BrailleRap Documentation

Release 6.5.0

BrailleRap Team

Aug 15, 2023

CONTENTS

Contenu:

CHAPTER

ONE

PROJECT HISTORY

1.1 The beginning

In 2016 **MyHumanKit** organization organizes with the partnership of Airbus Industries a hackacaton called Fabriakarium

During the Fabrikarium many tests were made to emboss **Braille** on 160g paper with hacked 3D printers,

The project was called BrailleRap.

In the BrailleRAP-SP team we thought that this work was a demonstration of feasibility, but that it was better to develop a specialized machine that was easy to reproduce.

1.2 OpenBraille

In 2017 Carlos Campos starts the OpenBraille project and builds a braille embosser from recycled printer parts.

The project demonstrates that it is possible to move a sheet of paper with enough precision in a braille embosser.

1.3 BrailleRap-SP

In January 2018, we started with some linear rails, Nema motors and printed parts to try to make a braille embosser. A few tries later, we started to show examples of Braille embossed texts, and everyone was very excited. The BrailleRAP-SP project was born.

1.4 BrailleRap

In 2022, to improve the project with some enthousiasts, we create BrailleRap project

1.5 BrailleRap Cameroon

Also in 2022, the CCLab entrusts us with the preparation and realization of 4 general public workshops in Cameroon. It's Operation BrailleRAP Cameroon.

2 workshops for the general public, 2 master classes in 4 cities in Cameroon in collaboration with CCLab and Cameroonian partners. It is the opportunity for 3 weeks to confront the project once againto the general public: blind people, makers, associations, establishmentslessons learned. All this in a very different international context of our usual activities.

An experience rich in exceptional encounters, in anecdotes, in experiments and new ideas for evolutions and improvements.

The BrailleRAP Cameroon operation resulted in the production of 2 sheets of workshop conduct:

- General public workshop conduct sheet
- Master class workshop conduct sheet

As well as sheets that describe the experiments carried out on the sidelinesworkshops.

- Blind workshop mental representation

More on BrailleRAP Cameroon here


Fondation
NIKE

CHAPTER

TWO

LICENSE

All original BrailleRap works are licensed under the CERN Open Hardware License v1.2 license (https://www.ohwr.org/projects/cernohl/wiki), translated into French on this page: http://fr-voosilla.ouvaton.org/CERN-OHL-%5Bfr%5D-Traduction-Fran%C3%A7aise.html

We use several open source projects, which have their own license:

1. The “Marlin firmware” project as the firmware for the control board: https://github.com/MarlinFirmware/Marlin
2. BrailleRap that has a gcode generator https://github.com/arthursw/BrailleRap
3. NatBraille open source Braille transcriptor http://natbraille.free.fr/

CHAPTER

THREE

BILL OFF MATERIAL

3.1 Laser cutting

2 600mm x 400mm 5mm plywood sheets

The dxf files are availables here : https://github.com/BrailleRap/BrailleRap/tree/master/lasercut

3.2 Printed parts

All printed parts are printed in ABS, 50% infill, 3 outside perimeters. We use eSun ABS Natural filament

The stl files are availables here : https://github.com/braillerap/BrailleRap/tree/master/printed_parts

3.3 Mechanical parts

Qty	Type
4	Linear rod 8mm diameter **330 mm** length
1	Rail de guidage linéaire (diamètre 8mm) **365 mm** length
1	Rail de guidage linéaire (diamètre 8mm) **100 mm** length
6	RJ4JP-01-08 polymer linear bushing
3	GT2 pulley 20 teeth 8mm bore
2	GT2 free pulley 20 teeth bore 3mm (with bearing)
2	KP08 linear bearing for 8mm linear shaft
2	KFL08 vertical bearing for 8mm linear shaft
1	5mm/8mm flexible motor coupling
1	Closed GT2 belt 200 mm
2	GT2 belt 630 mm
3	O-ring 15.1 mm inside diameter 20.5 mm outside diameter (15.1 x 20.5 x 2.7)
10	Zip tie selflock 2.5 x 160 mm
3	GT2 tensionner springs
…	

3.4 Electronics

Qty	Type
1	MKS GEN 1.4 or Ramps 1.4 compatible or MKS GEN L 2.1 https://github.com/makerbase-mks
2	DRV8825 drivers with cooling radiator
2	Nema 17 40 N/cm with wire (17HS4401)
1	Electro-magnet *tau-826* 12V 2A
1	1N4004 flyback diode (12V 2A) (only for MKS GEN 1.4)
1	jack 2.5mm alimentation connector
1	12V 6A Alimentation

CHAPTER

FOUR

BRAILLERAP BUILDING MANUAL

4.1 Necessary tools

- Small pliers.
- Small cutting pliers.
- M3 tap.
- 8mm drill.
- 3mm drill.
- Hex keys 1.5, 2, 2.5 and 4
- Tube wrenches 5.5 and 8.
- wood glue
- Adhesive Blue tape

4.2 Notes on screws

M3 and M5 refer to the diameter in mm of the threaded part of the screws second number corresponds to the length of the screw For example M3-12 means a screw 3mm in diameter and 12mm in length

M5-18 refer to a screw with a hexagonal head (5mm in diameter 18mm in length)

M3-12 grub refer to a grub screw (3mm diameter - 12 mm length)

4.3 Notes on nuts

M3 nut or M5 nut refer to standard nuts with a diameter of 3mm or 5mm

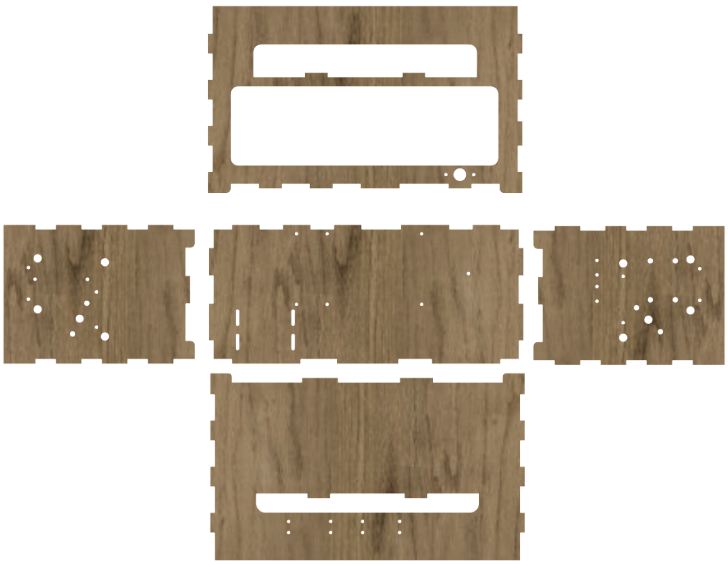
M3 NYL nut or **M5 NYL nut** refer to **locking** nuts of diameter 3mm or 5mm

4.4 Woodbox assembling

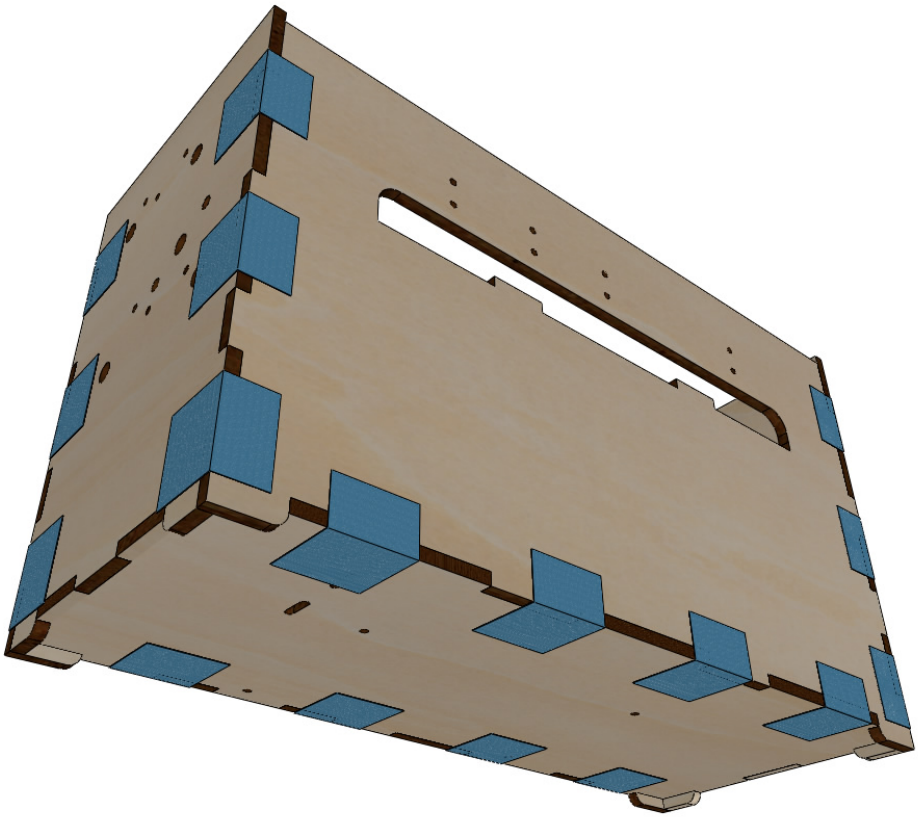
Material:

- FACE (5mm laser cut plywood).
- BACK () 5mm laser cut plywood
- BOTTOM (5mm laser cut plywood).
- LEFT_SIDE (5mm laser cut plywood).
- RIGHT_SIDE (5mm laser cut plywood).
- wood glue
- Adhesive Blue tape
- Prepare the 5 elements: FACE, BACK, LEFT_SIDE, RIGHT_SIDE and BOTTOM.

