEDGEMENTS

COEN Machinist Phil Boysen for his design and fabrication advice, COEN Student Machine Shop Manager Chris Davis for his fabrication help, and financial support of the US Department of Energy, Office of Basic Energy Sciences (BES) through project DEFG-02-07ER46396.

