

WATTS COOKING?

Combustion, Ignition, Radiation & Energy Lab

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BACKGROUND

- Low-grade waste heat accounts for 50% of heat loss in industrial processes
- Low-grade waste heat is excess heat at temperatures of under 100°C
- Low-grade waste heat recovery and power generation using piezoelectric materials is a novel concept of Dr. Deepak Sharma

PROJECT SCOPE

- Generate electricity using heat that would otherwise be released into the atmosphere
- Reasonably priced, easy-to-use system
- Improve access to electricity for rural communities



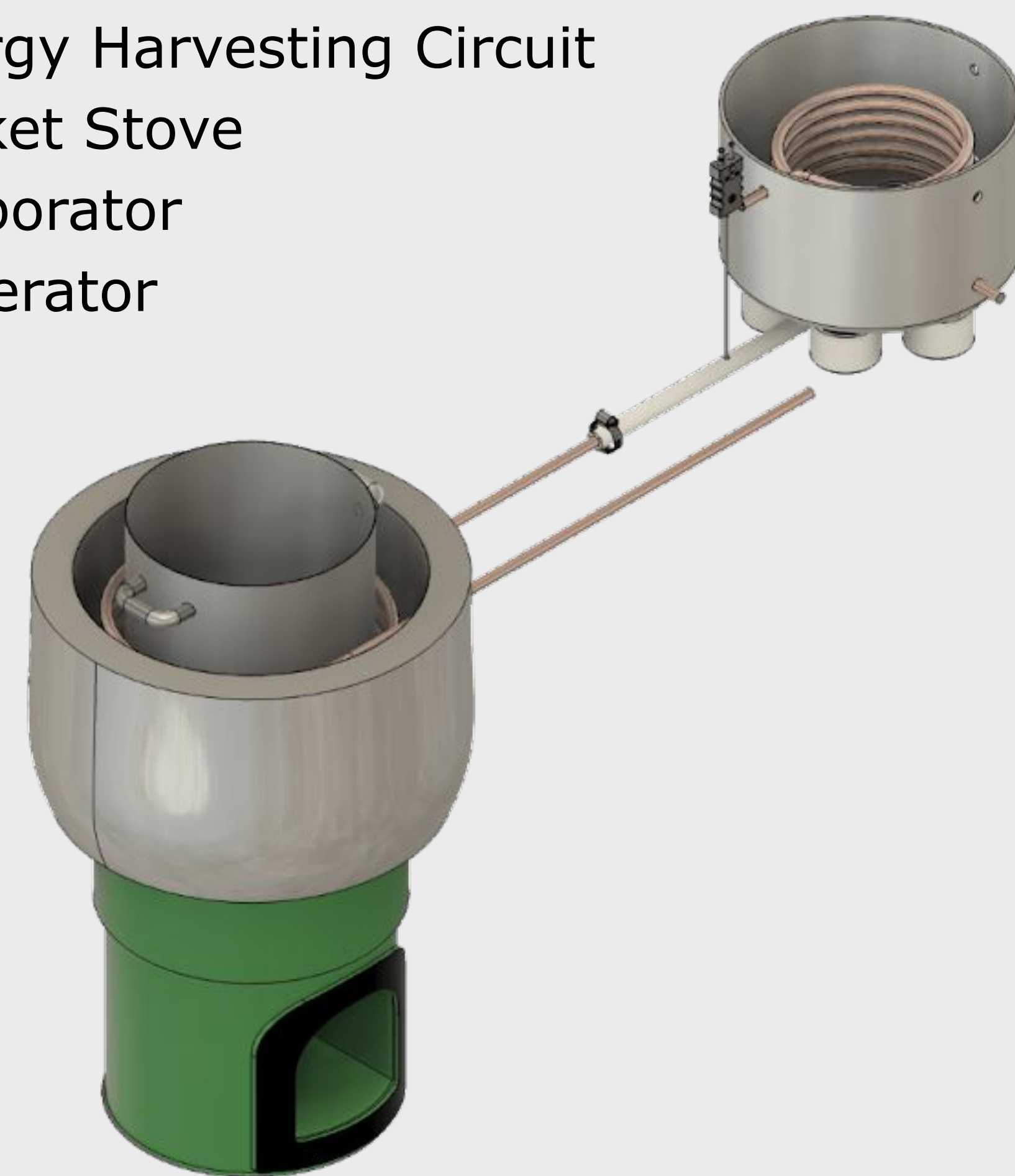
Wood-burning Rocket Stove



First Generation Prototype

MAJOR SUBSYSTEMS

- Low Temperature Heat Exchanger (LTHX)
- Energy Harvesting Circuit
- Rocket Stove
- Evaporator
- Generator



