MECHANICAL DESIGN OF

Haptic Pantograph

LOW COST GROUP

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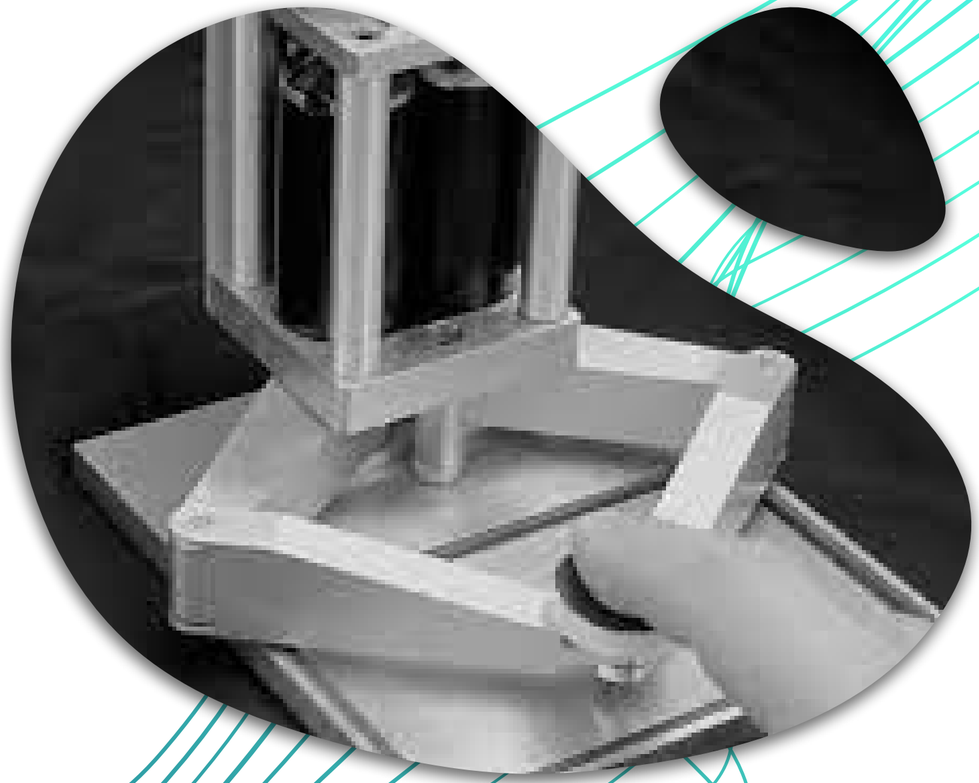
Introduction

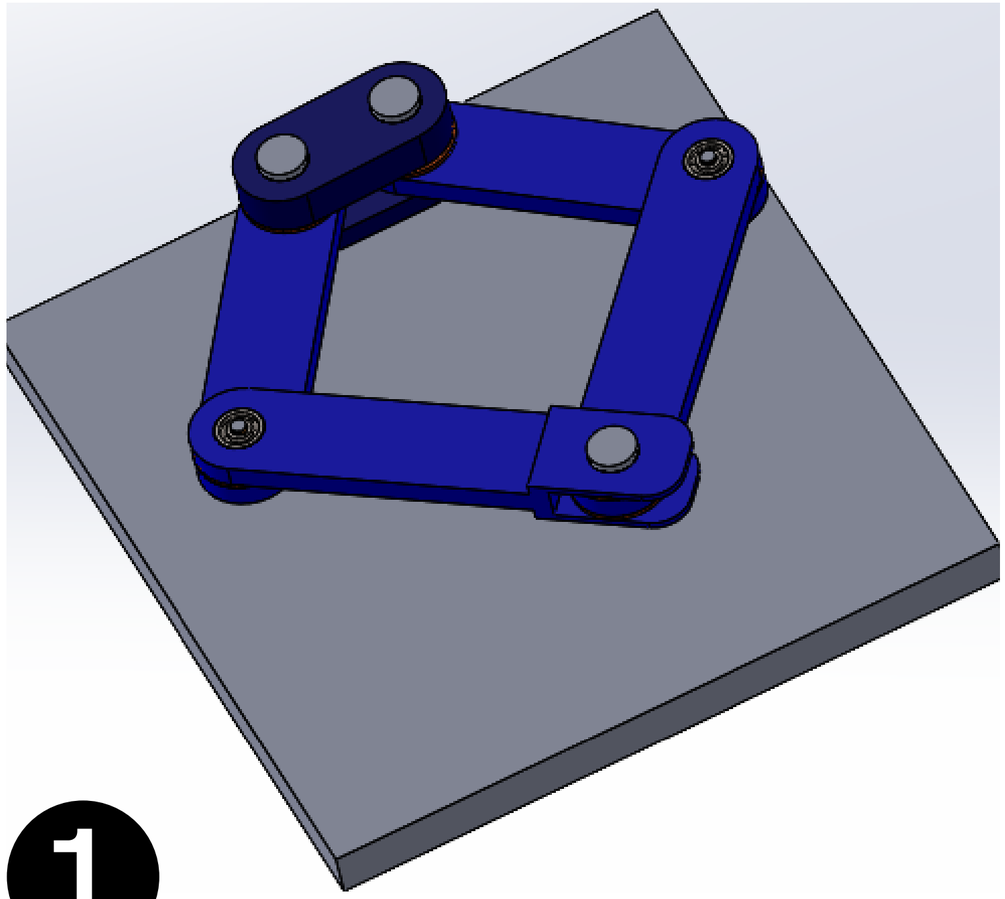
OUR OBJECTIVE :

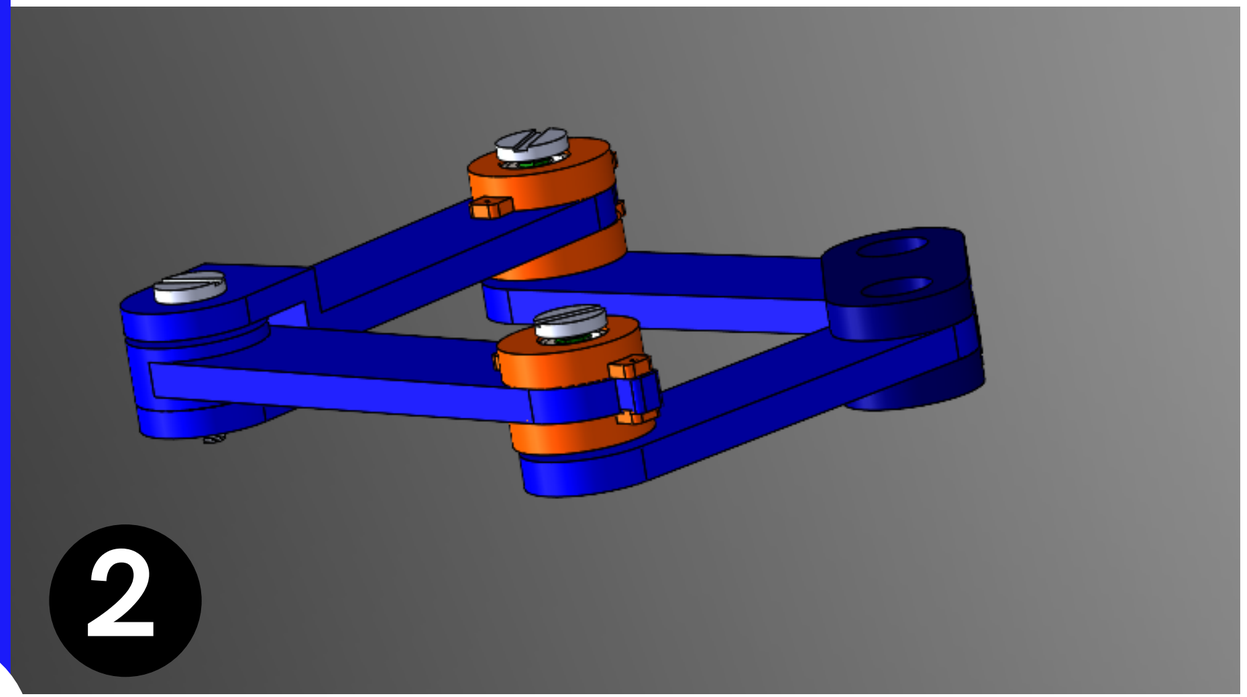
THE MECHANICAL DESIGN OF A LOW-COST BACK DRIVABLE HAPTIC DEVICE WITH LOW FRICTION AND INERTIA

