

CAMbox

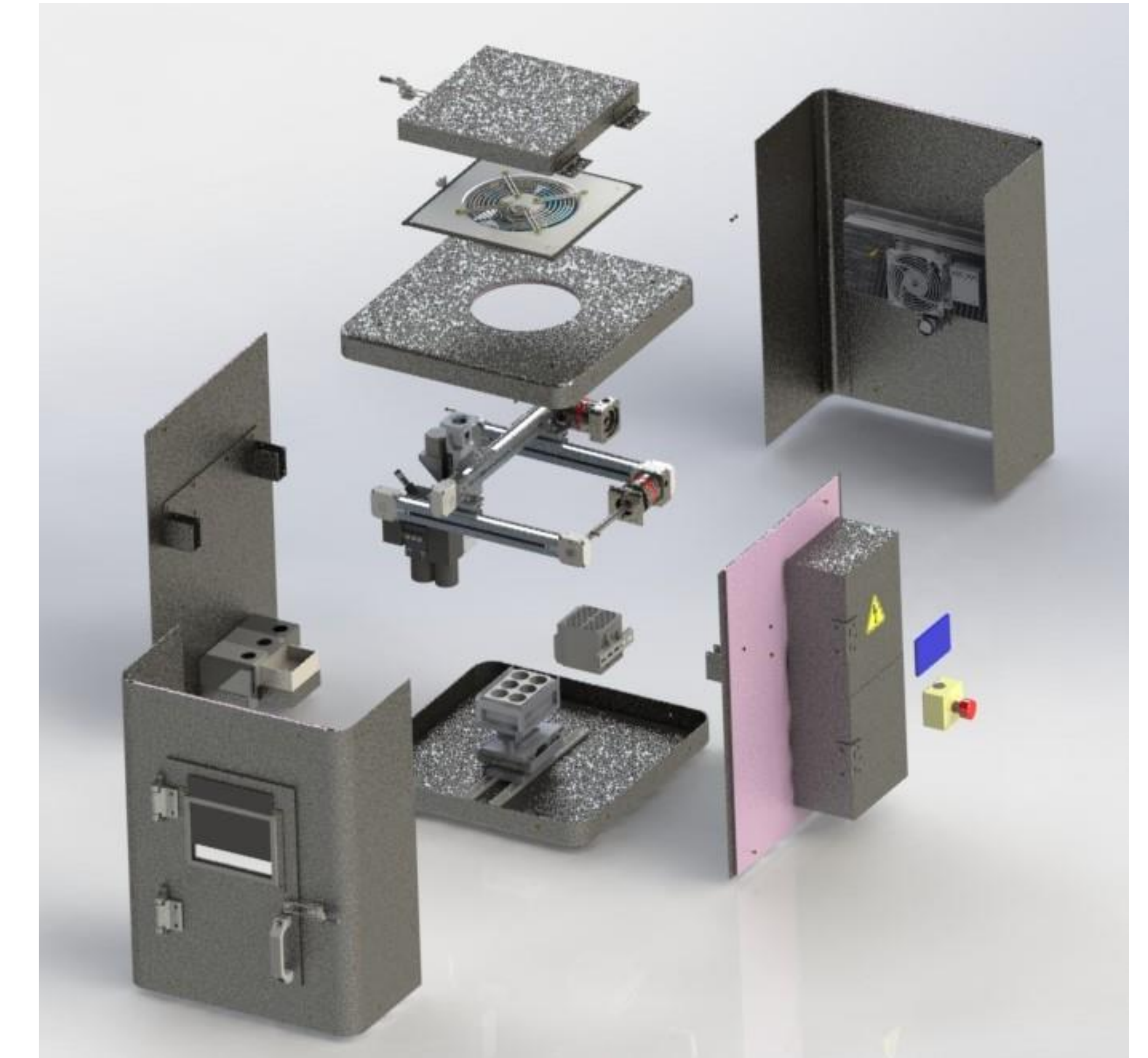