Attention: identify the position of the sides (right and left) and the bottom. Use the holes to orient the parts as shown in the figure



- Glue the notches, assemble the 5 parts and hold them in place with painter's tape the drying time recommended by the manufacturer.

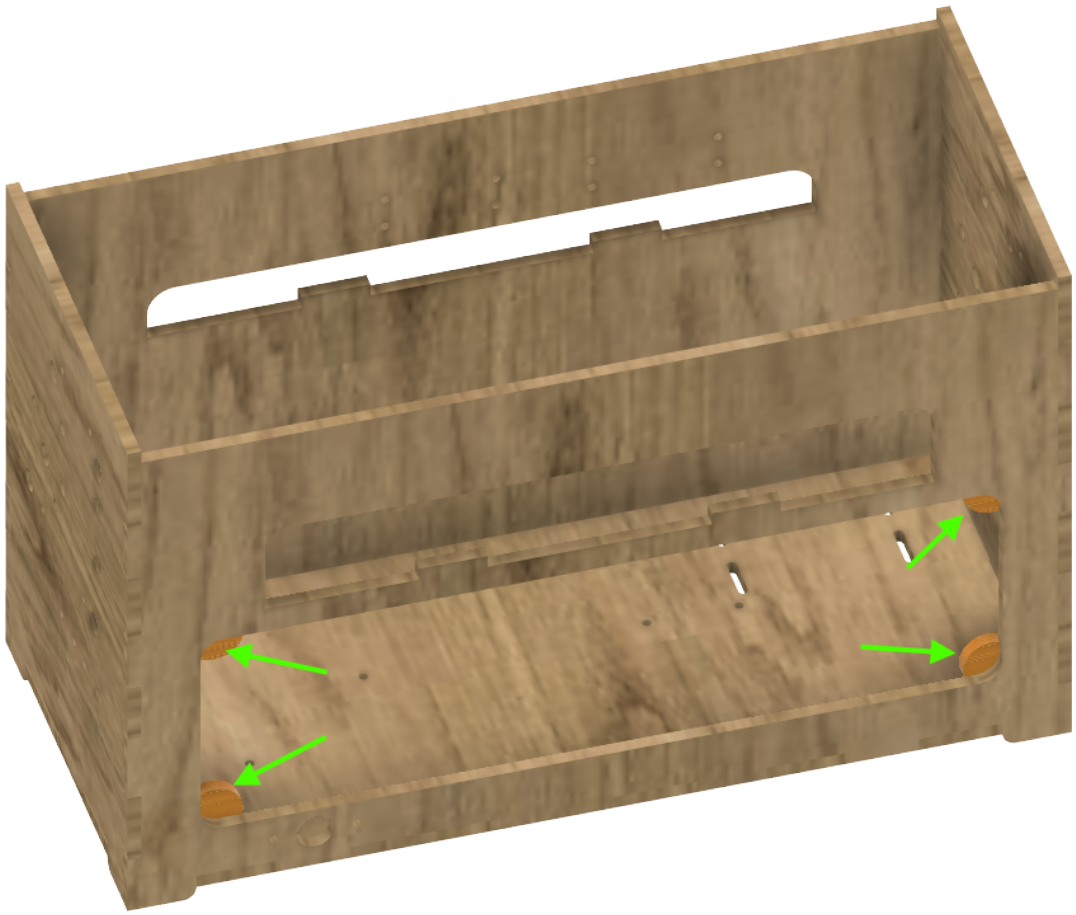


4.5 Door blockers bonding

Material:

- Assembled wood box.
- 4 wooden discs recovered from the laser cutting of the lid.
- wood glue

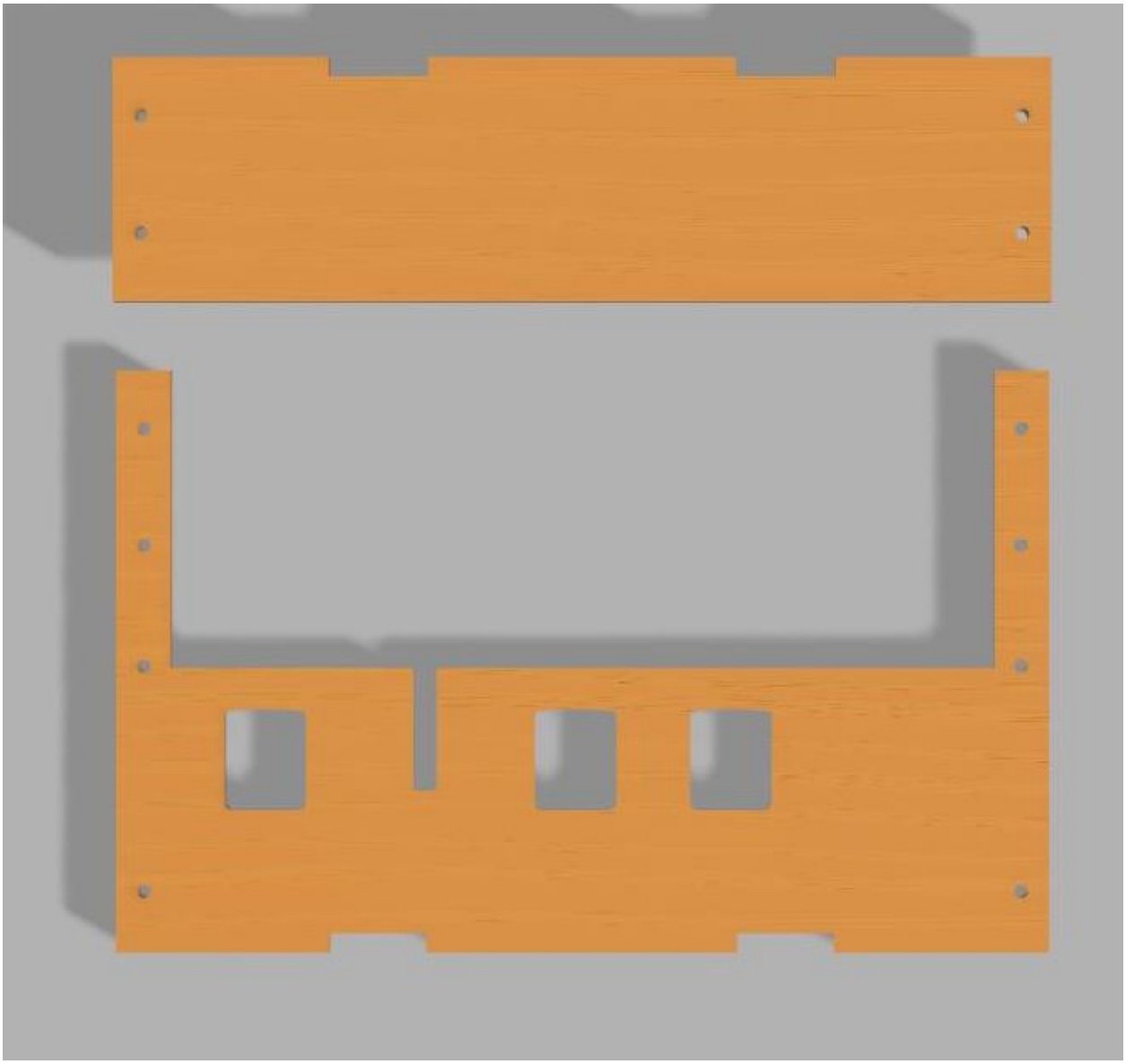
Glue the 4 wooden discs on the back cover inside the crate. These discs will hold the access hatch inside the machine.