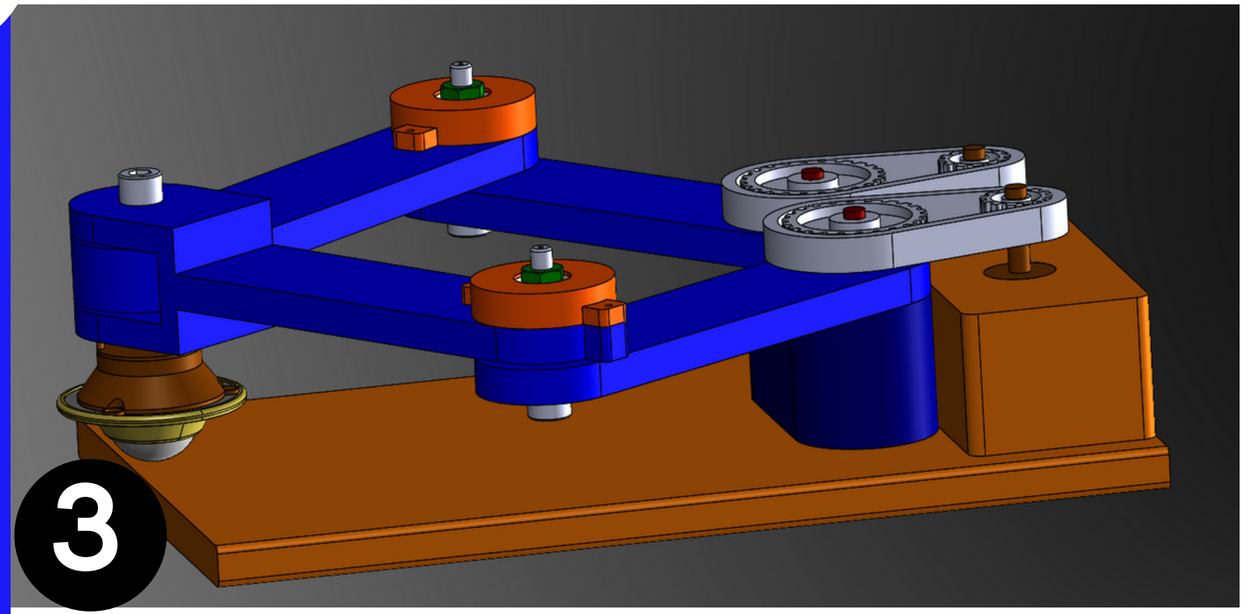


Project Evolution

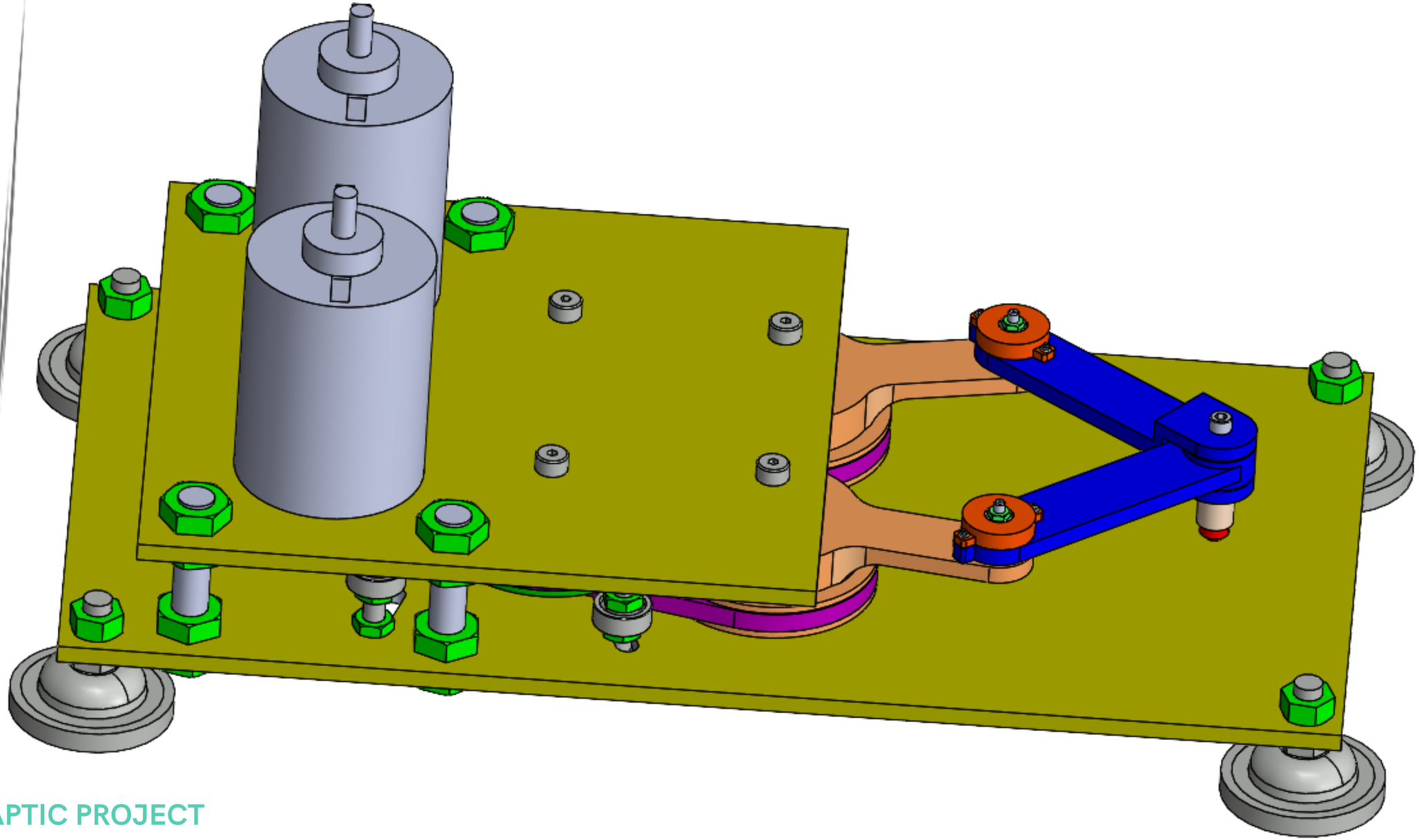
- Iterative Process



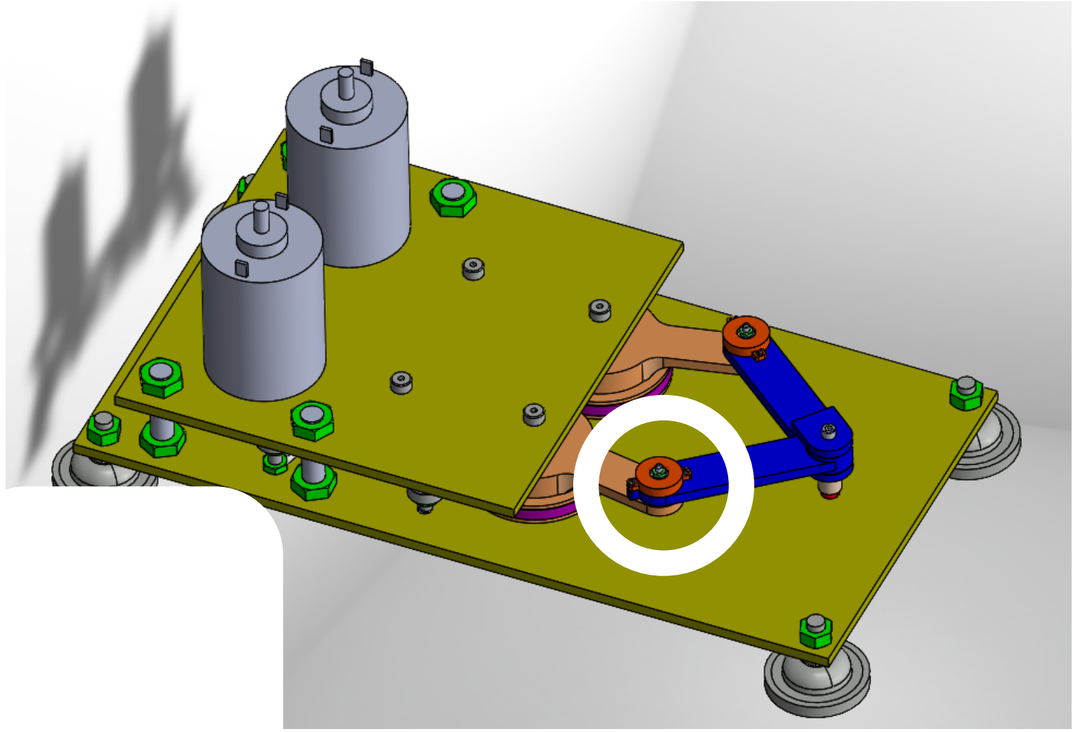


