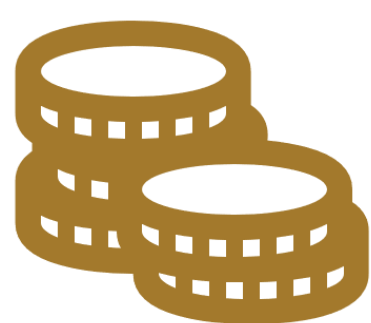


Problem Definition

Current 3D printers cannot print with multiple materials at once efficiently



Delay in printing due to switching and preheating the system



Wasted material between each material change



Affect print quality when materials mix through the same nozzle

Team Mission:

Create a Multi Material Dockable 3D Print head mechanism

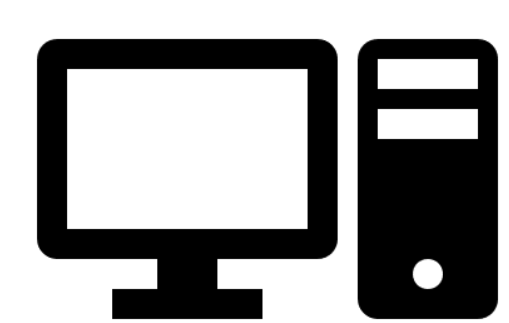
Benchmarks

Number of	Formbot	Diabase	Prusa i3	Palette 2
Materials	2	5	5	4
Heads	2	5	1	1
Compatible Printers	None	None	None	All single extruder printers
Switch Time (1-5)	3	5	1	1

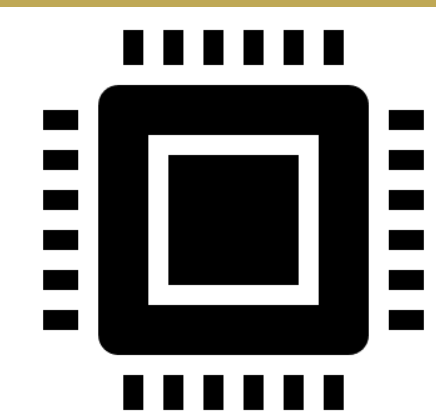
Customer Requirements

- Ability to print using multiple materials
- Separate printing heads for each material
- Ability to heat the hot-ends to 400° C
- Fully automated system