4.6 Bonding of the paper tray

Material:

- Upper paper support
- Lower paper support
- wood glue
- Collets



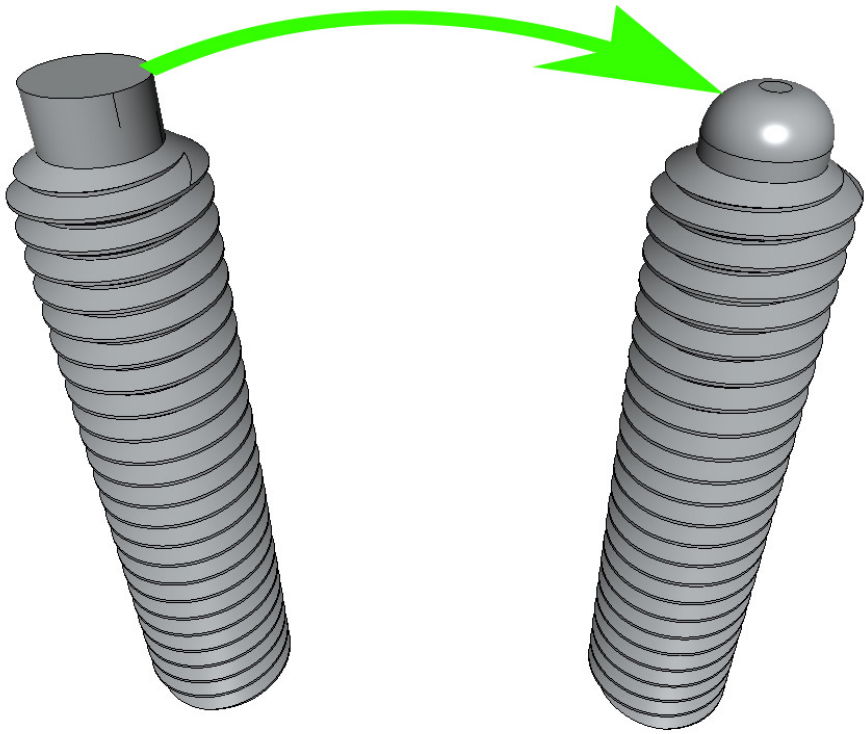
- Glue the lower support under the upper support.

Attention: the 2 parts must be perfectly aligned. Place screws in drillings to properly align the parts. There must not be any of space between the two pieces (where the sheet of paper could come jam). Tighten the parts well against each other with clamps

4.7 Prepare the Braille stylus

Equipment:

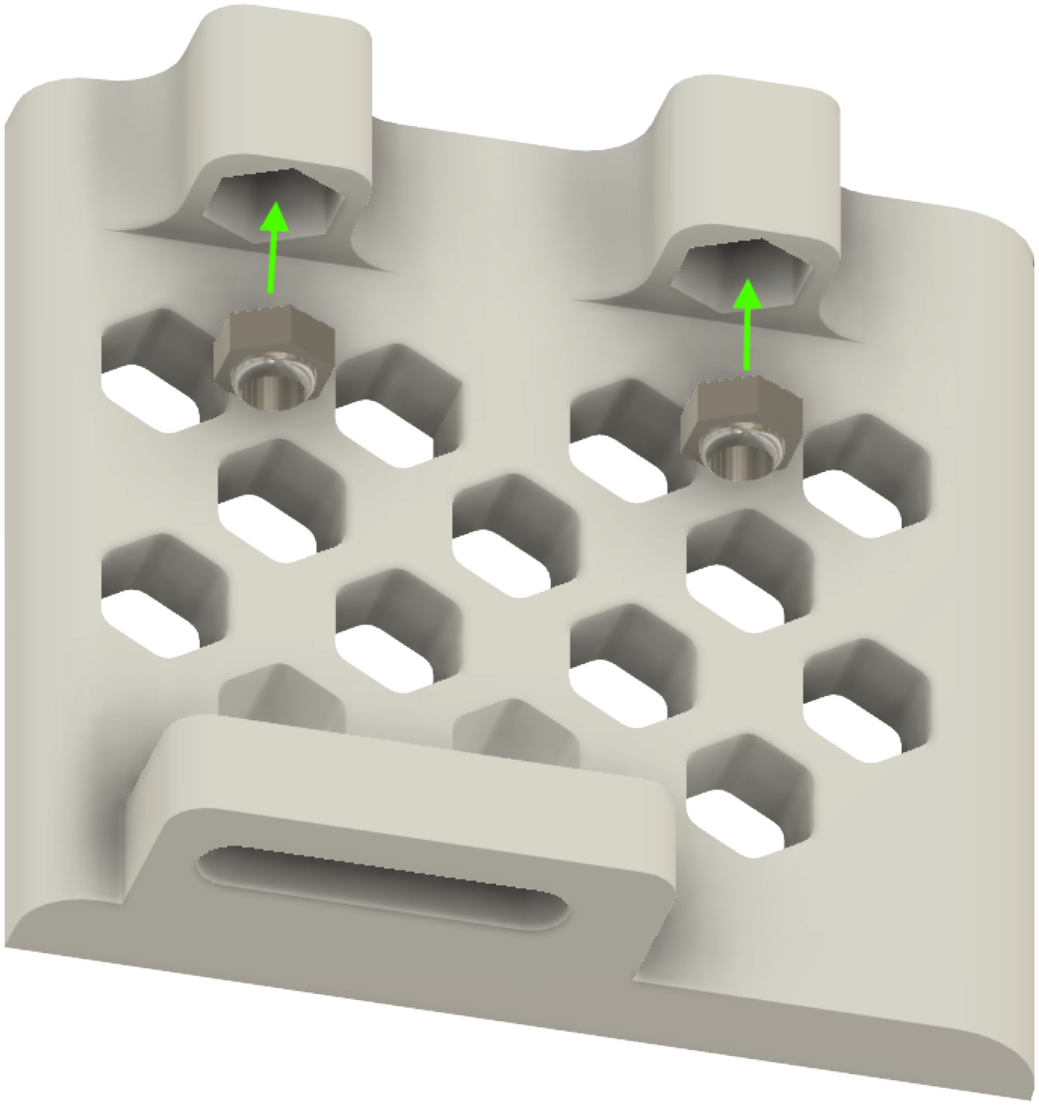
- 1 Whetstone
- 1 grub screw M3-16 butt end
- File the edge of the nipple to obtain a profile approaching that illustrated.



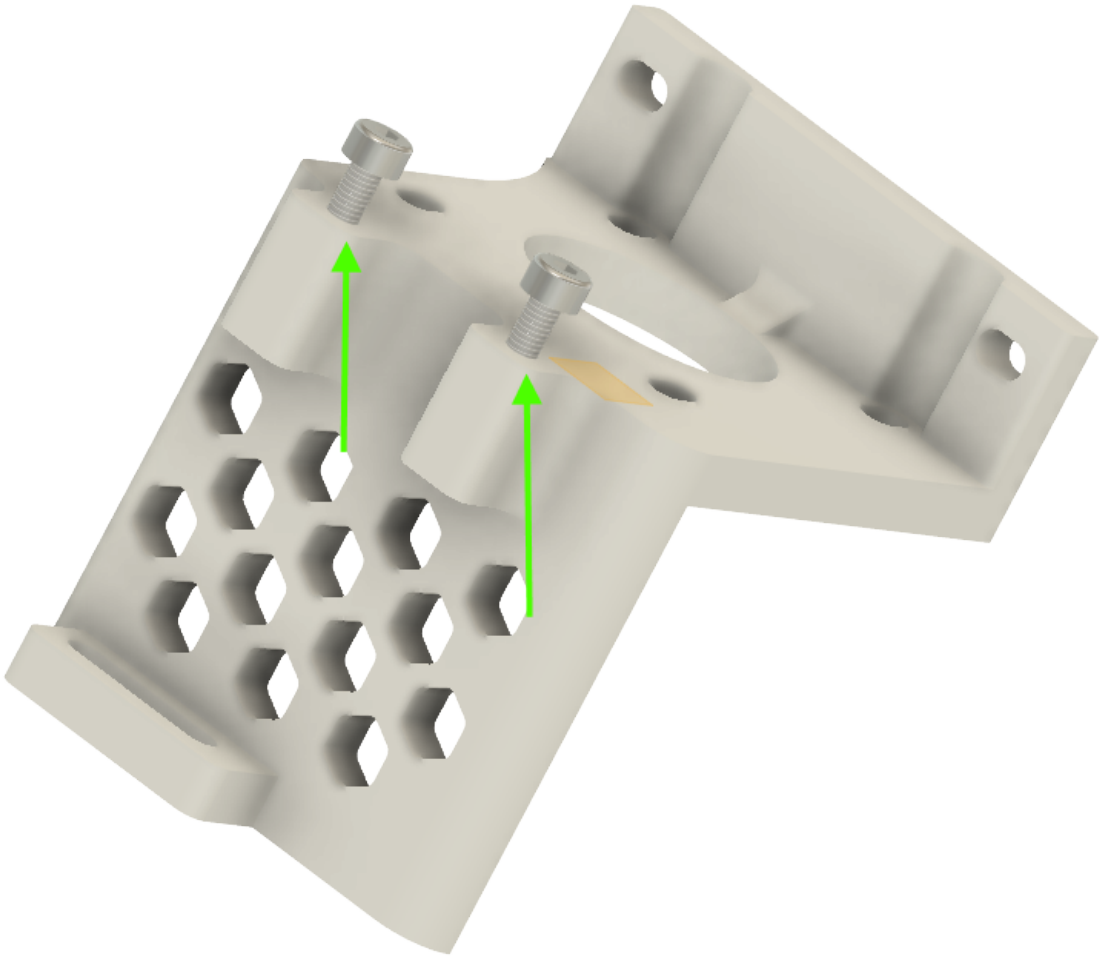
4.8 X Motor prepare

Equipment:

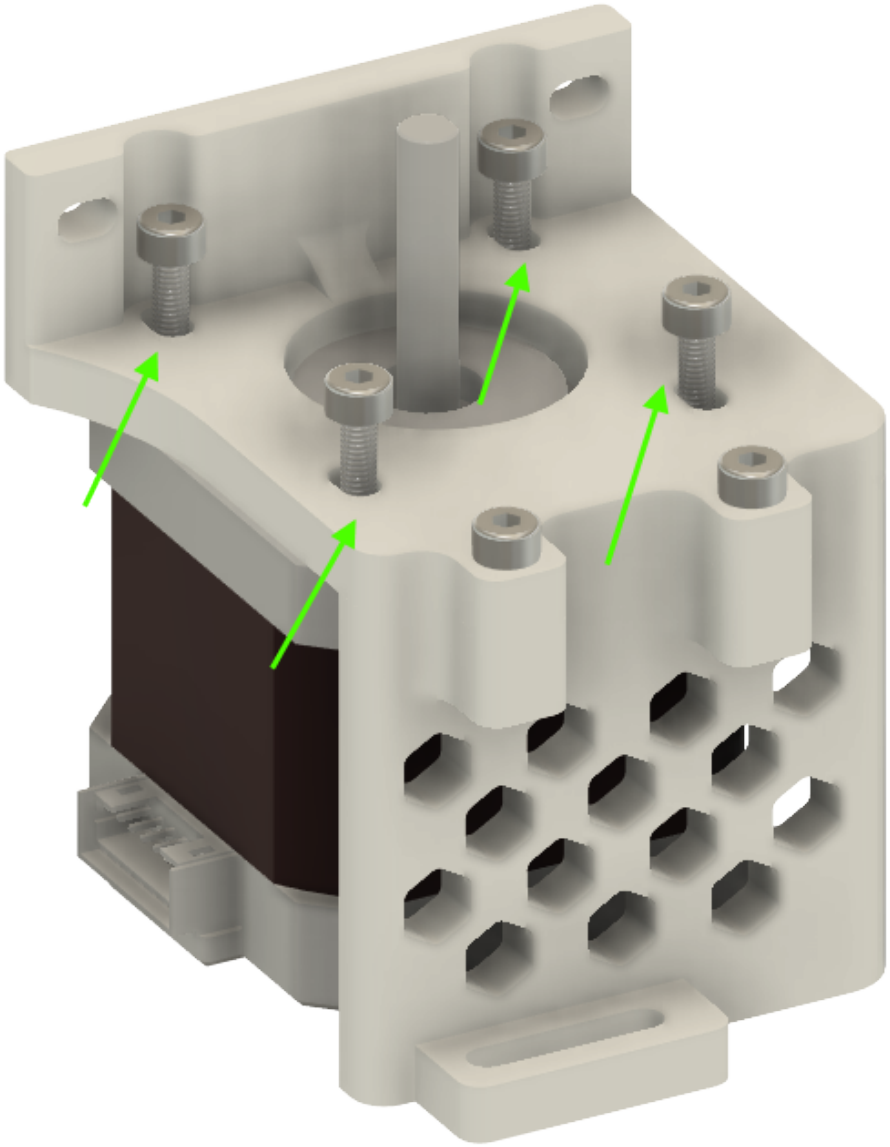
- **3D printed parts** : XMOTOR_support2 ou XMOTOR_support2_1
- 1 Nema 17 motor
- 4 screw M3-8
- 2 NYLSTOP M3
- 2 M3-14 screws
- Insert 2 NYL M3 nuts in the printed part **XMOTOR_support2_1**.



- Fix the two parts printed **XMOTOR_support2_1** and **XMOTOR_support2** with two M3-14 screws.



- Fix the motor in its support with 4 M3-8 screws. Do not tighten the screws, the motor must be free to move, it will be tighten later.

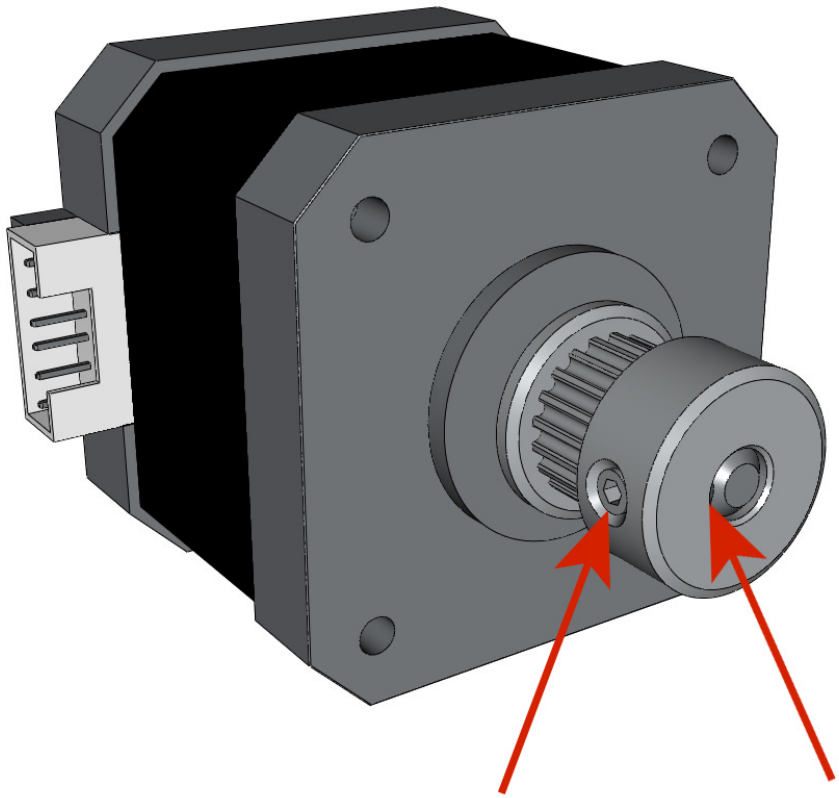


Note: Pay attention to the orientation of the motor connector!