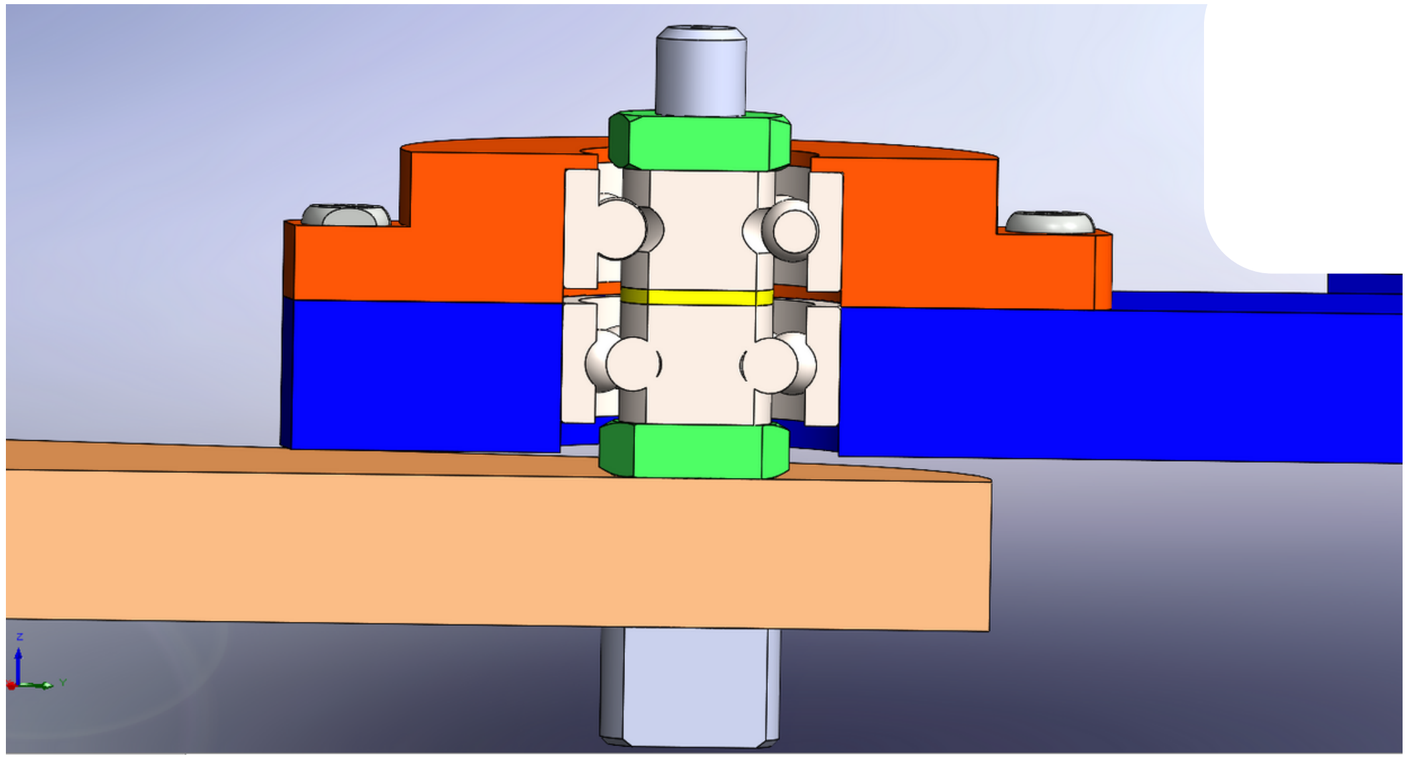


Final model



DETAINED CUT VIEW - ARM





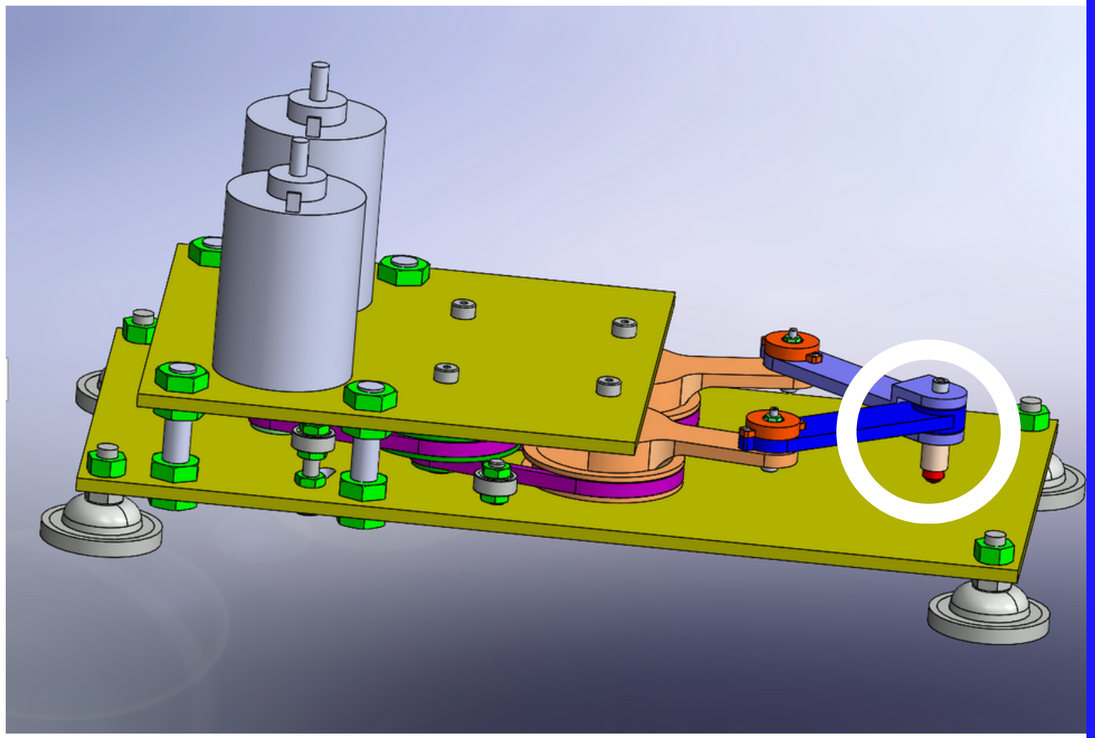
LINKAGE