Problem Breakdown



Software Modification

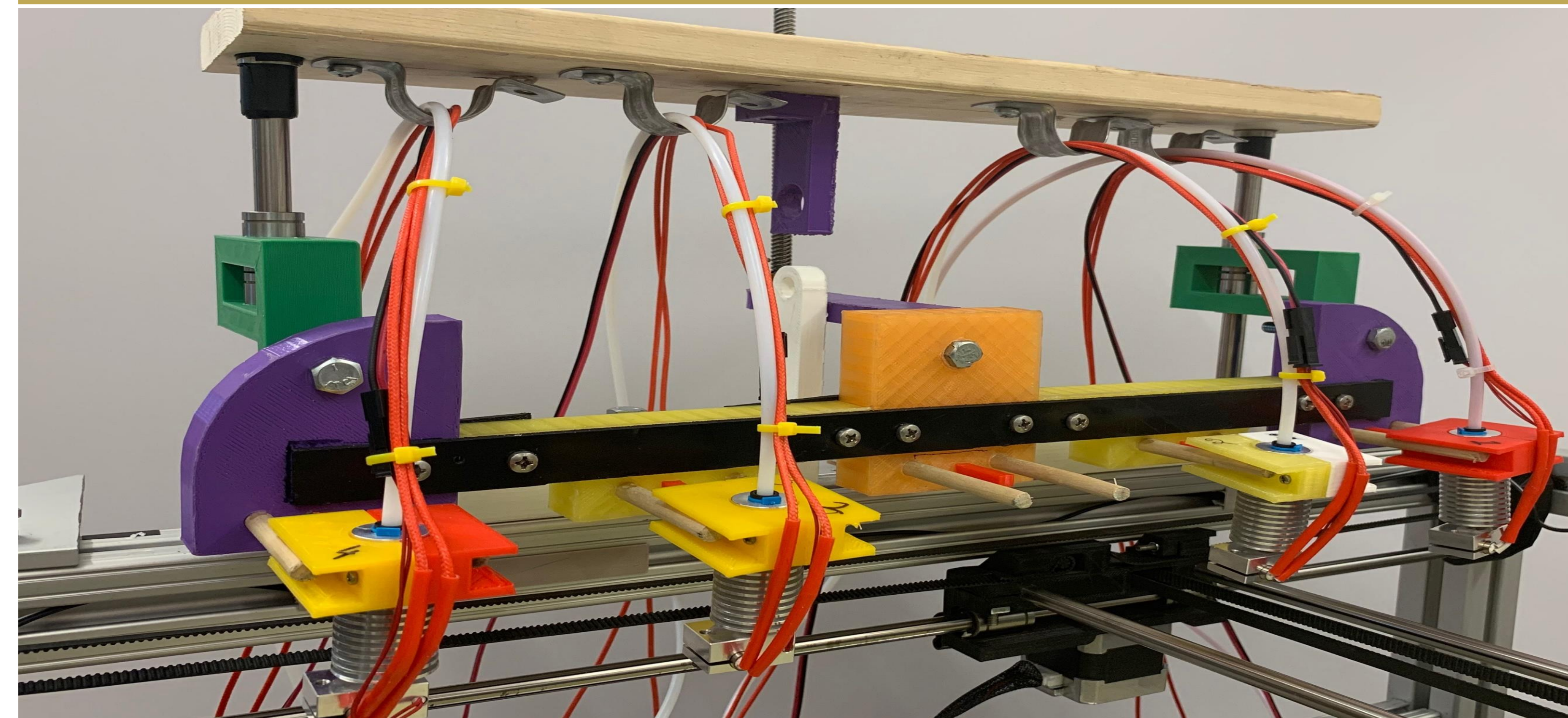


Electronics Expansion

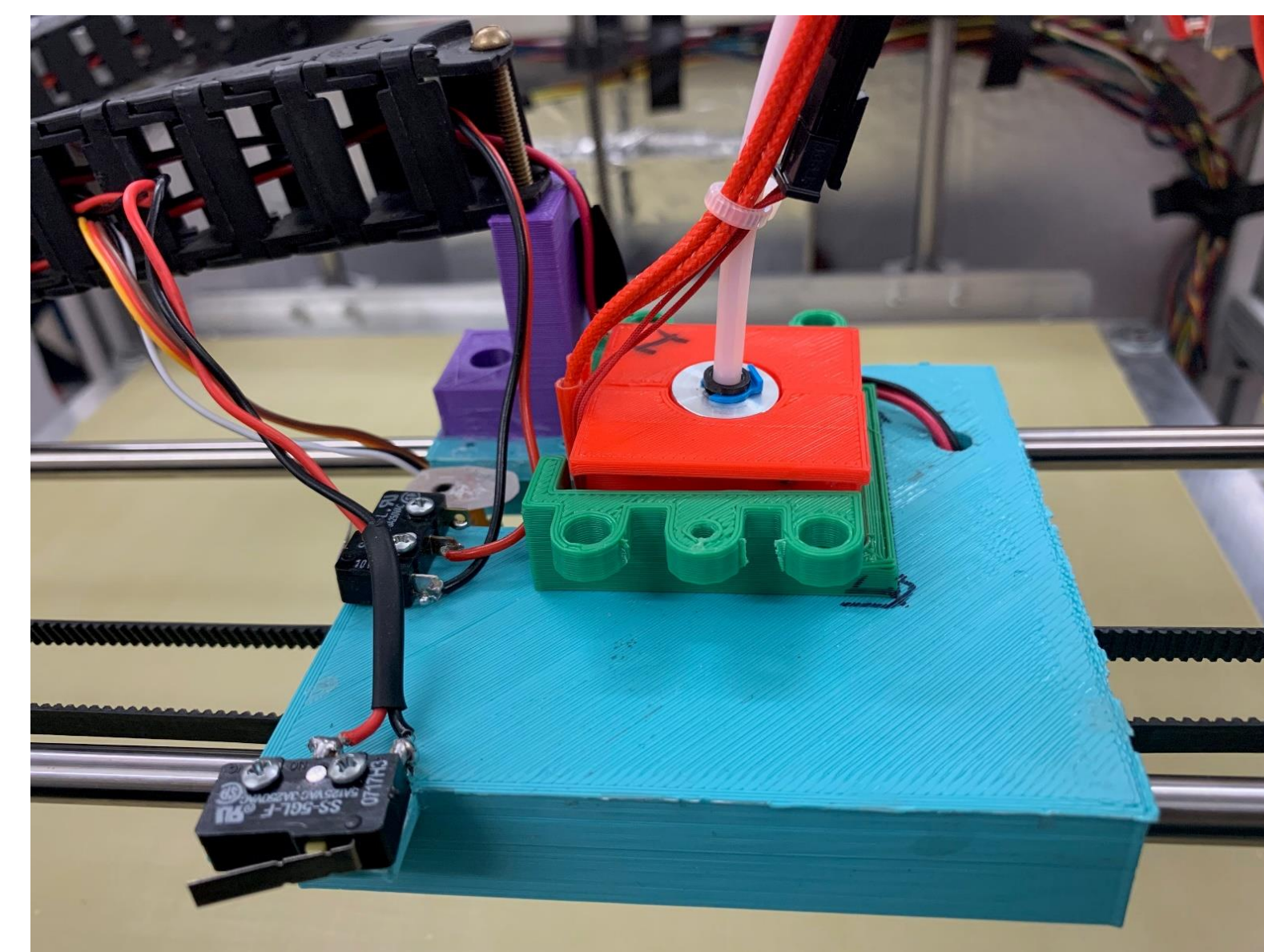