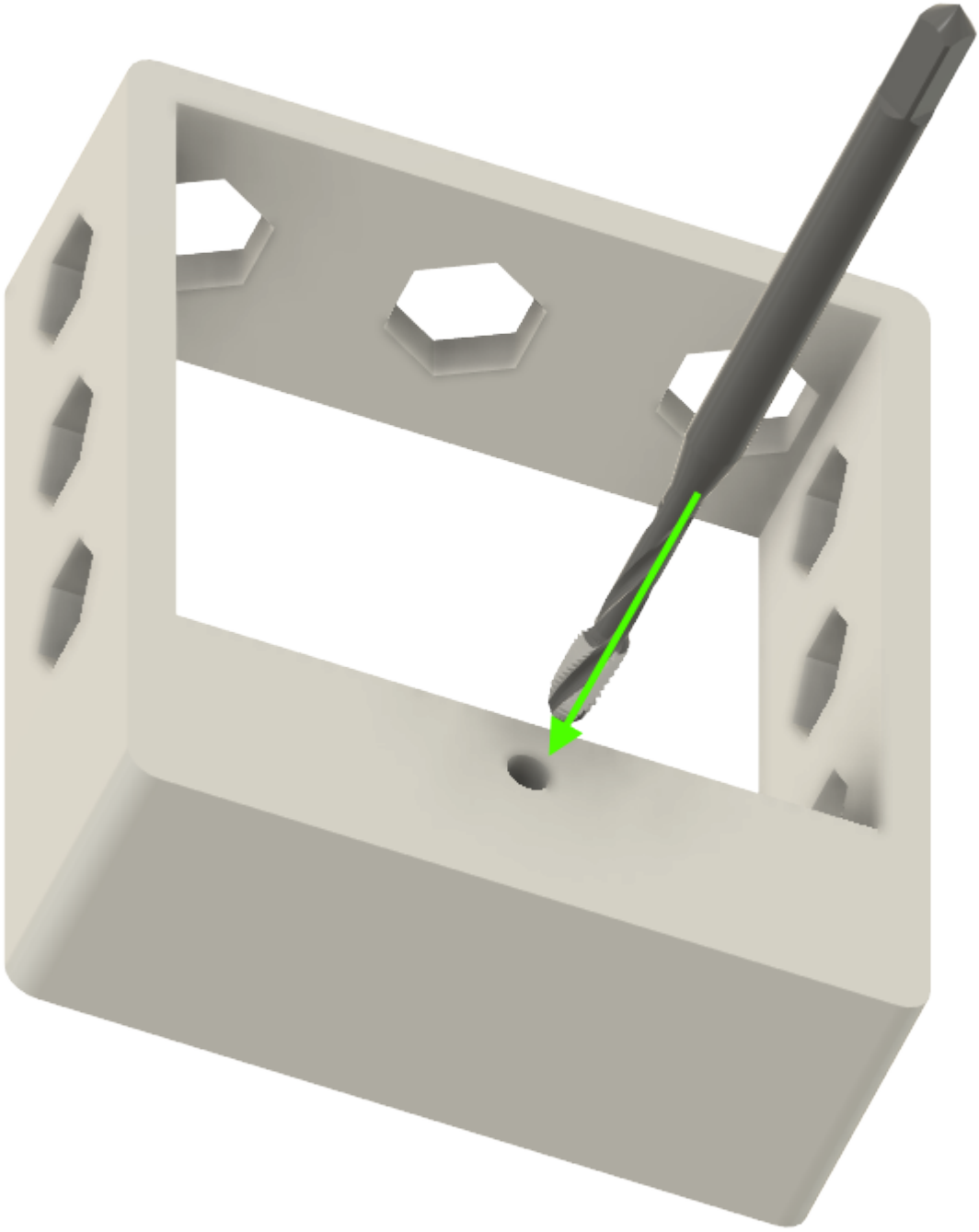
4.9 Y Motor prepare

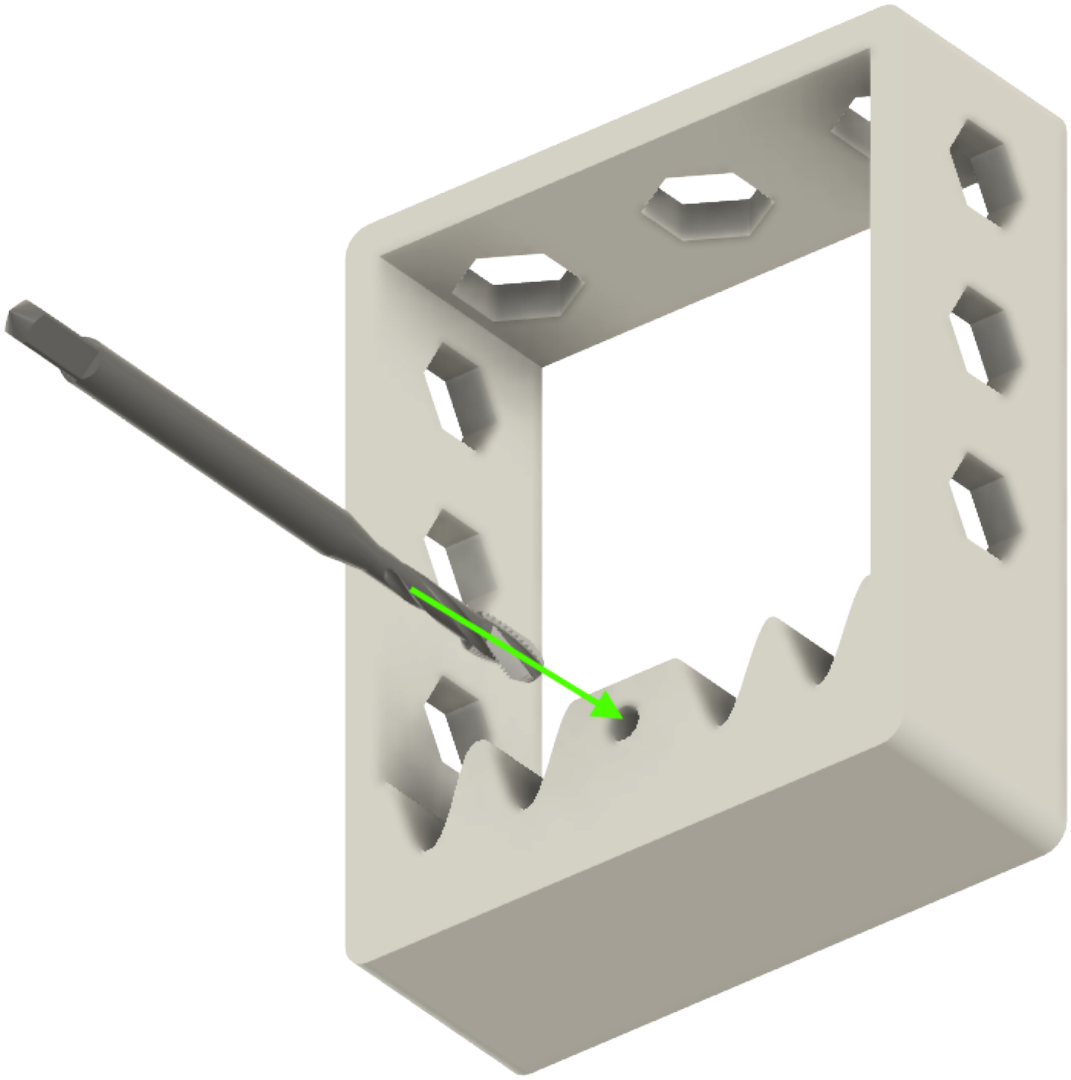
Equipment:

- **3D Printed parts** : YMOTOR_support2_200_1, YMOTOR_support2_200_2, YMOTOR_support2_200
- 1 Nema 17 motor
- 1 pulley GT2 20 teeth 5mm bore
- 4 screw M3-8
- 2 screws M3-12
- Screw the pulley onto the motor shaft, making sure that at least one of the two screws is in front of the flat part of the motor shaft and that the teeth of the pulley are facing towards the motor.