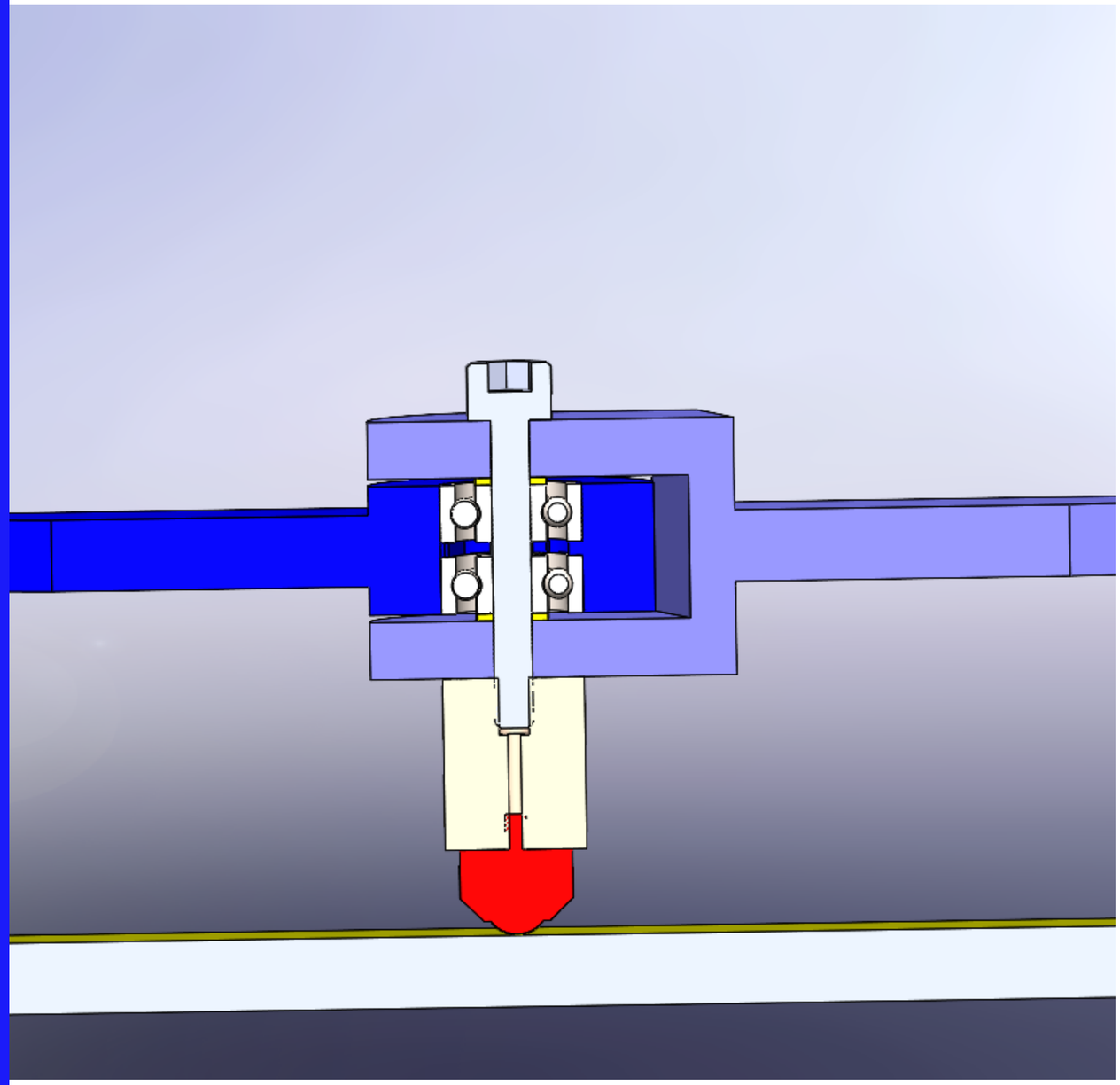
- Pivot (Ball bearing)

AXIAL STOP

- Shoulder and spacer

DETAILED CUT VIEW - FORK & EYE





LINKAGE

- Pivot (Ball bearing)