Docking mechanism

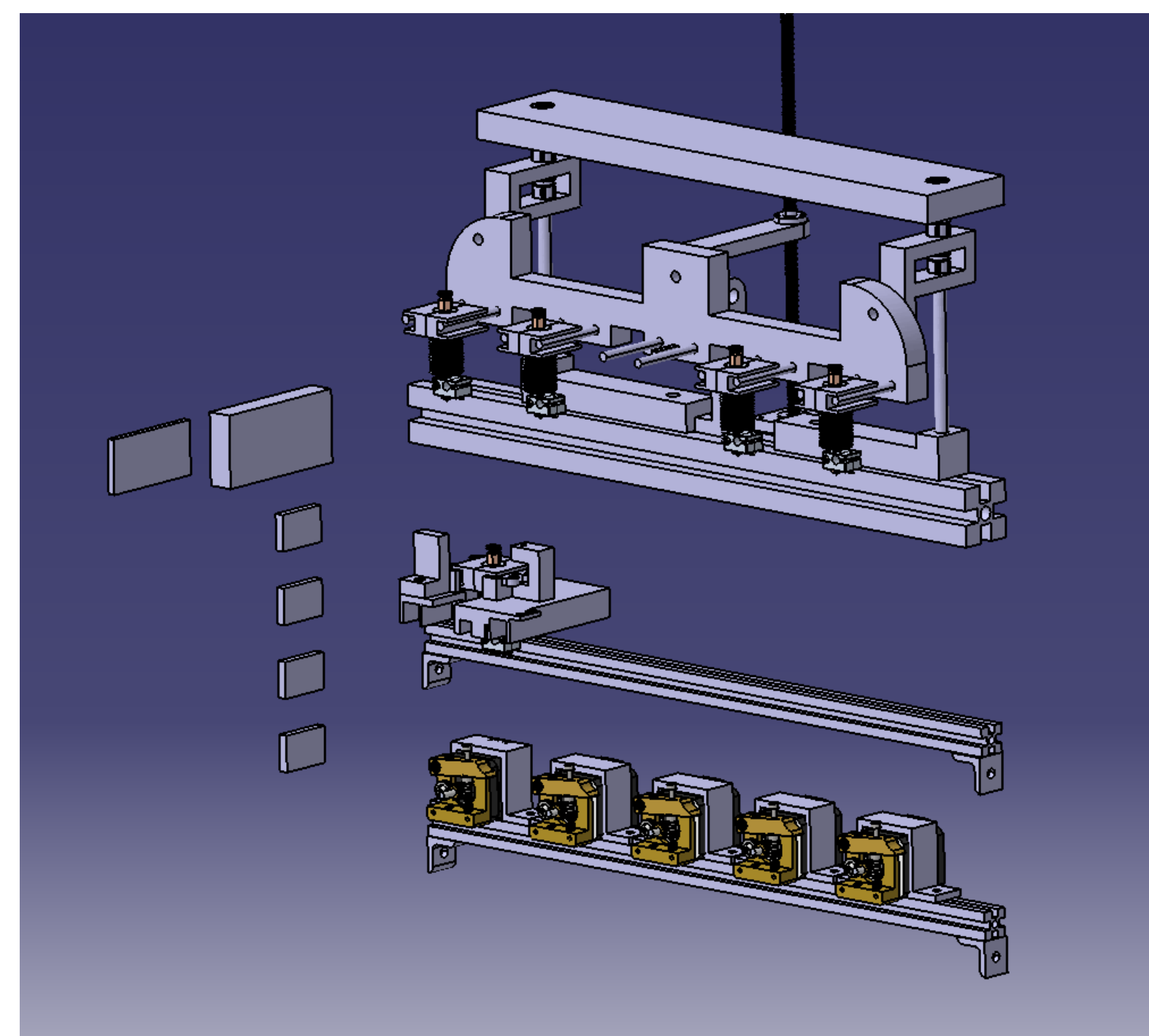
Design



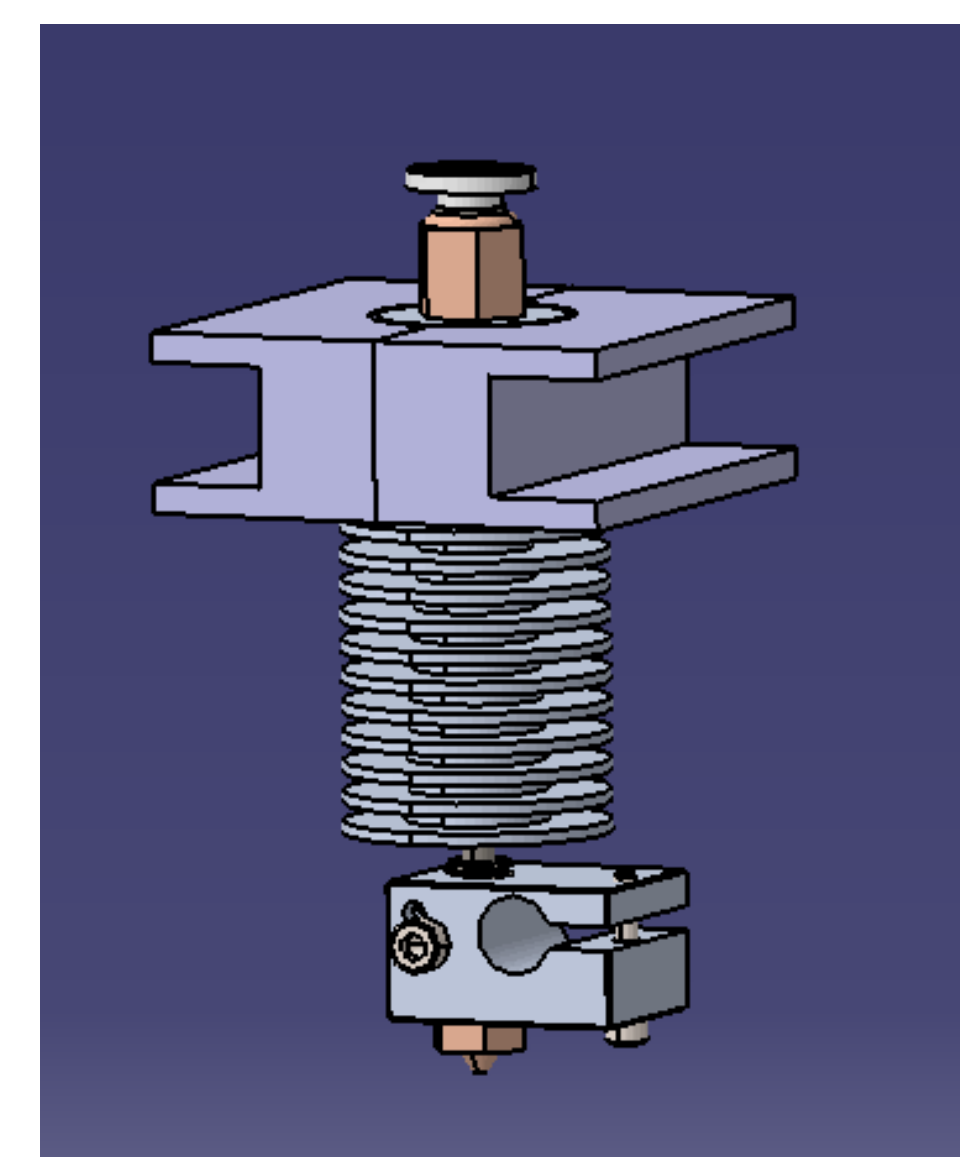
- Lifting Dock mechanism which holds heads during storage



- Adapted Gantry system for quick replacement of printer heads.