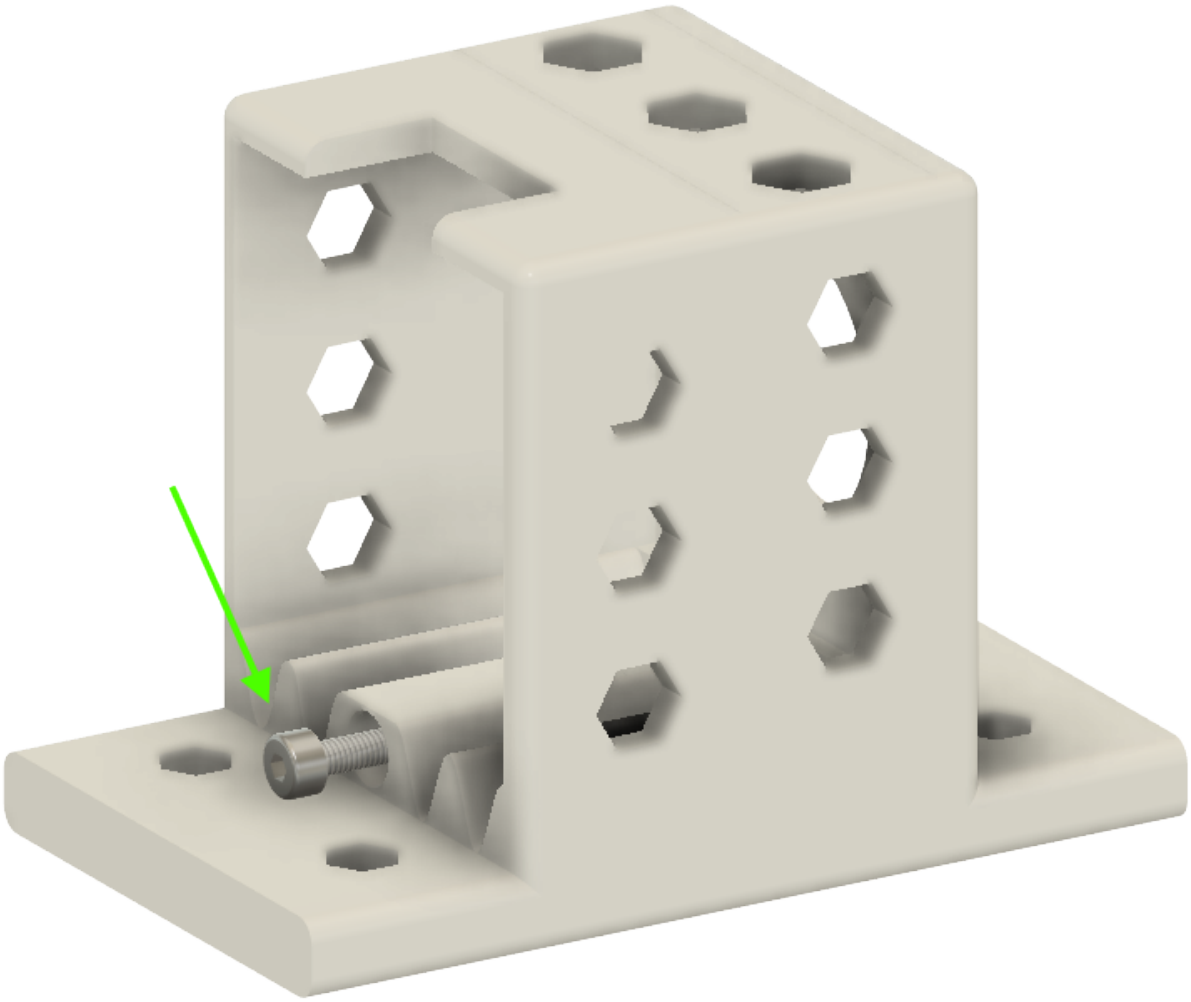


- Tap both sides of the central part of the support(**YMOTOR_support2_200_2**)

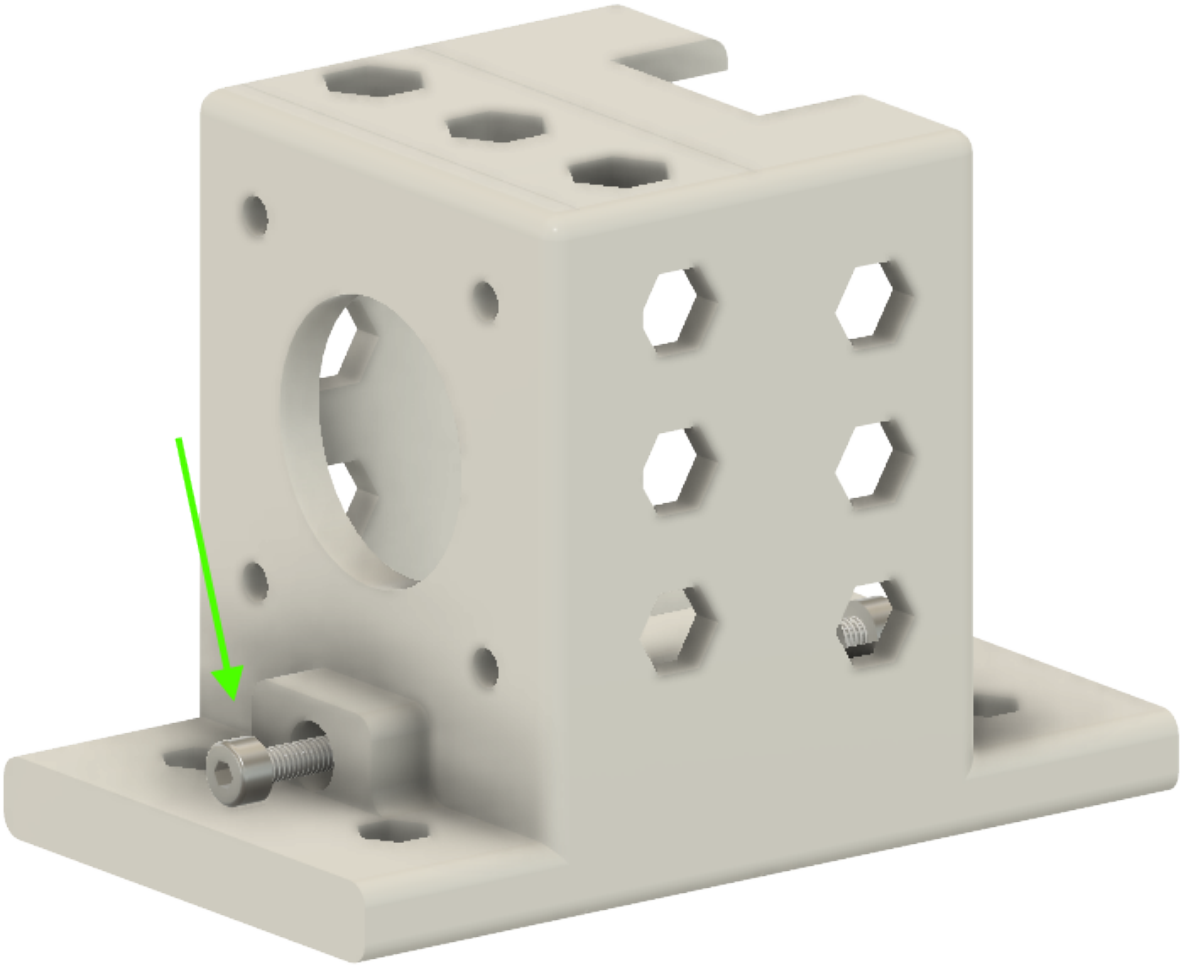




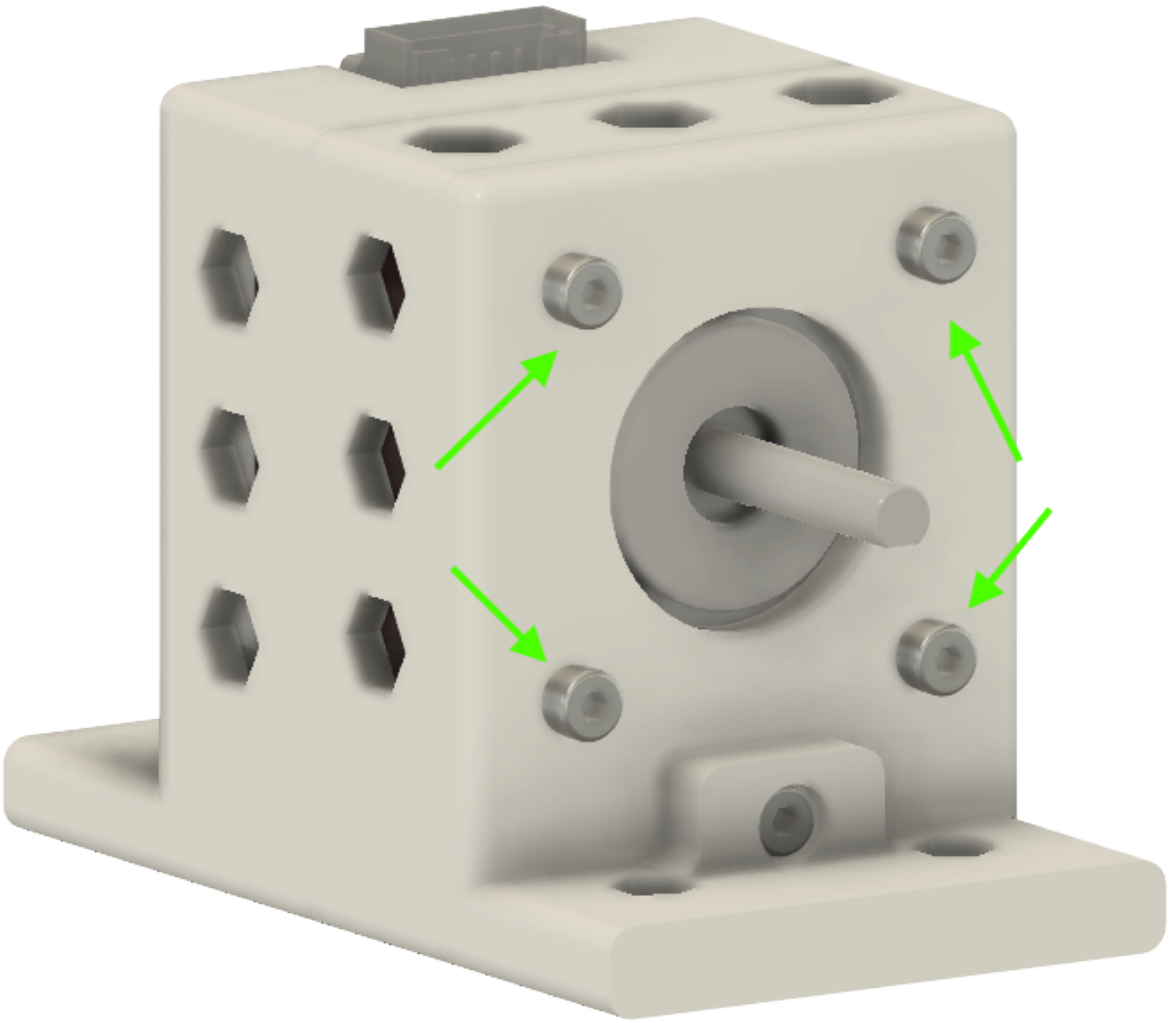
- Fix the two parts printed **YMOTOR_support2_200_2** and **YMOTOR_support2_200_1** with an M3-12 screws.