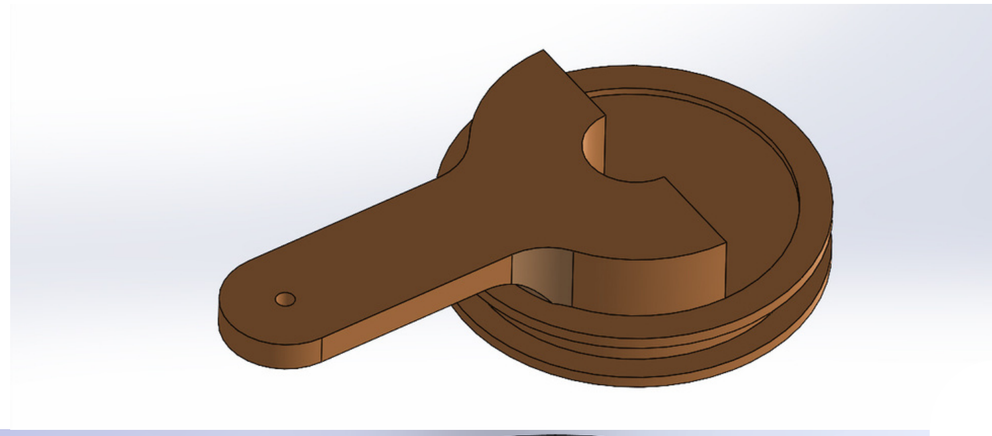
AXIAL STOP

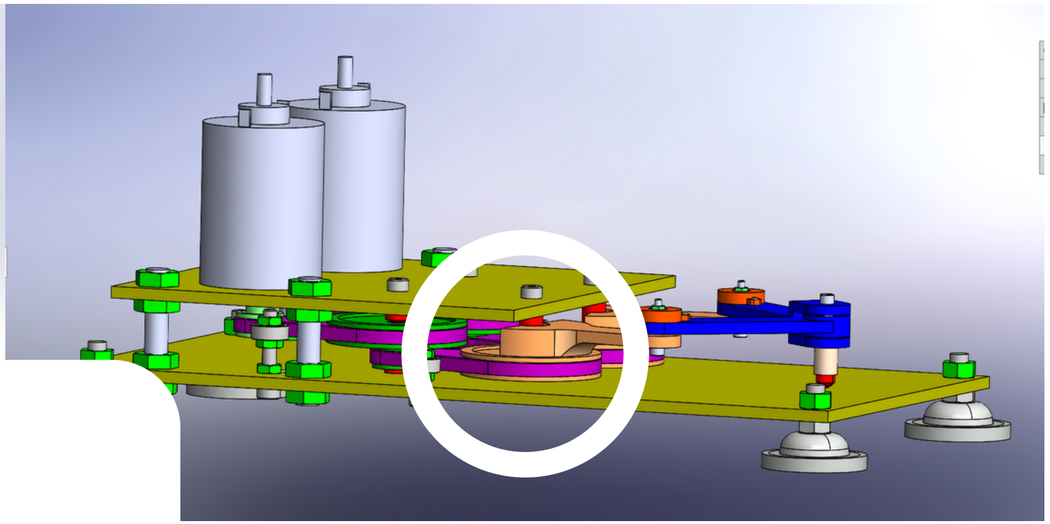
- Shoulder and spacer

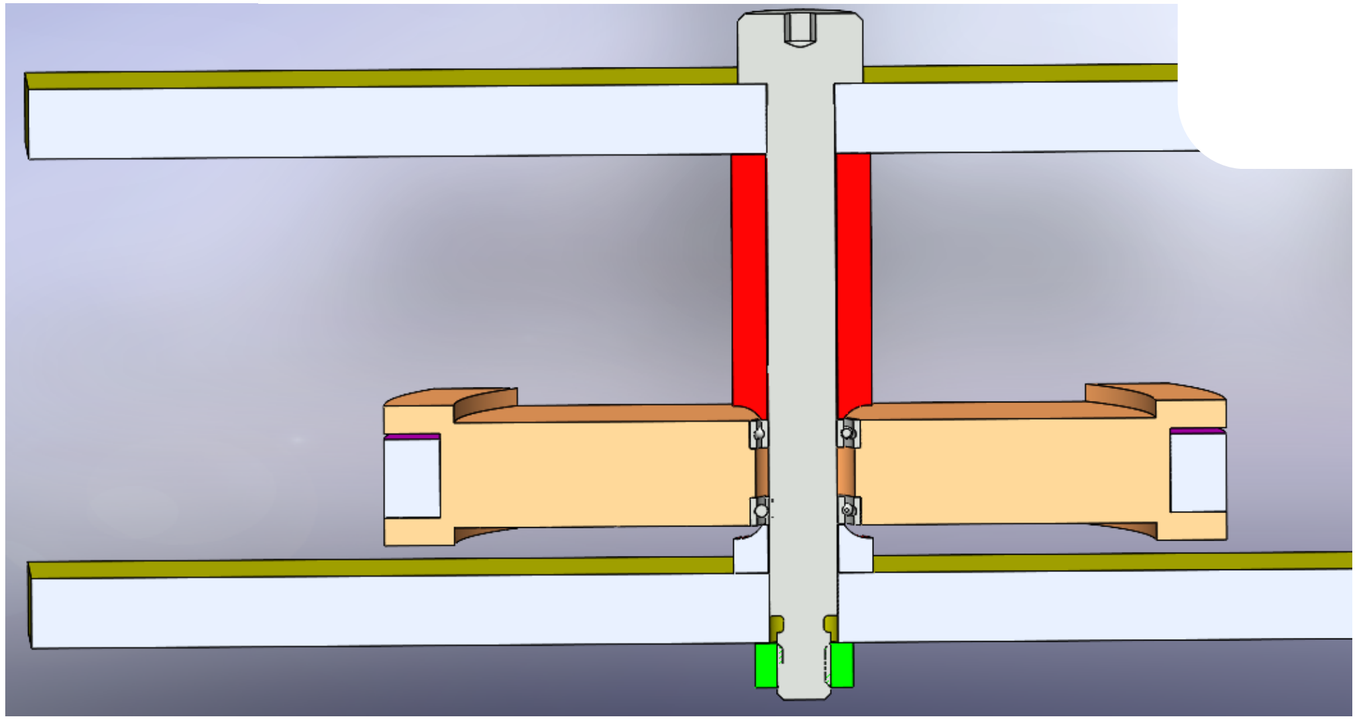
SUPPORT

- Ball transfer unit

DETAINED CUT VIEW - PULLEY







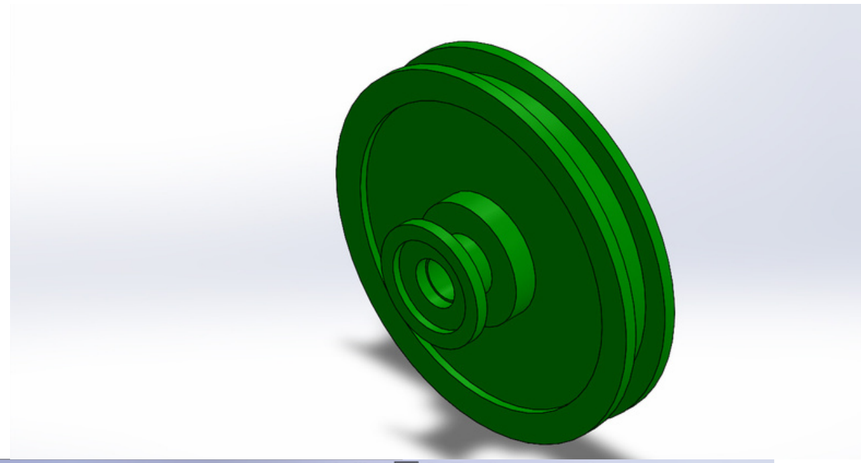
LINKAGE

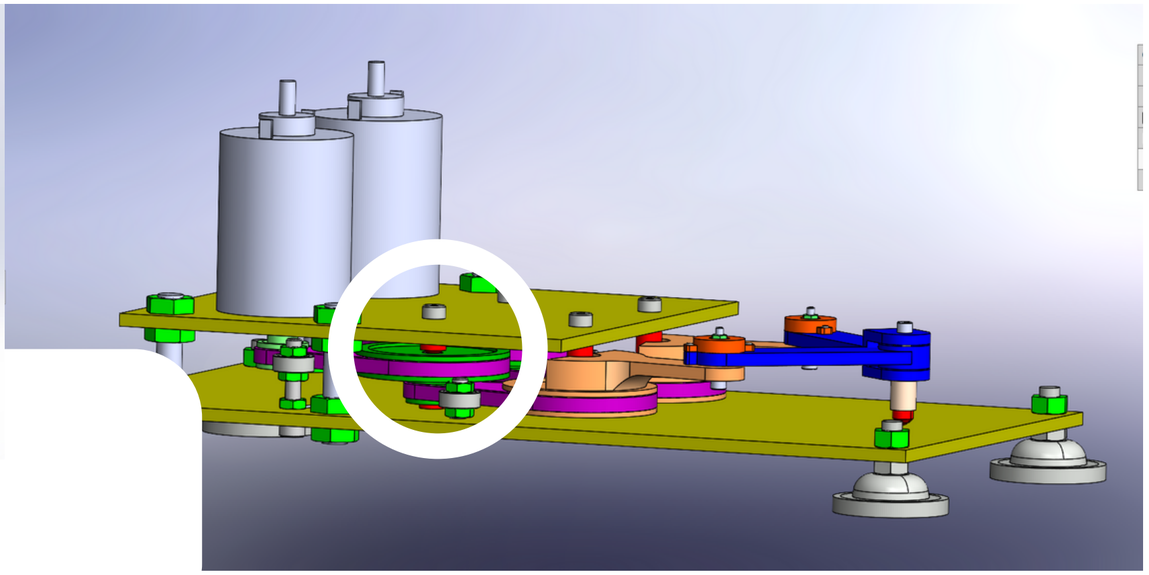
- Pivot (Ball bearing)