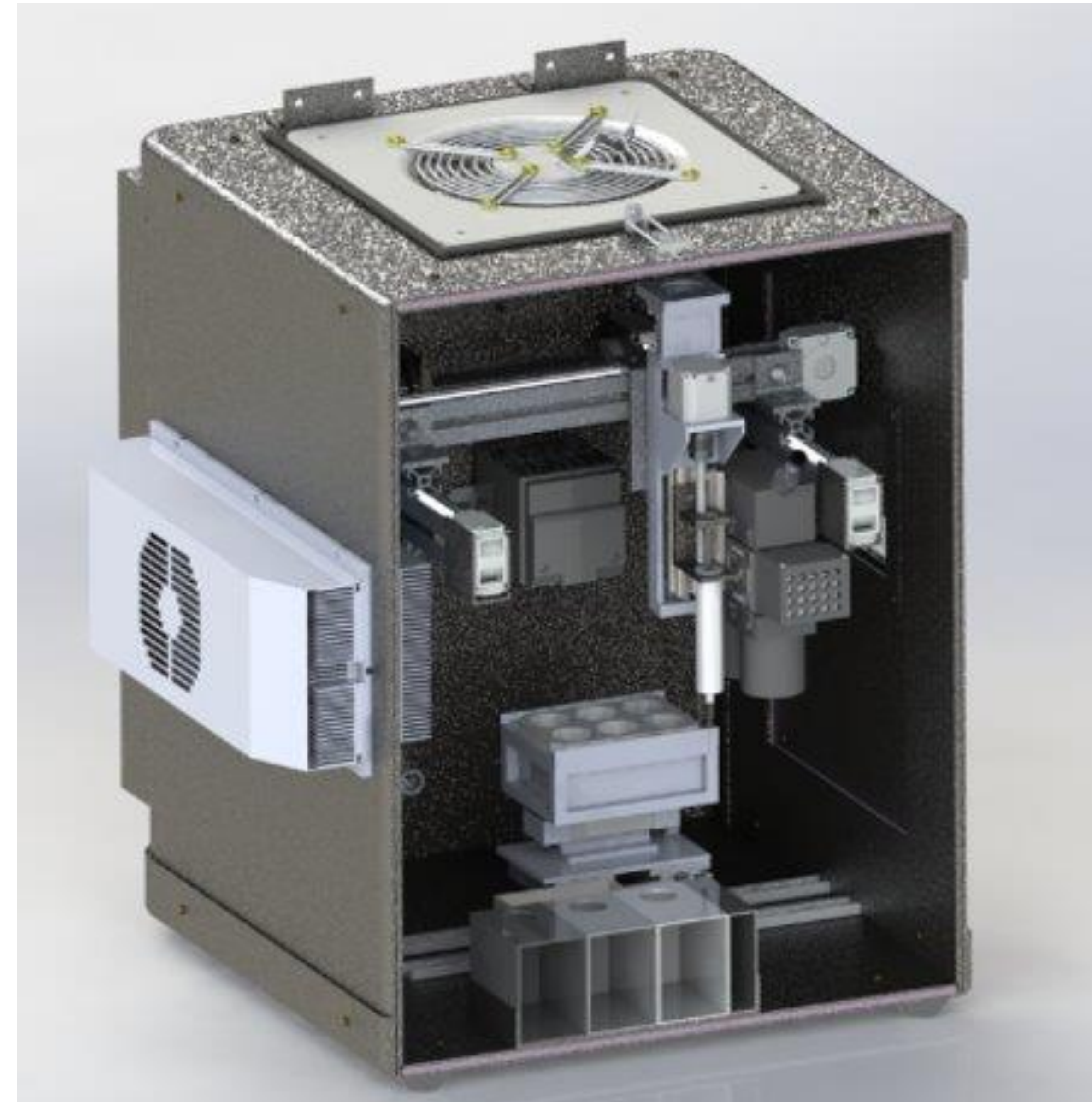
Group 14