- Assembly model for all parts added to the existing printer



- CAD models depicting the printer head sub-assembly, and full prototype assembly

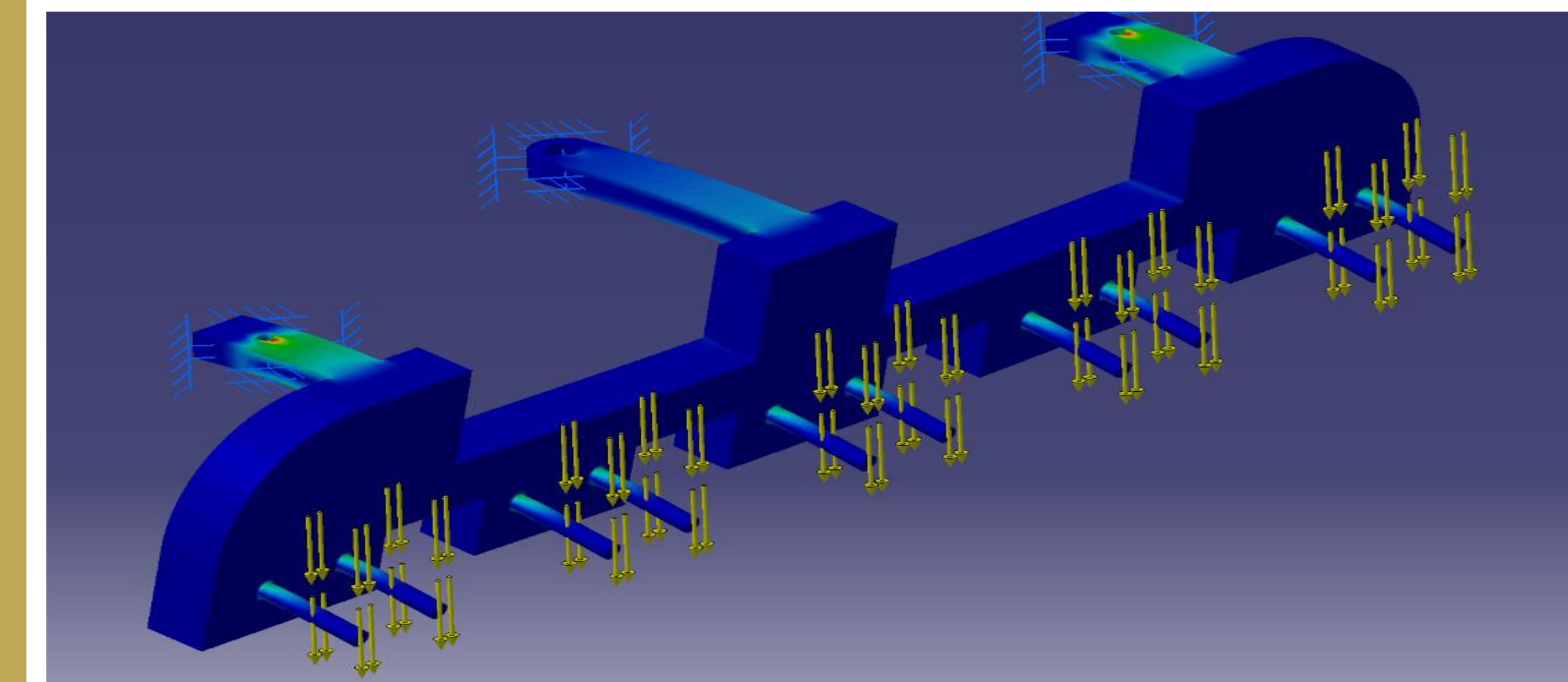


Prototype Demonstration

Financial Analysis

Category	Cost (\$)
Electronics expansion	597
Mechanical parts	333
Total	930

Testing & Validation



The Dock fully loaded can withstand a maximum stress more than 31 MPa

- ✓ Accurate Temperature Readings within $\pm 5^\circ$ C of desired temperature
- ✓ Required Torque Output from Motor of 40Ncm
- ✓ Gantry aligns within 2mm of the inner edge of I-beam and fork.
- ✓ Aligned rack movement with a discrepancy of ± 1 mm between all printing heads
- ✓ Return of Gantry to home position based on previous (x,y,z) coordinates

Testing Demonstration



XYZ Axes homing



Loading & Unloading



Heating

Future Improvement

- Utilize pogo pins to remove additional friction present due to wires
- Manufacture the Dock as one part
- Height adjustment mechanism in the Gantry
- Incorporate a subsystem to accurately dock the printer head on docking rack