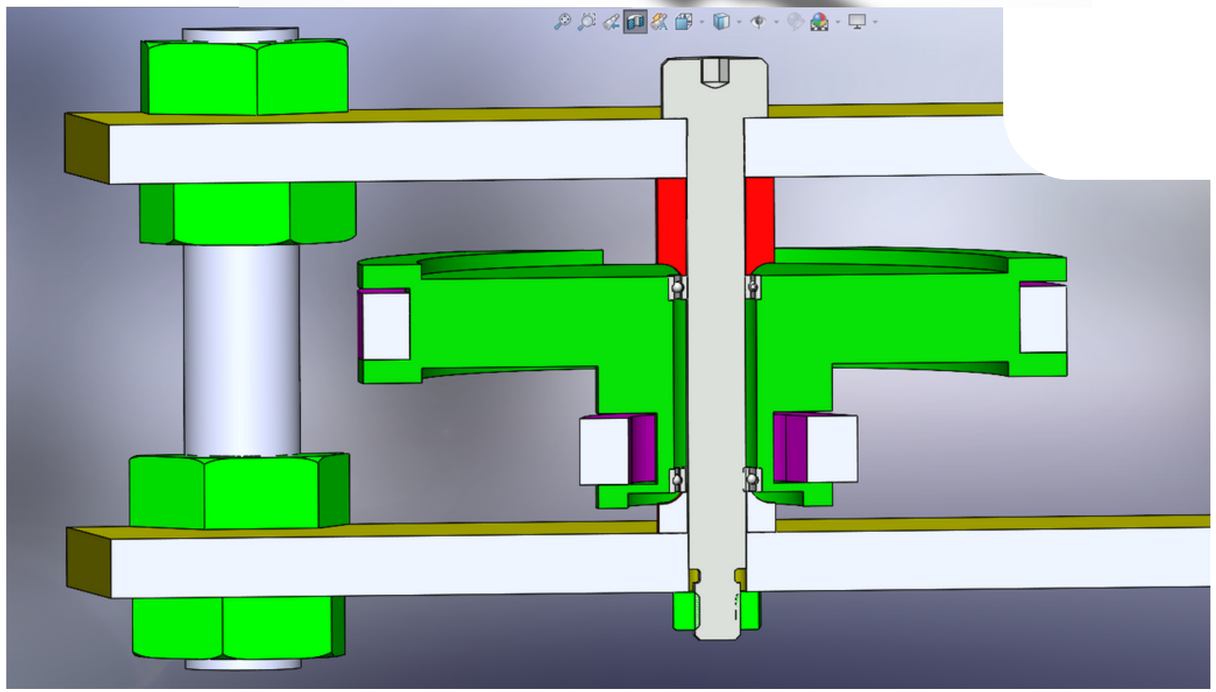
AXIAL STOP

- Shoulder and spacer

DETAINED CUT VIEW - COMBINE PULLEY







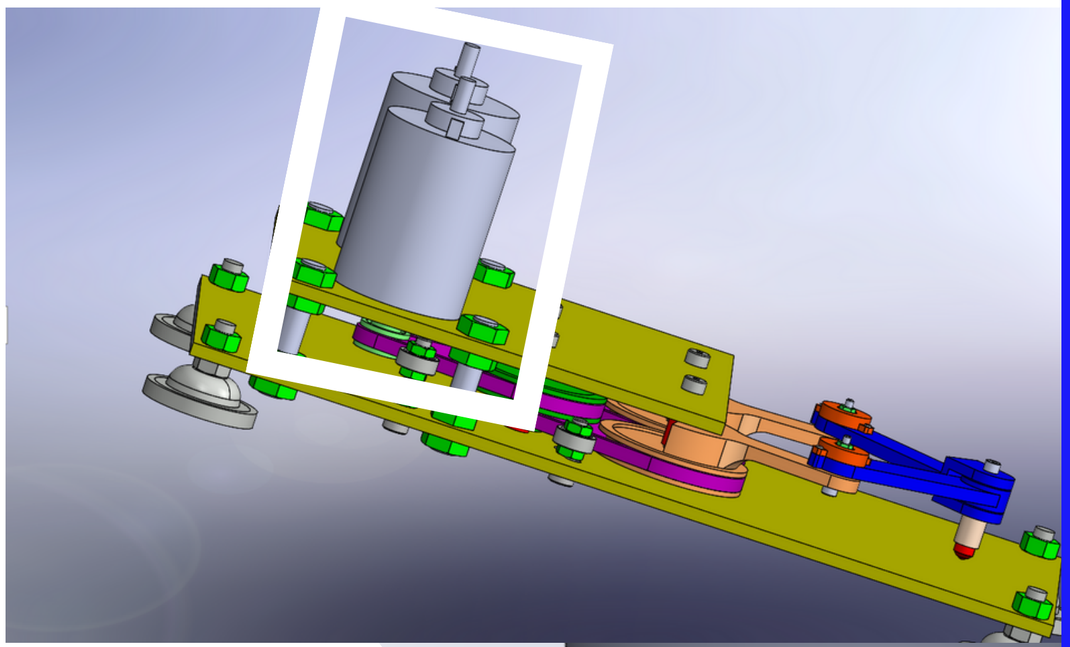
LINKAGE

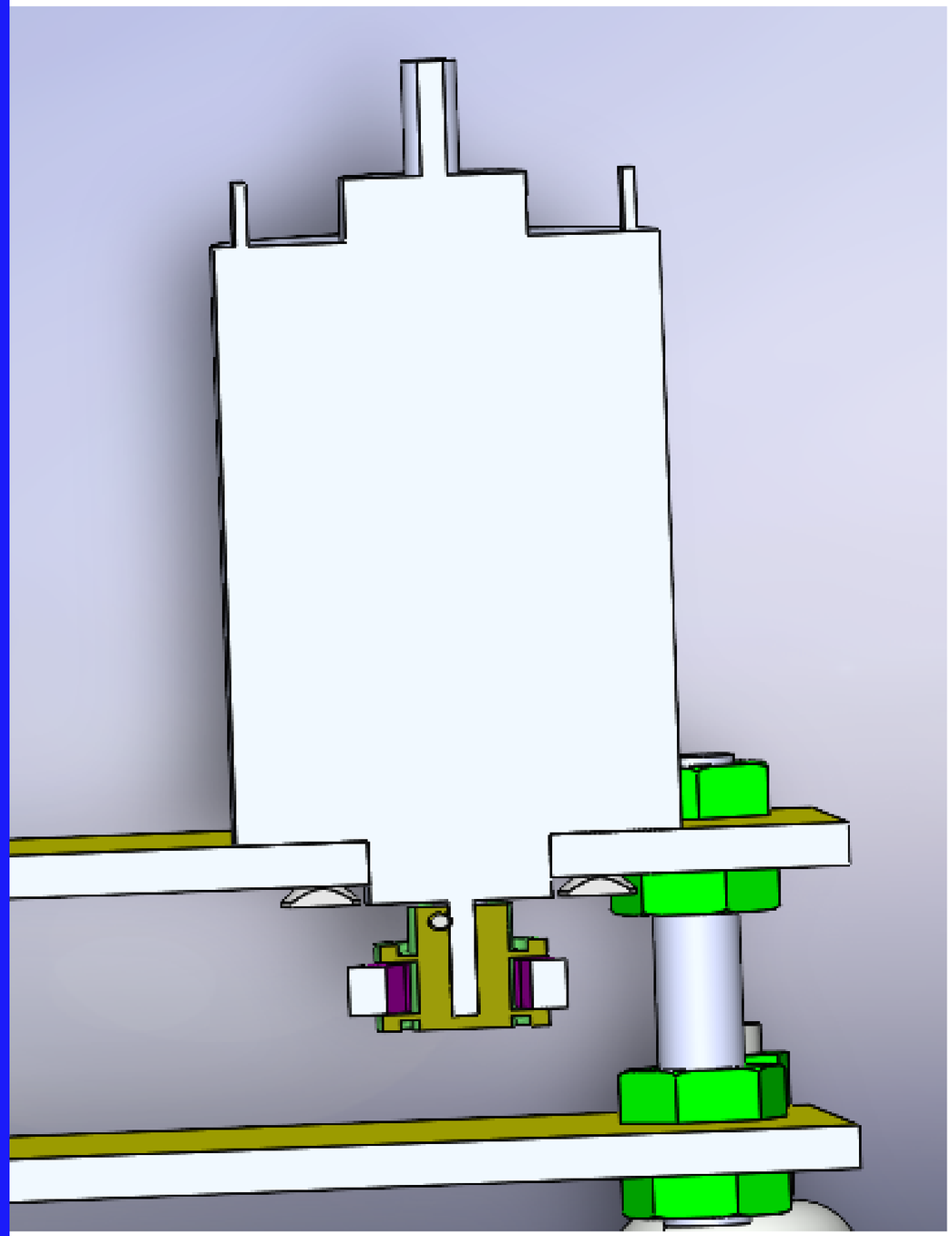
- Pivot (Ball bearing)