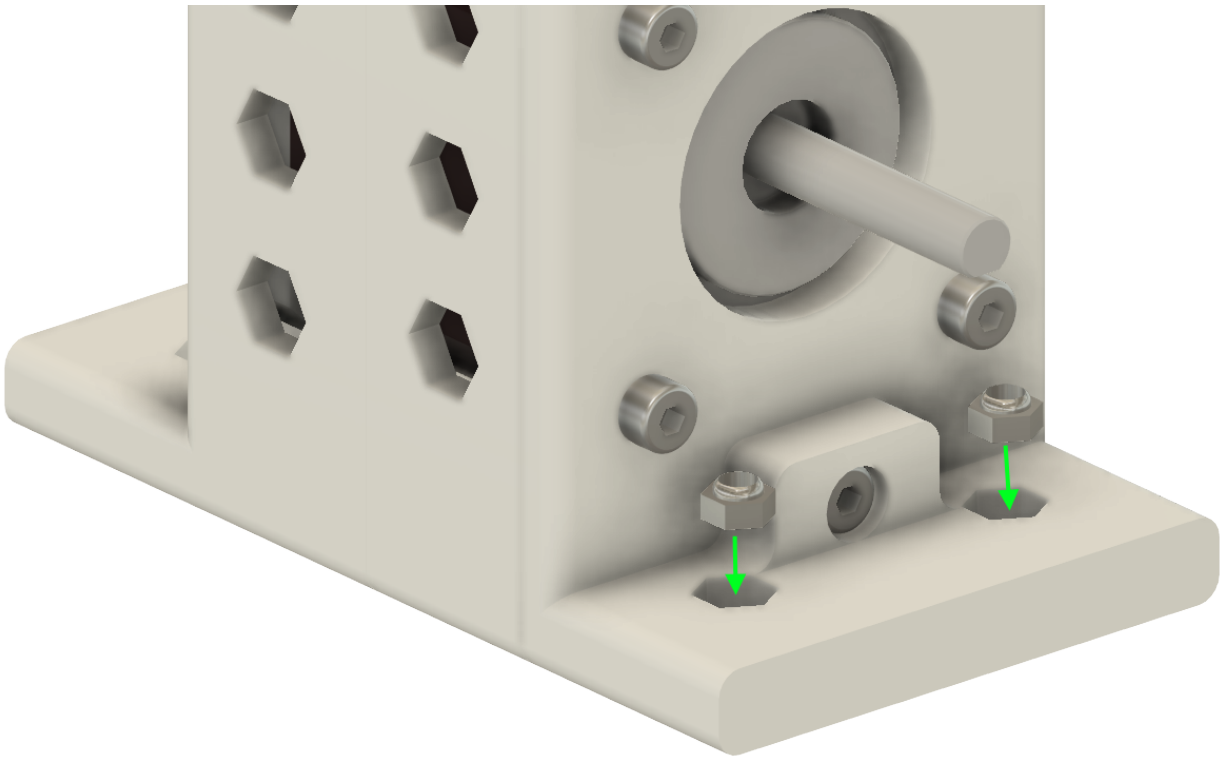
- Fix the part **YMOTOR_support2_200** on the previous set with a M3-12 screws.



- Mount the motor on its support with the 4 screws M3-8 making sure that the connector is in the position corresponding to the illustration.



- Insert the 4 NYL M3 nuts into the engine mount. Hold them in place with a small piece of painter's tape.

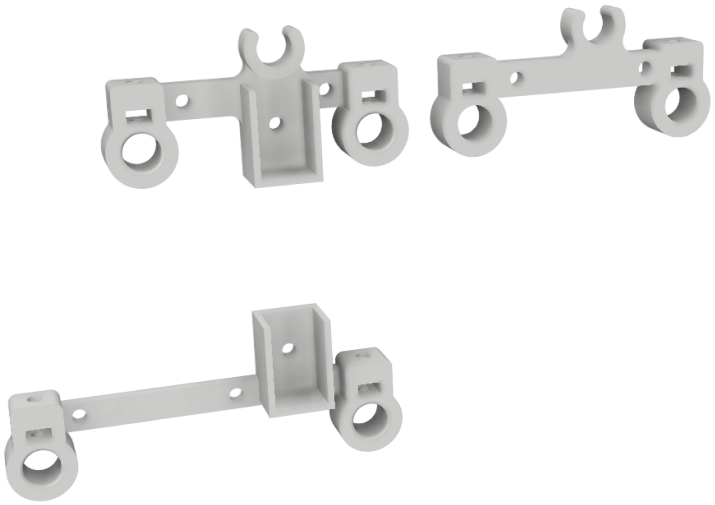


4.10 Axis supports Preparation

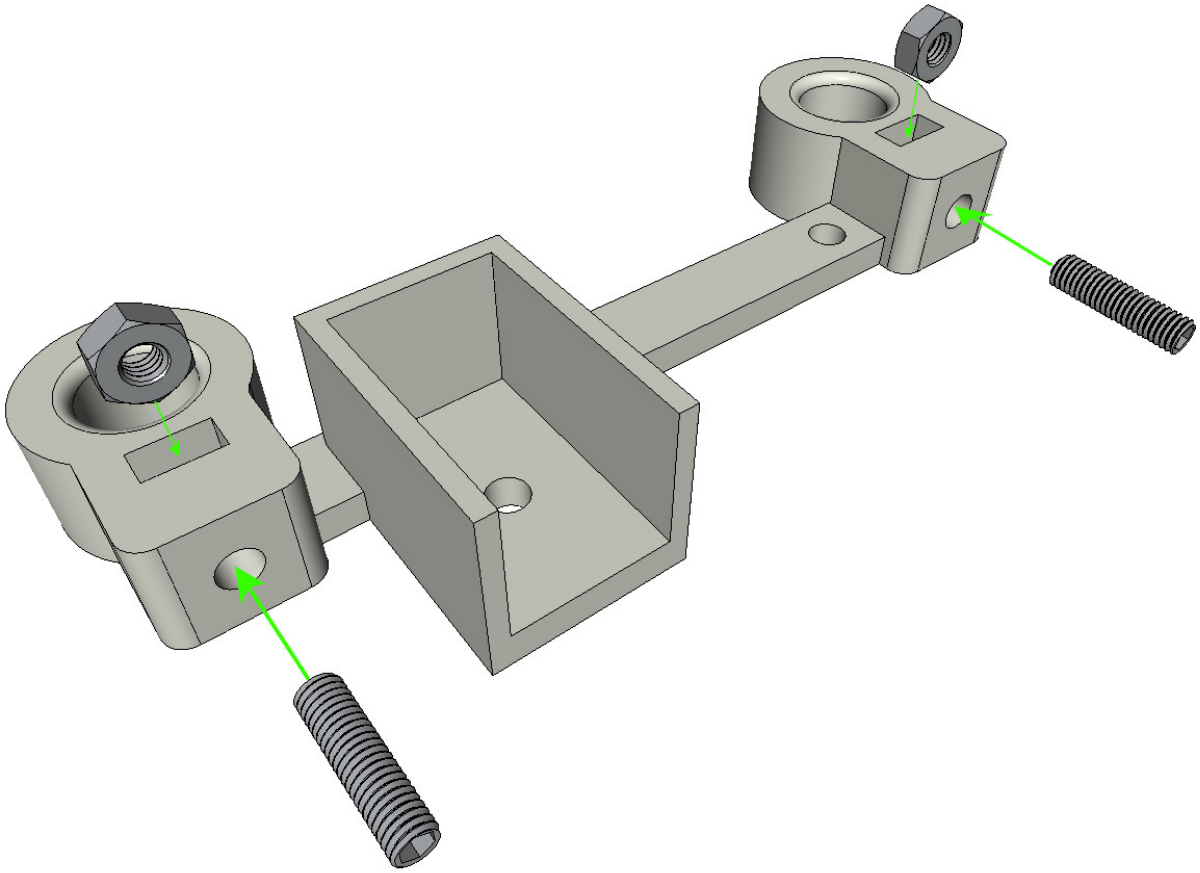
- **3D printed part** : BOTTOM_AXIS_left
- **3D printed parts** : TOP_AXIS_left
- **3D printed parts** : TOP_AXIS_right
- 1 8mm drill
- 8 M3 nuts
- 8 M3-12 grub screw

> **Attention:** Depending on the print quality of the plastic parts, make sure that the 8mm bars can slide easily into their housings. If necessary, drill the hole with a drill of 8.

