Compact Pressure Sensing Device for Multi-Layer Insulation Blanket Vacuum - Team 11

FAMU-FSU College of Engineering

Marshall Space Flight Center

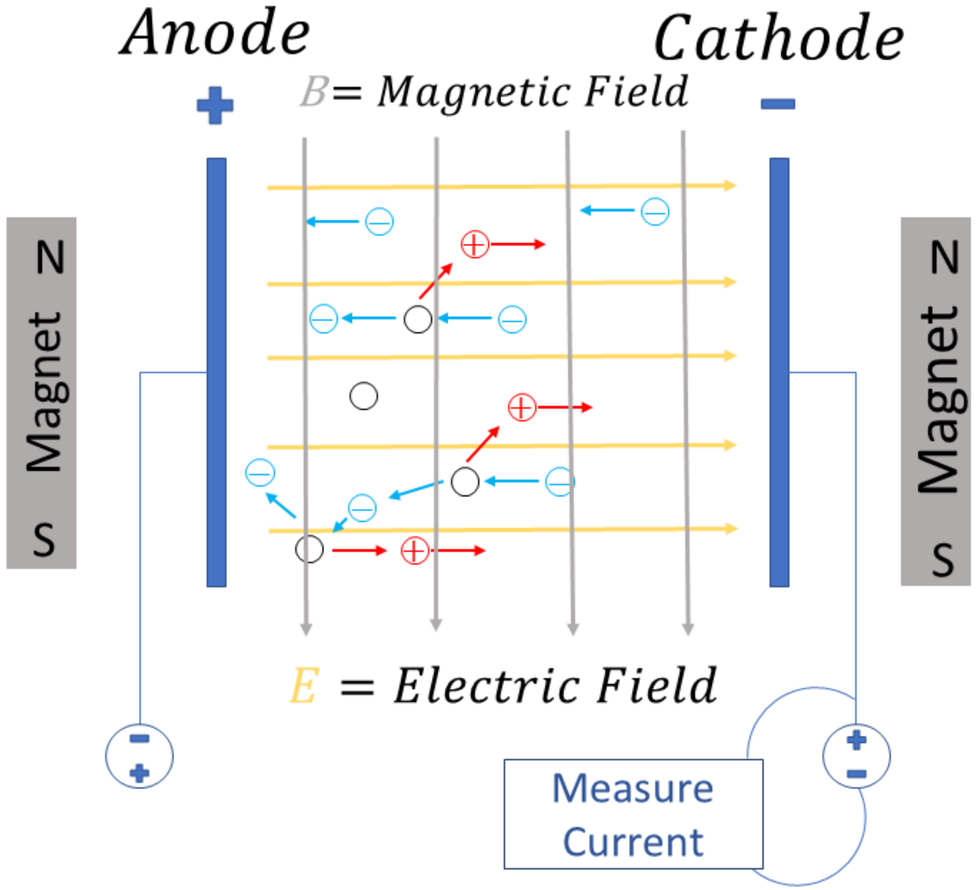
Team Members: Qinjie Chen • Justin DiEmmanuele • Jordan Eljaiek • Benjamin Hallstrom • Marie Medelius
Sponsors: Jim Martin • James Smith Advisor: Dr. Wei Guo Instructor: Dr. Shayne McConomy

Objective

- Design a pressure sensor to be used by NASA's fuel tank insulation blankets.
- Measure pressure between 1e-3 torr (atmosphere pressure) to 1e-5 torr (extreme vacuum).
- Must fit within 2 cm x 1 mm x 1 mm.

Background

- The cryogenic fuel tanks used by NASA satellites must be kept at extremely cold temperatures.
- A specially designed aluminum/polyester blanket, called a multi-layer insulation blanket (MLI), is used to keep heat from solar radiation out.
- **MLI blankets must be kept at extremely low temperatures.**
- We are designing a pressure sensor that can detect the pressure in the MLI blanket to ensure it is running correctly.



A high voltage emits electrons → Electrons collide with any residual gas and form a current → The amount of ionized current correlates to pressure

Selected Design

- **Cold Cathode Ionization Gauge**
- Our utilizes a strong magnetic field and strong electric field to trap electrons.
- Final prototype consists of two tungsten terminals under a large electric field.

Testing

- Testing took place in the National High Magnetic Field Laboratory cryogenics lab.
- Our prototype was connected to a power source and then placed in a Dewar connected to a vacuum pump.

Future Work

Build	Scale down	Implement Nanotech
•Build a more realistic testing chamber that includes the use of liquid nitrogen.	•Scale down the components that work	• Implement nanotechnology into the design of a cold cathode gauge. Although this route was too expensive for our budget, it could be the most viable solution to scaling down the design

Acknowledgements

Our team would like to thank Jim Martin and James Smith, our sponsors, for the opportunity to work on this project and for providing the necessary resources as we designed our sensor. We would like to thank Dr. Guo, our advisor, for providing technical knowledge and guidance. We also would like to thank Professor McConomy for advising us in the design process.