AXIAL STOP

- Shoulder and spacer

DETAILED CUT VIEW - MOTOR DRIVE





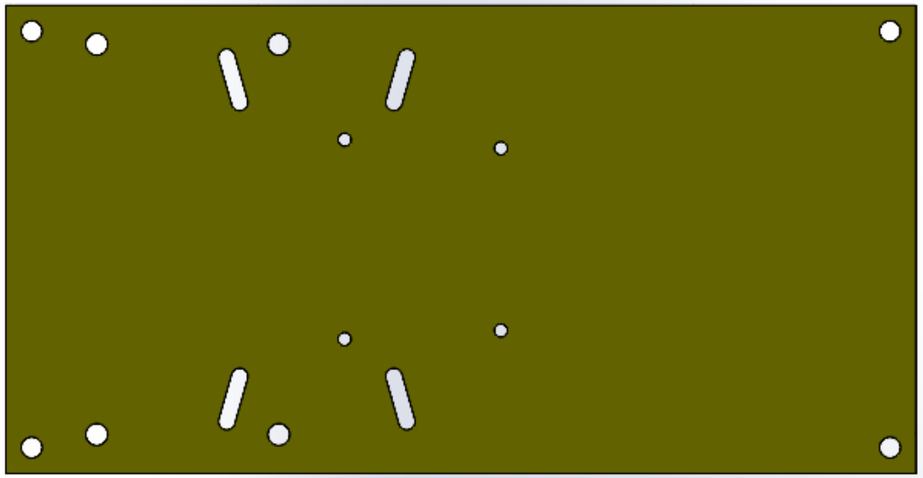
LINKAGE

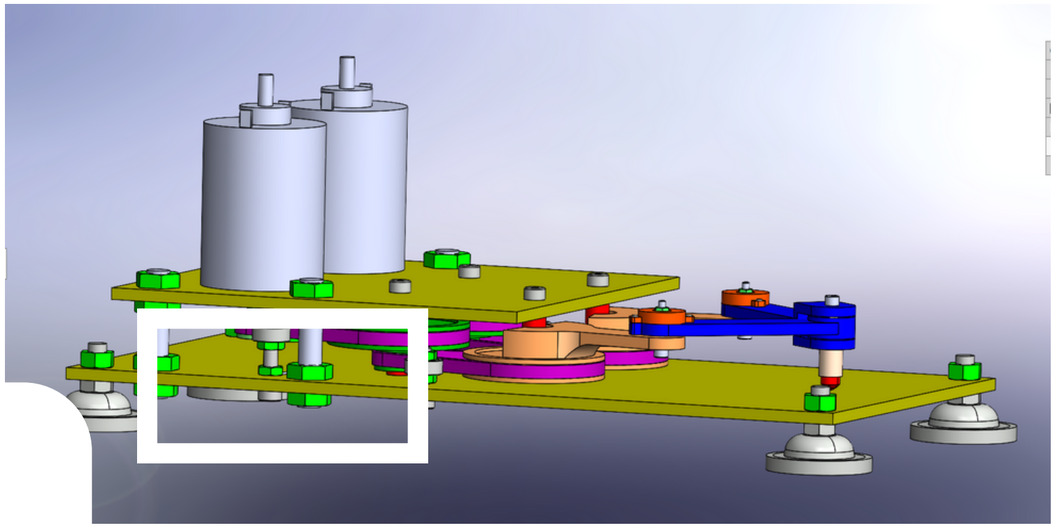
- Pivot

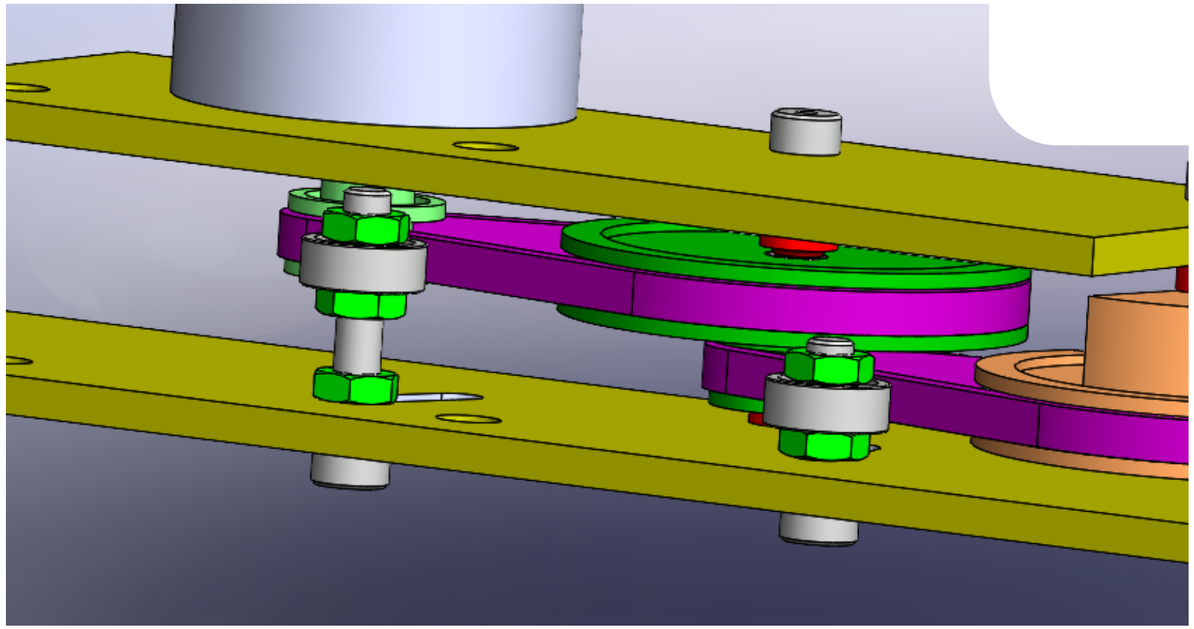
AXIAL STOP

- Shoulder

DETAINED CUT VIEW - TENSION SYSTEM







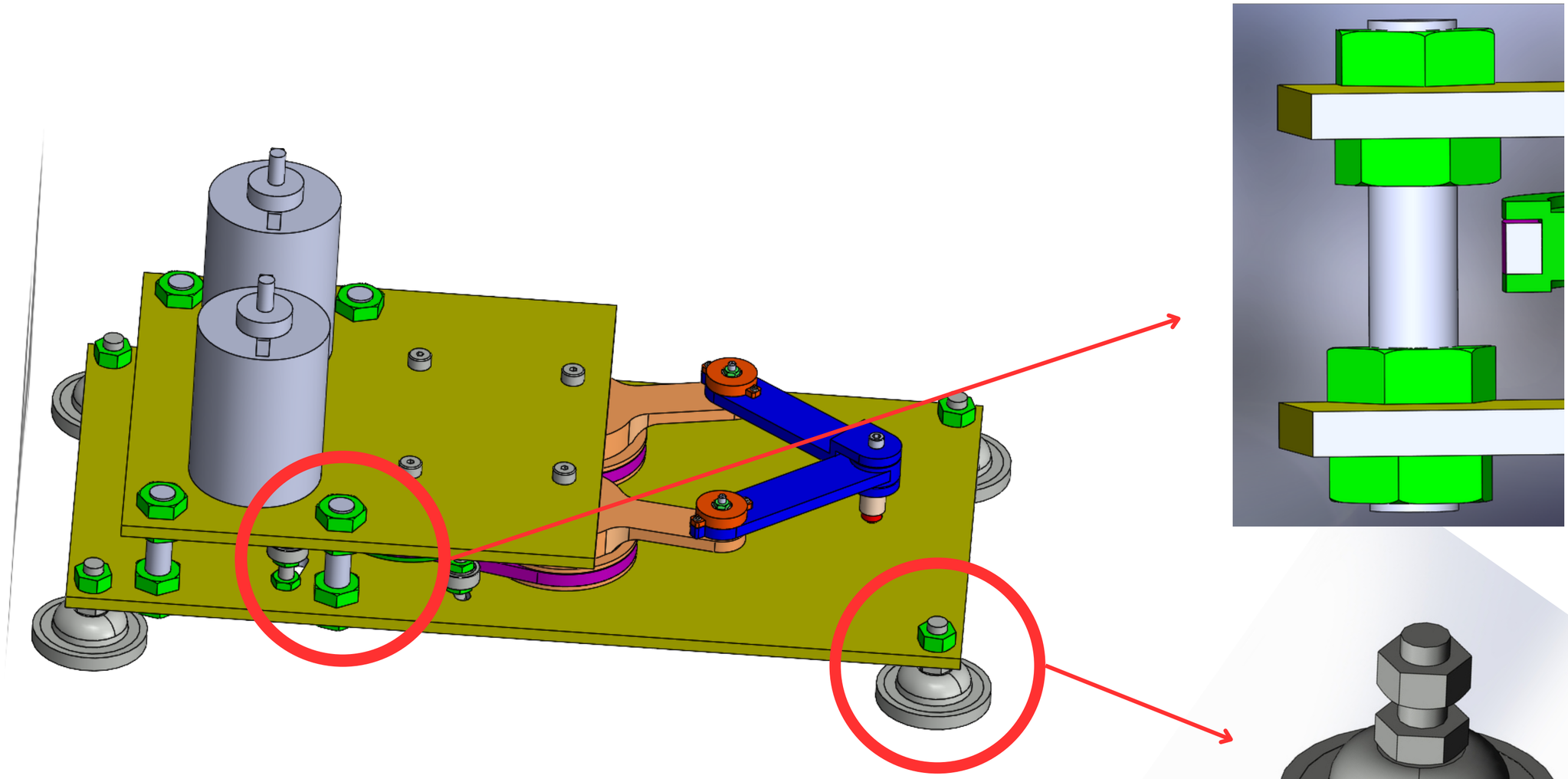
LINKAGE

- Pivot (Ball bearing)

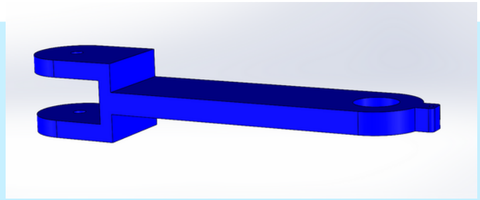
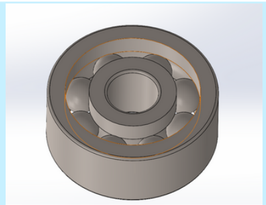
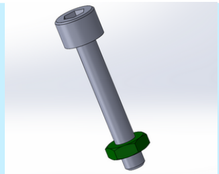
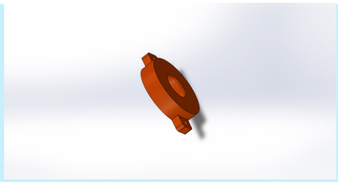
AXIAL STOP

