# Moonshot

## Goal

Demonstrate my skills by completing the mission

- Critical thinking
- Plan and design
- execution

## Mission

Electromagnetic gun simulation as described in the task doc

## Execution principles

- Everything always can be better, concentrate on a basic version that works as time is limited.
    - basic V1 that works.
    - Map gaps.
    - Suggest improvements

## Design principles

- OOP
- AI to generate documentation
- AI to acquire the background knowledge
    - Electromagnetic
    - Python
    - MATLAB
- AI wherever it can multiply my productivity.
    - Code structure
    - Coding
    - Code review

# Design

Represent each component and each interaction between two components in the system as a class.

The benefits of this design are:

1. Easy to use, maintain and understand as it's structure is the same as the simulated setup. Important because this simulation serves other non-software engineers.

2. scalable:
- Adding more objects i.e. connecting wires, power supplier, damping capacitor.
- Adding objects characteristics i.e. conductance, capacitance.
- Adding more interactions i.e. between the acceleration stages
- Adding more types of interactions i.e. mechanical interactions such as heat, air resistance and such

V1 system components:

- Capsule
- Acceleration stage
- Acceleration tube

V1 parameters:

- Coil current


# Plan

V1

☒ Project template in PyCharm

☒ Upload to a GitHub repository

☒ Implement objects

☒ Implement Objects Interactions

☒ Run simulation

☒ Plots

☒ CLI

☒ Sample run configuration

☒ Documentation


MATLAB

☒ Install

☒ Compile first task

☒ User interface


**Execution summary:**

Current implementation fulfill all the system requirements.

The execution leveraged Gen AI Agents:

- ROO (VS Code extension) for designing and coding
- Bing MCP for acquiring the agent with physical background and best practices for Python and MATLAB coding, OOP and TTD.
- ChatGPT for self validation.
  *Roo tended to overdo, next time need to strain him better.

Main gaps:

- Physical understanding of the system can and should be deeper.
  - The force is repulsing.
  - The capsule doesn't move as expected (that's why test_simulation_termination_conditions is failing).
- More code cleaning iterations should be made.
- MATLAB integration can be simplified
- Output plots correctness should be verified i.e. final distance cant be 20mm