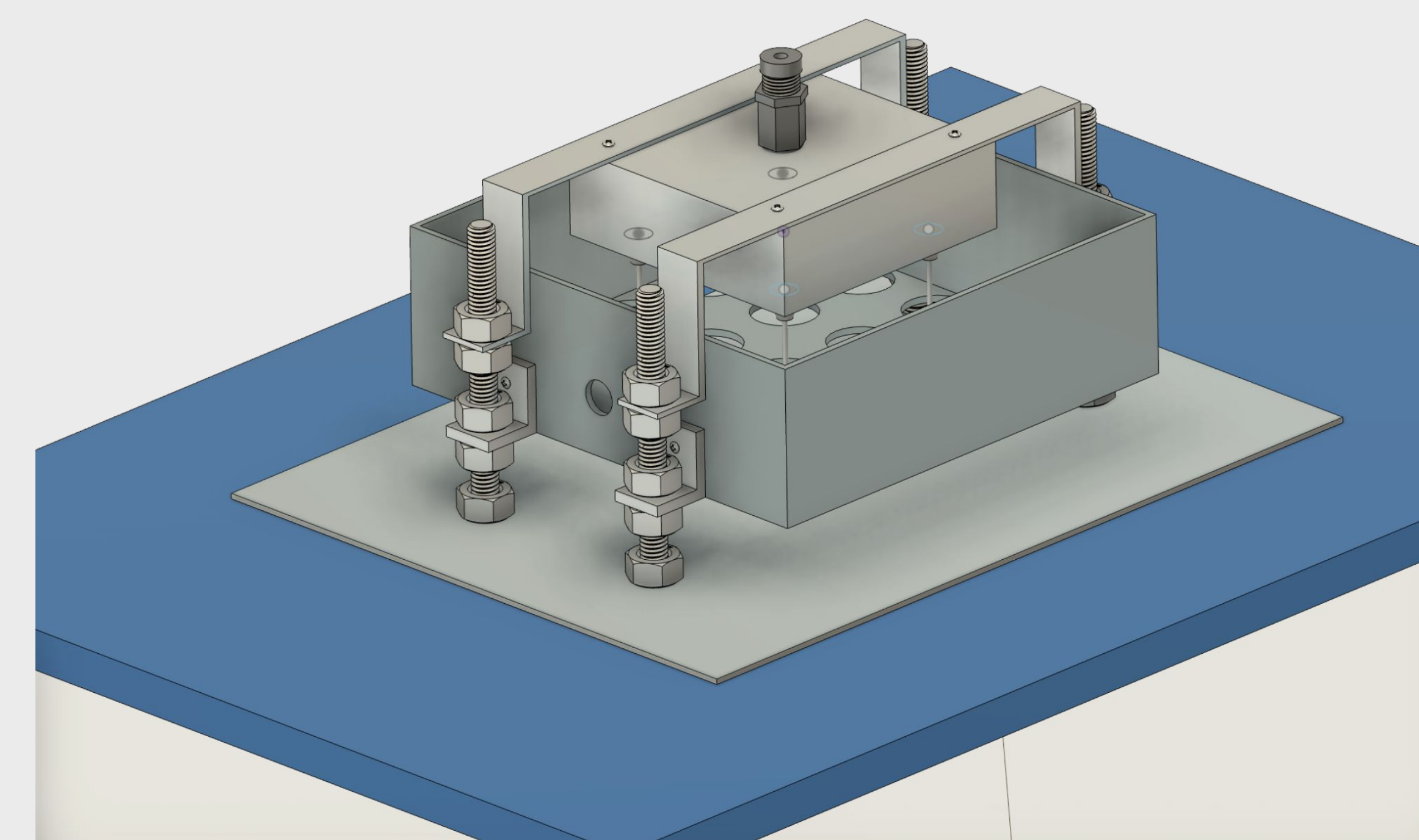
First Generation ThermoPEG Model

SYSTEM DESIGN PROCESS

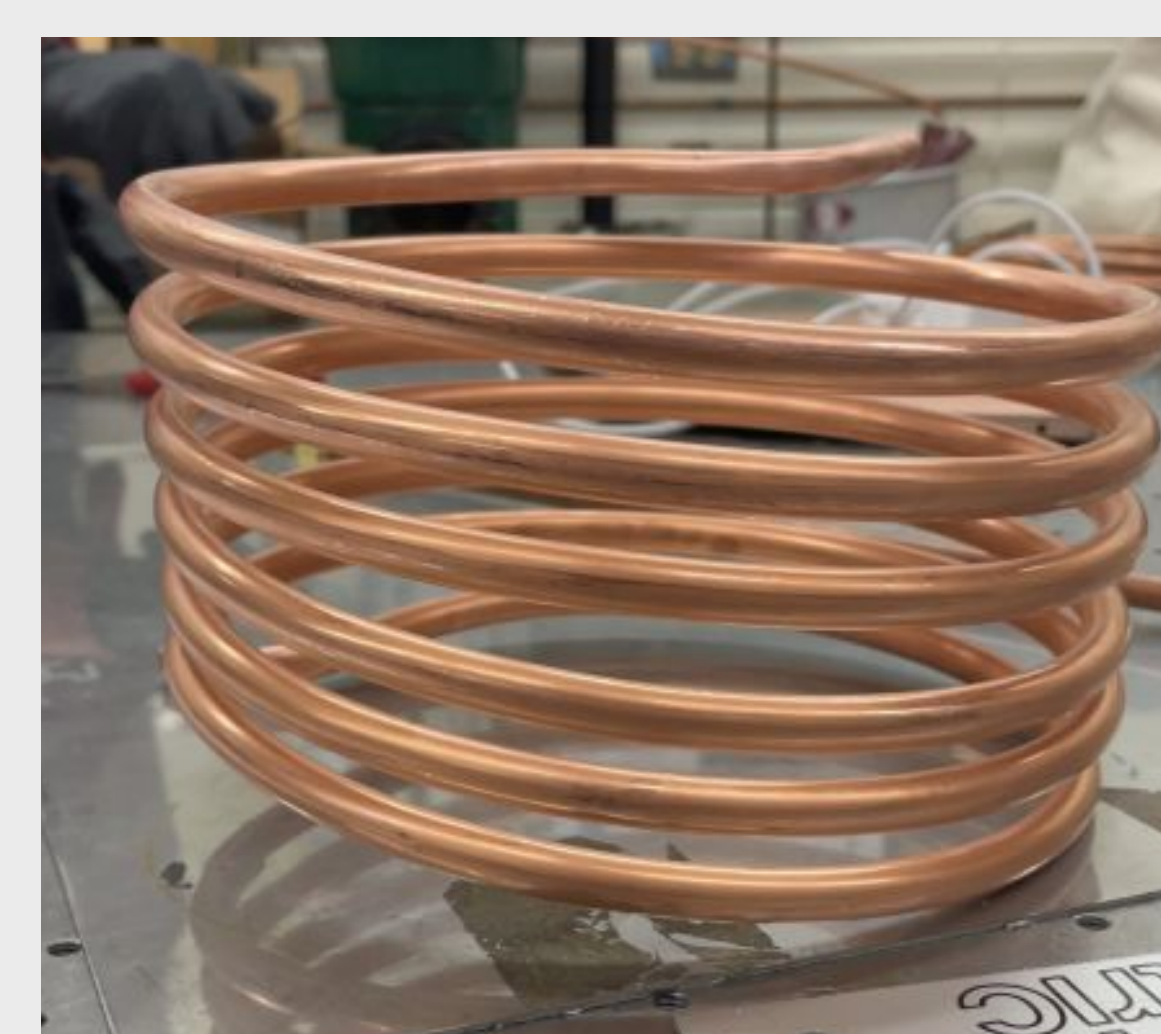
- Developed understanding of system requirements
- Designed and built iterative experimental set-ups to test various ideas and parameters
- In the process of reworking the final design for increased user safety and efficiency