- Shoulder

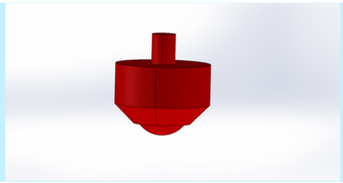
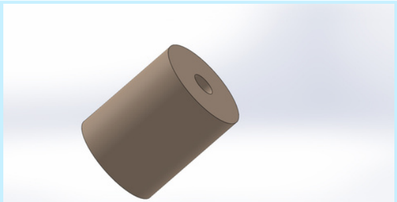
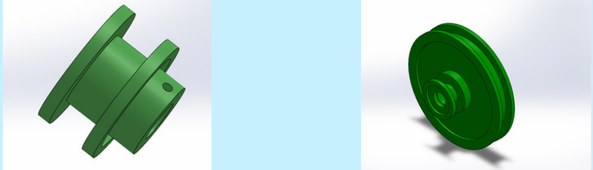
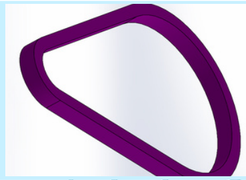
DETAINED CUT VIEW - BASE SUPPORT



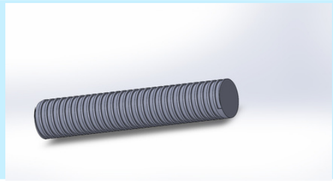
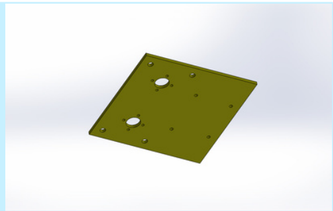
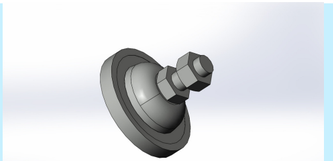
Pantograph parts

Part	Image	How / Where ?	Cost (€)
Arm (Link)		3D printed	--
Ball Bearing		Misumi	3 -5
Screw and nut		Misumi	2-3
Ball bearing housing		3D printed	--

Pantograph parts

Part	Image	How / Where ?	Cost (€)
Ball transfer unit		Misumi	24
Ball transfer unit housing		3D printed	--
Pulley		3D printed	--
Belt		3D printed	--

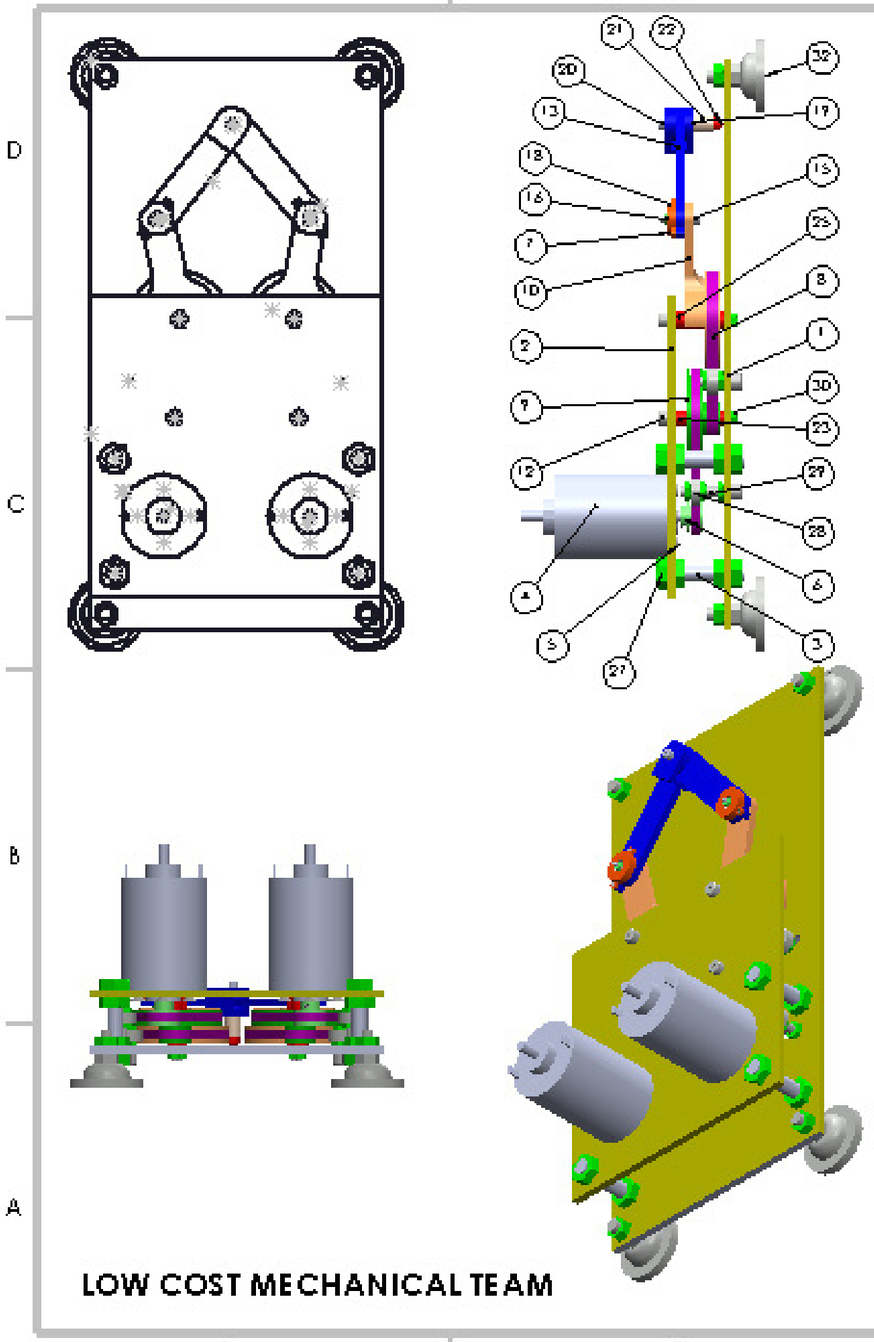
Pantograph parts

Part	Image	How / Where ?	Cost (€)
Treaded shaft		Misumi	3-4
Plexiglass (Base)		Laser cut	--
Base foot		Misumi	4.77

BILL OF MATERIALS

Global cost	
With motor components	648,09
Without motors components	164.29 €

Detailed Bill of Material



ITEM NO.	PART NAME	QTY.
1	Inferior_base	1
2	Superior_base	1
3	Threaded _shaft_5mm	4
4	Final_motor	2
5	CSPLC79-SUS-M5-12	8
6	Small_Pulley Motor	2
7	Screw_2mm	6
8	Belt	4
9	Combined Pulley	2
10	Big_Pulley_with_pantograph	2
11	675	8
12	Shaft_in_pulleys	4
13	Arm_pantograph	1
14	AFBMA 12.1.4.1 - 0030-10 - 8,DE,NC,8_68	6
15	Screw_arm_pantograph	2
16	HNT3C-BR-M3	4
17	Spacer_in_pantograph	4
18	Ball_Bearing_housing	2
19	Fork_pantograph	1
21	Ball_transfer_unit_housing	1
22	Ball_transfer_unit	1
23	Spacer_combined_pulley_top	2
24	Spacer_combined_pulley_bottom	4
25	Spacer_big_pulley	2
26	HNT3C-BR-M6	10
27	Nut_Threaded_shaft	16
28	Tension_Ball_Bearing	4
29	CSH-ST-M6-32	2
30	Nut_pulley_Shaft	4
31	CSH-STN-M6-20	2
32	Foot	4

Conclusion

- We "succeeded" in realizing a LOW-COST back drivable HAPTIC DEVICE with low friction and inertia

- Limitation: COST

- To prototype this design, the work of the Robotic team and the Virtual environment team will be incorporated

Deliverables

- CAD Files
- Report
- Detailled bill of materials

THANK YOU