

# Noise Reduction in ALPHA-g Magnet Control System

Sara Sawford

Supervisor: Dr. William Bertsche

25 July 2024

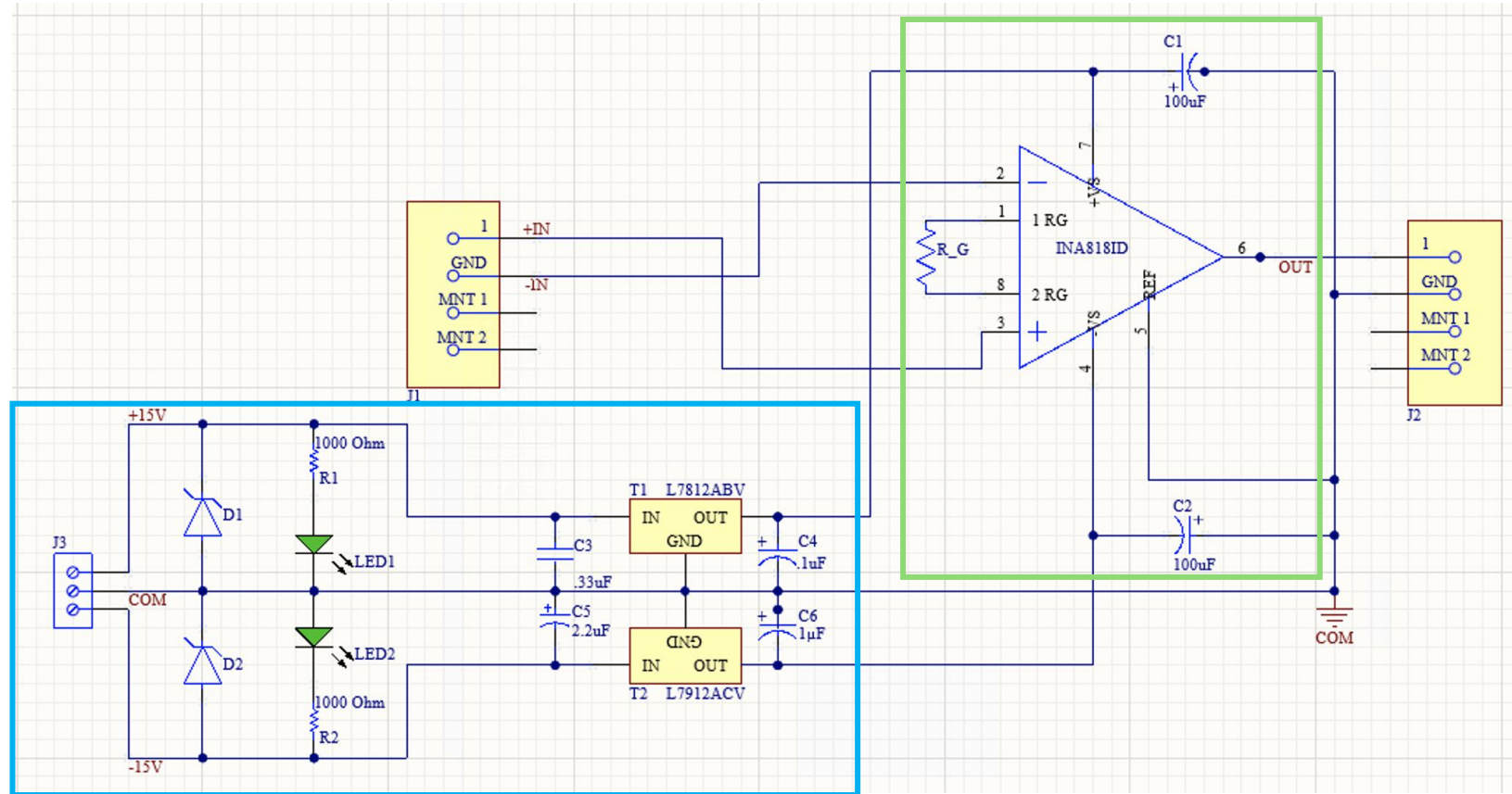


# Background

- ALPHA-g measures gravitational effects on  $\bar{H}$  to understand CPT
- Undergoing modifications for better measurements of gravity on  $\bar{H}$ 
  - One new precision trap already installed
- Adding magnets = more noise
- Goal: Design/build circuit to reduce noise when extra magnets are added