Marcela Abadia,¹ Joao Pedro Dos Santos,¹ Ashton Goan,¹ Ollie Goodall,¹ Brenden Modi,¹ Audrey Myat,¹ Wojciech Przepiora,¹ Pelayo Urrios,¹ Dr. Matthew J. Traum¹

¹Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, FL

Abstract

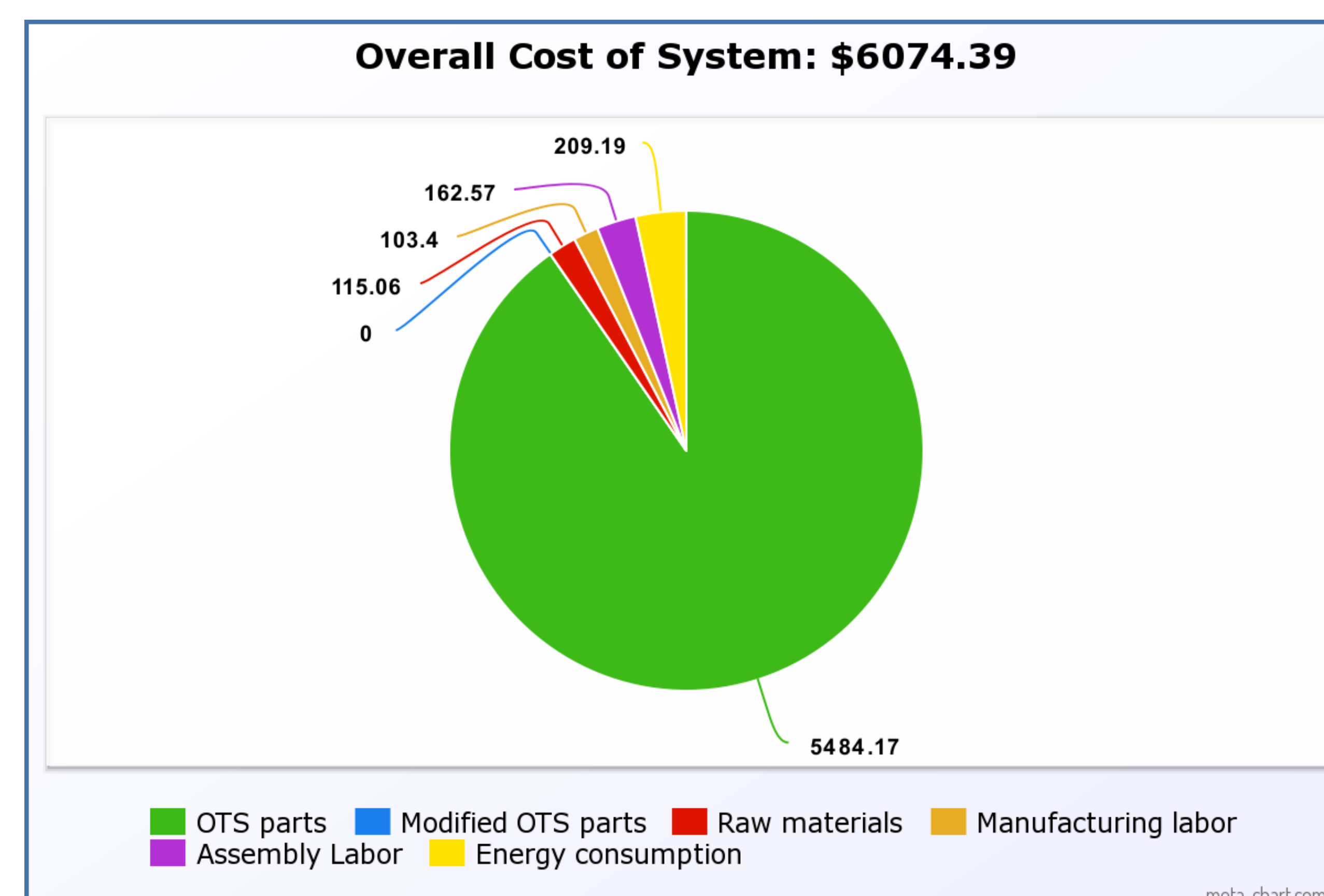
The Compact Automated Bioreactor box (CAMbox) is an autonomous microbioreactor designed to culture, sanitize, and measure different samples for six different well plates and 2 different conical tubes in the smallest size possible. The CAMbox has a steel enclosure designed to fit all these operations through the most efficient use of space, leaving a small footprint. The compact design allows this device to be able to reach setpoint temperatures with speed and cost efficiency. With the addition of the high-powered Siefert thermoelectric cooling system and the Omega 300W Compact Enclosure fan heater for climate control. For measuring the vitals, using optical density and fluorescence intensity; the samples will be able to be measured in real time, requiring no interference. To allow an incubation period of two weeks there is a liquid handling system which can add/subtract liquid into the cell cultures and dispose of waste by using a stepper motor, pipette and disposable pipette tips to avoid cross contamination. The device also includes a shaker system which implements a rail and bearing system in both the x and y direction with motors that can run either individually, for linear motion, or simultaneously, for circular motion. Additionally, various gases can be added into the environment using solenoid valves. Our device performs these operations while still being compact through efficient use of space. The goal to achieve the smallest size possible allows for unique marketability due to lower cost, size, and transportability.