Modular Testing Set Up



Final Generator Design

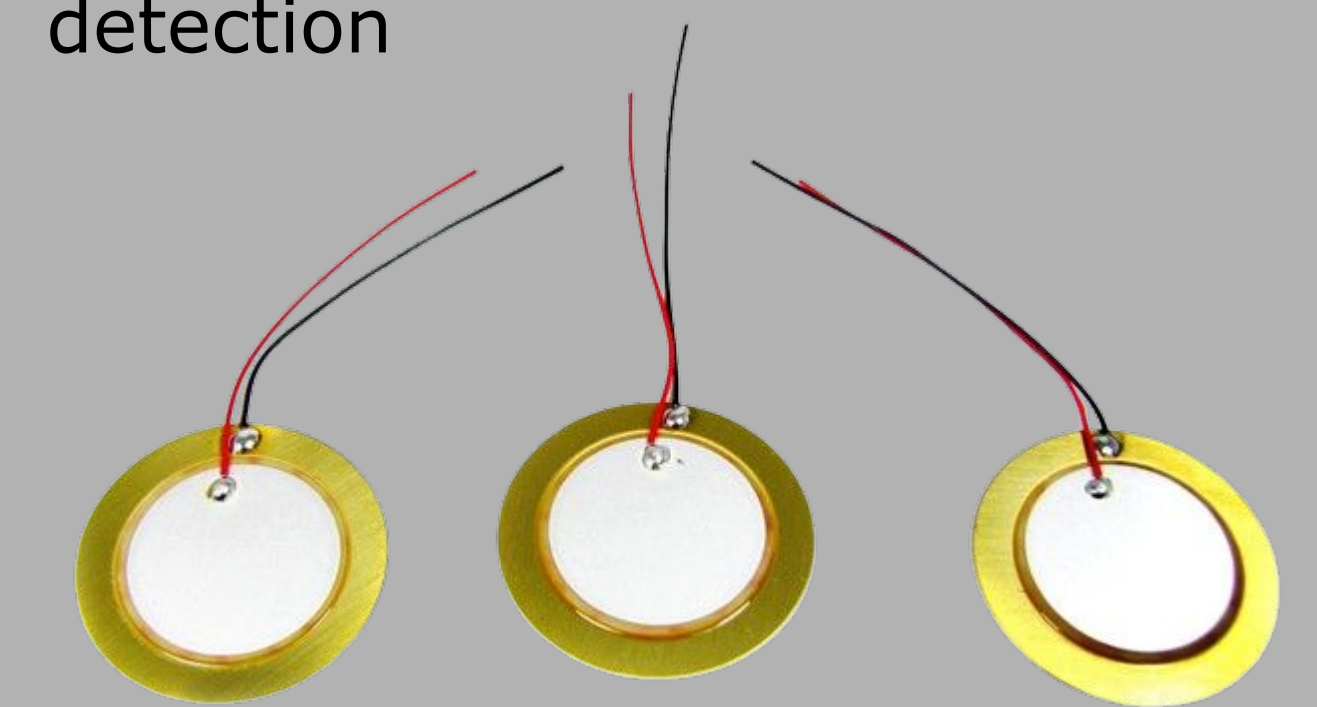


MATERIAL SELECTION

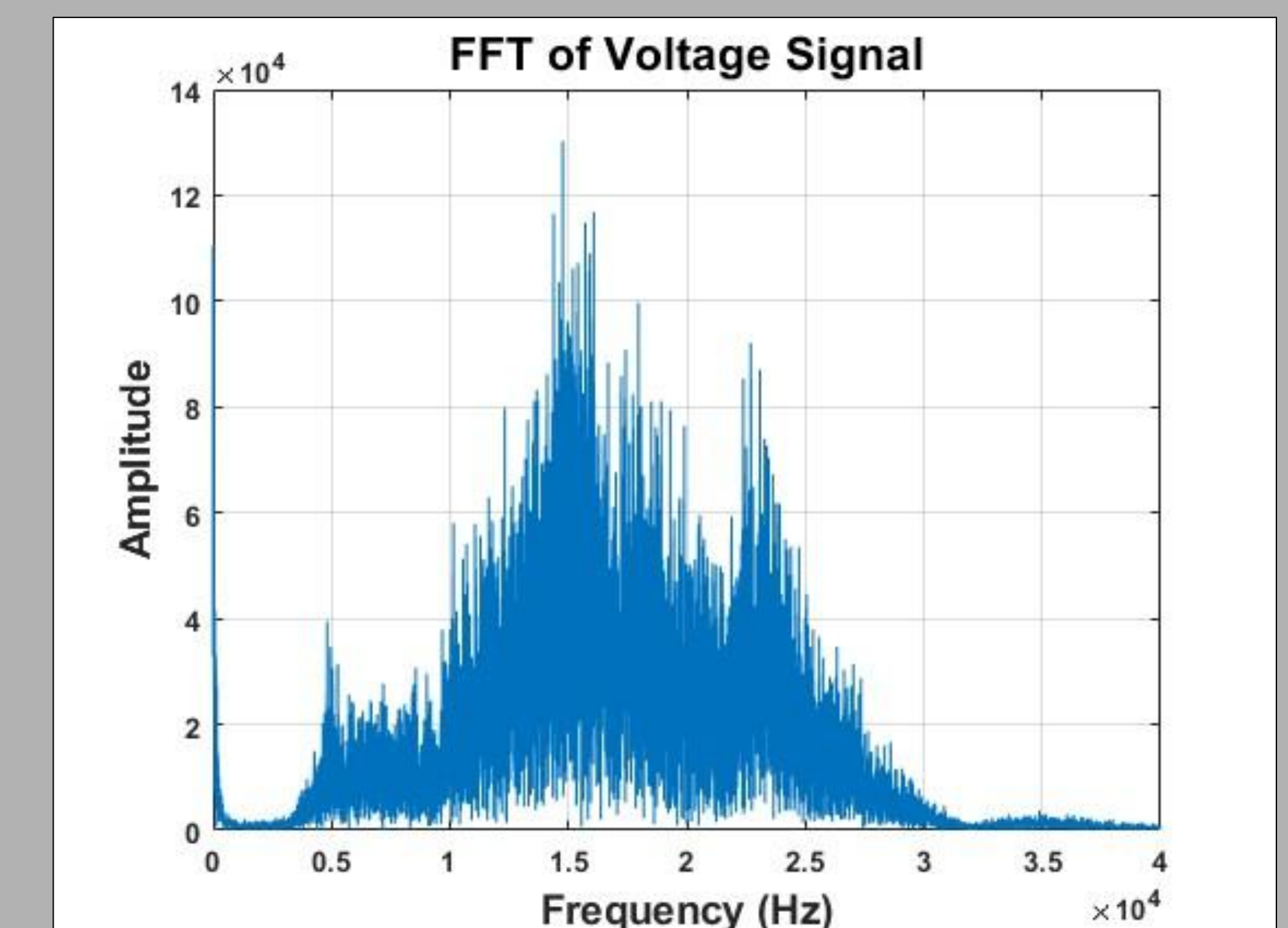
- Piezoelectric discs were chosen with a small thickness, large diameter and high resonant frequency
- Materials for the Generator chosen based on longevity
- Evaporator, Generator, LTHX material properties and parameters
 - High heat transfer coefficients
 - Pliable and fairly inexpensive

PIEZOELECTRICITY

- Electric charge accumulates in certain solid materials due to external stress
- Lots of materials are piezoelectric
 - Crystals, ceramics, polymers, biological matter (bone, DNA, etc.), even sugar!
- Piezoelectric materials are used in high voltage and power sources, sensors, actuators, and motors
 - Examples include auto focus in cameras, diesel engines, and sonar wave detection



Output Signal of Amazon Disc



FUTURE WORK

- Increase the energy extracted from waste heat
- Increase the energy extracted from waste heat
- Modularity of design

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