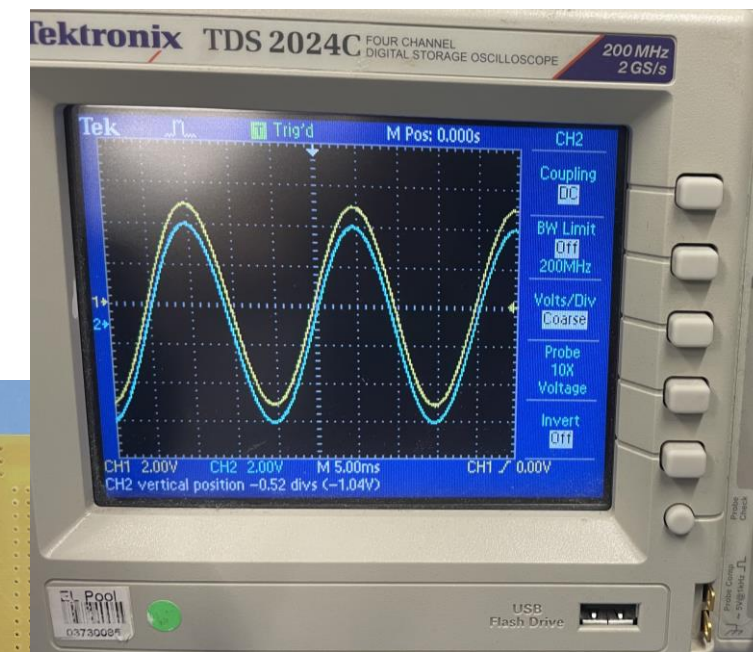
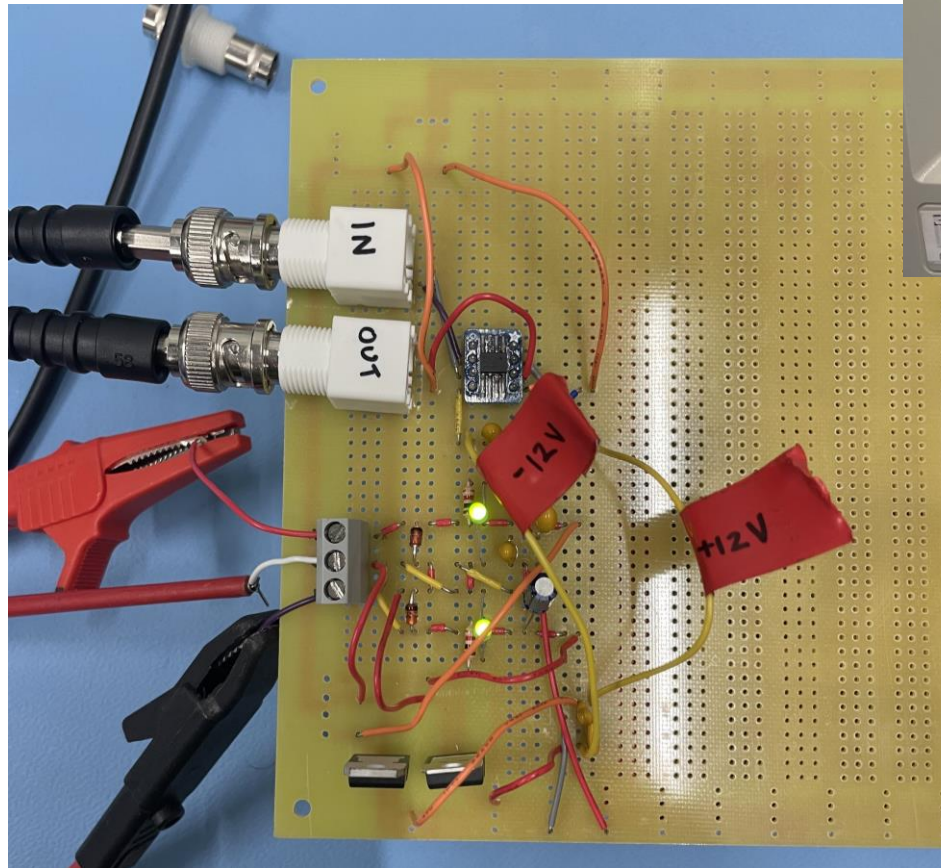
# Design Specifications

- Overall Goal: Noise reduction for high impedance input
  - IC with no gain
  - Decoupling capacitors to reduce noise in chip and provide high current to chip
- Protection for polarity swapping and overvoltage
  - Zener diodes to prevent reversed polarity damages
  - Voltage regulators keep RHS circuit to  $\pm 12$  V



# Prototype Circuit

- Soldered parts onto perf board
- First tested LHS from previous slide, then added RHS
  - LEDs indicate circuit behaves correctly
- Scope output shows signal was not distorted through circuit
  - Traces offset because perfectly overlap



Input = Yellow  
Output = Blue

# Next Steps

- Testing the prototype
  - Signal comes from direct current-current transformer (DCCT) connected to magnet
  - Collect data with/without circuit to compare noise in system output
- Design/print PCB for implementation to ALPHA-g
  - 3D print holding box for PCB for safe installation to hardware shelves

# Other Hardware Projects

- Side projects with Dr. Álvaro Nunes De Oliveira
- Adding panels to clean up chassis for new ALPHA-g hardware
- Designing and prototyping circuit to install new power supply to for QPS