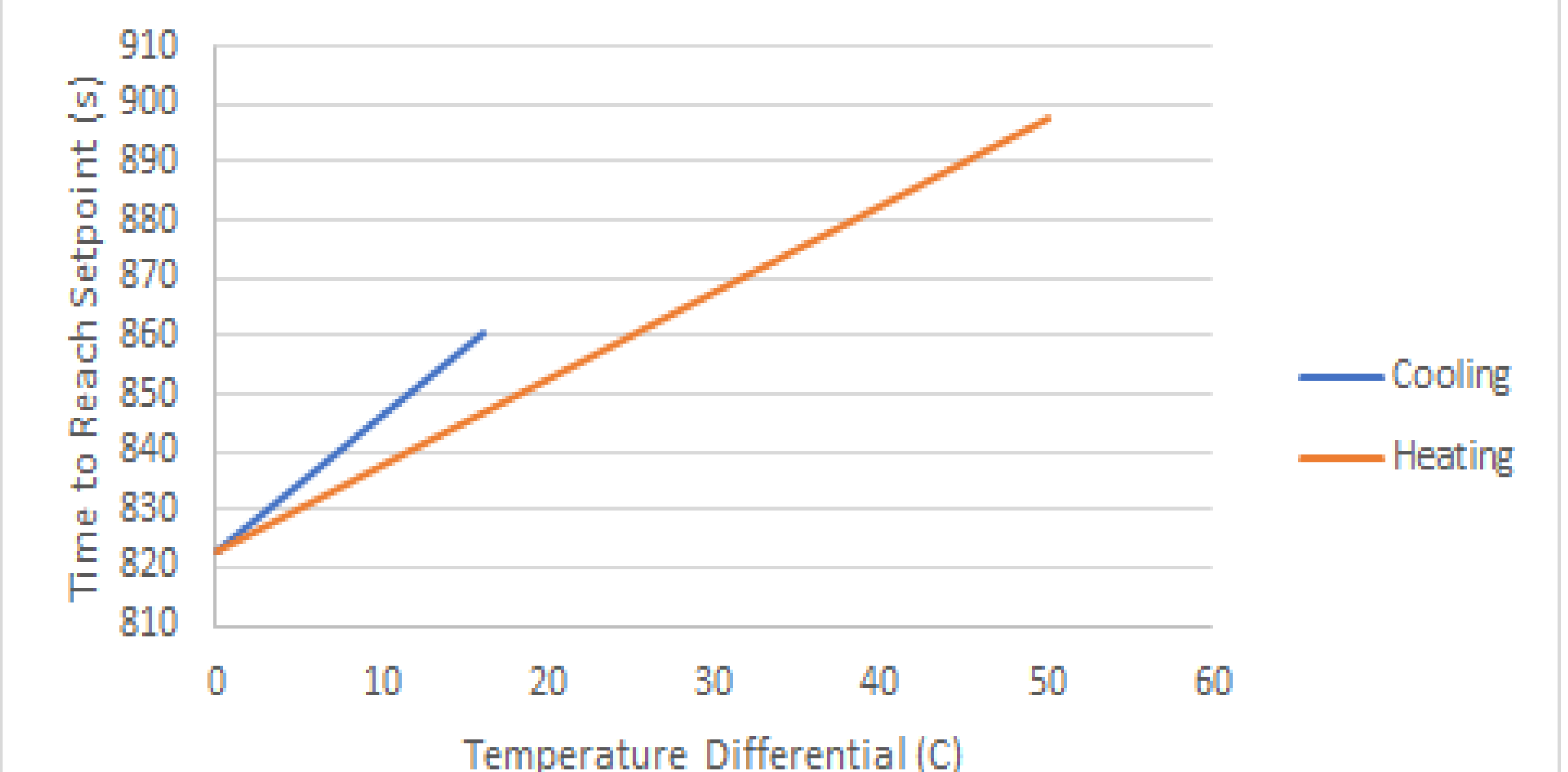
Functionality

The microbioreactor is split into 7 different subsystems that all operate and synergize with each other.

- **Enclosure** - the main frame of the system holds all other subsystems with a steel outer and inner shell with optimal insulation.
- **Climate Control** - the entire system can be cooled or heated in a quick manner to culture the samples at their desired environment.
- **User Interface** – cell vitals, humidity, temperature, gas levels, and desired sample setup are fully programmable. An immediate stop button and LED screen allows for the notification of an error or immediate situation.
- **Well Plate Shaker** – All desired well plate and conical tube size can be accommodated and shaken in three different patterns. An integrated white light illumination nests under the well plate.
- **Gas Control** – five different gases can be injected and monitored within the system.
- **Liquid Handling** – samples can be cultured and sanitized quickly with a gantry liquid handling system. Automatic disposable tips and waste storage is available.
- **OD/FI** – Both OD and FI can be measured simultaneously along with the liquid handling processes, allowing for quick process times.



Temperature Differential vs. Time to Reach Setpoint



This graph shows the time it takes for the CAMbox to reach a certain temperature within the enclosure. This shows how a small enclosure benefits heating and cooling processes, given the selected thermoelectric heater. With quick set point temperatures, users will save a lot of money on energy consumption over time.

Customer Needs Map