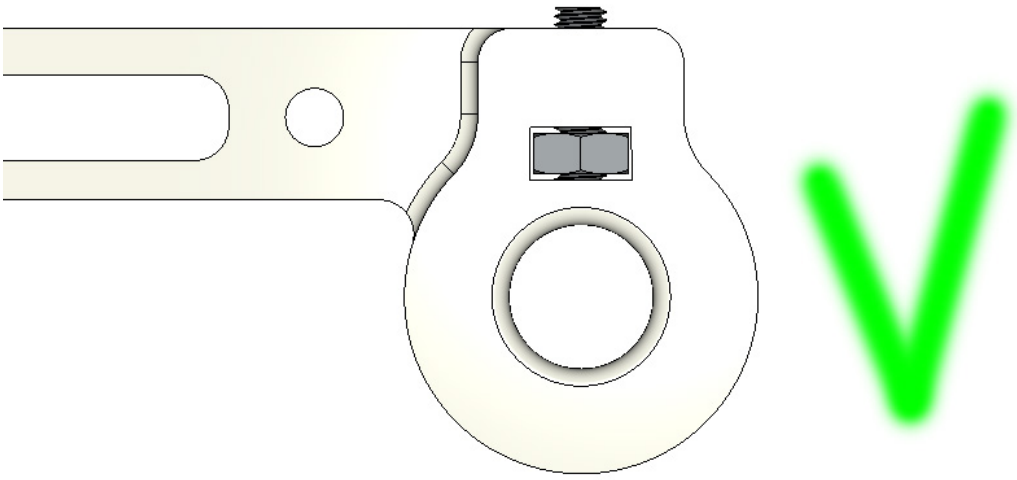
- The 3 parts to be assembled are as follows



- For each of the 3 pieces, insert an M3 nut into the rectangular holes. Tighten the M3-12 grub screws.



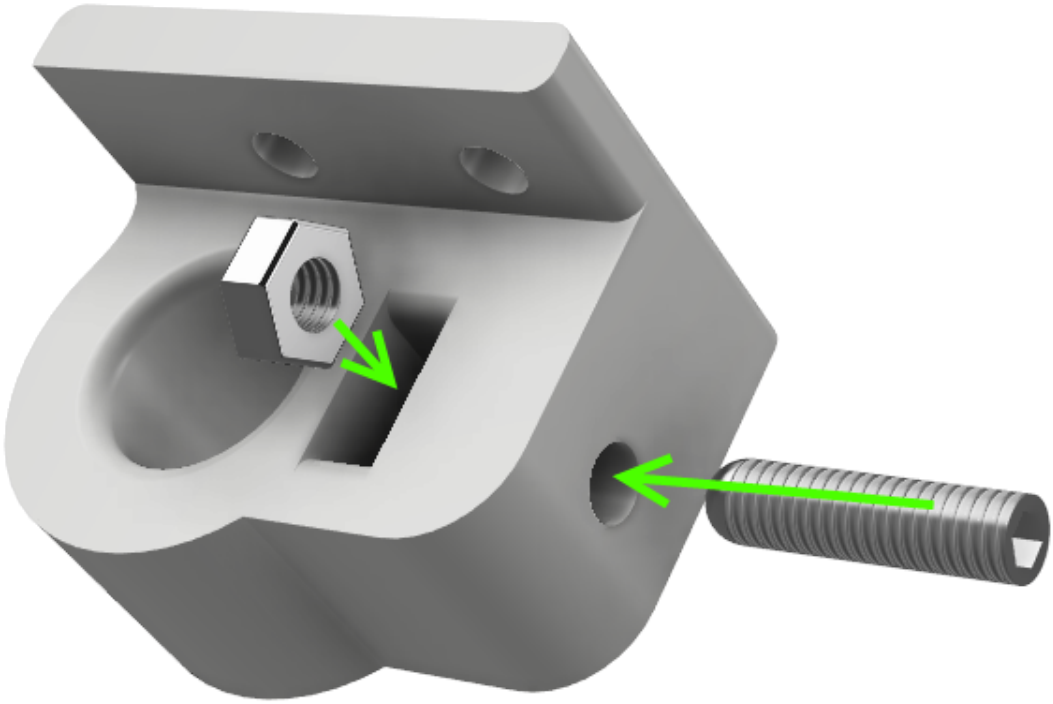
- The end of the screw must not protrude in the passage of Ø 8mm bars.



4.11 Limit switch X prepare

Equipment:

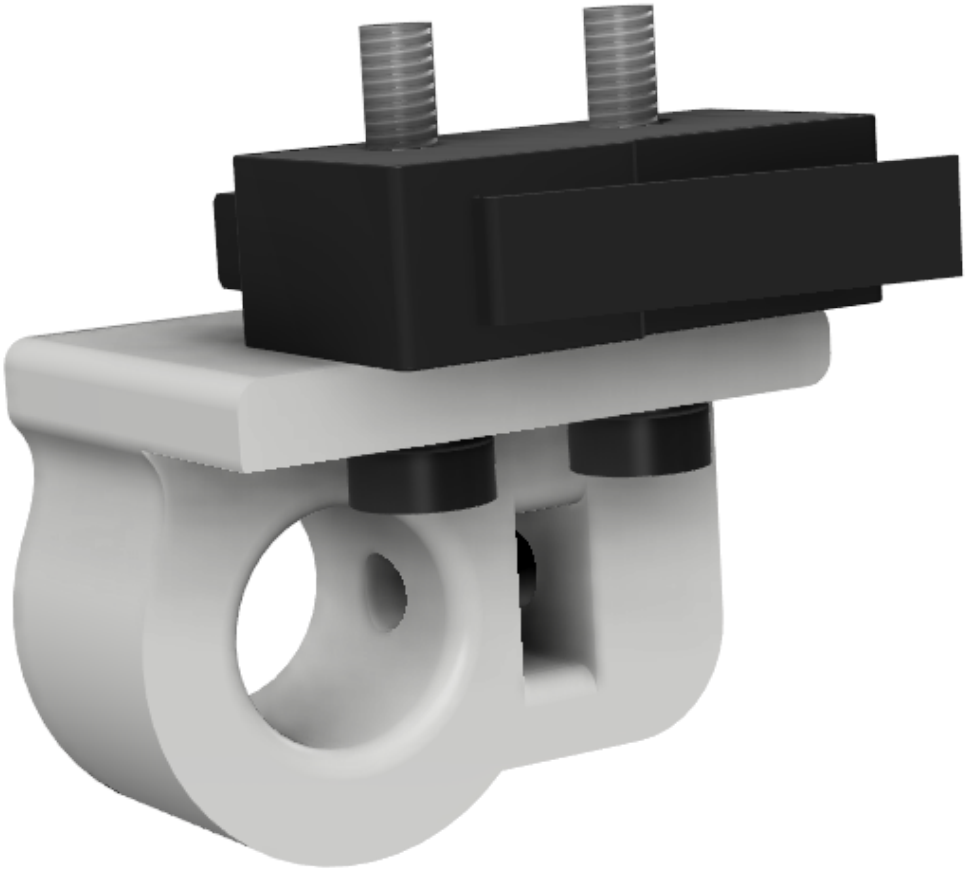
- **3D printed parts** : SWITCH_X_support
- 1 wired limit switch (see wiring of the limit switches)
- 1 grub screw M3-12
- 1 M3 nuts
- 2 M2.5-14 screw
- 2 M2.5 nuts
- Insert an M3 nut and screw in a M3-12 grub screw.



- Screw the limit switch to its support (SWITCH_X_support) using M2.5-14 screws and M2.5 nuts.

Note: The limit switch is shown not wired but must be wired before installation.

Note: Pay attention to the direction of the 2.5 screws. The head of the screw must be under the microswitch to allow passage of the linear axis.

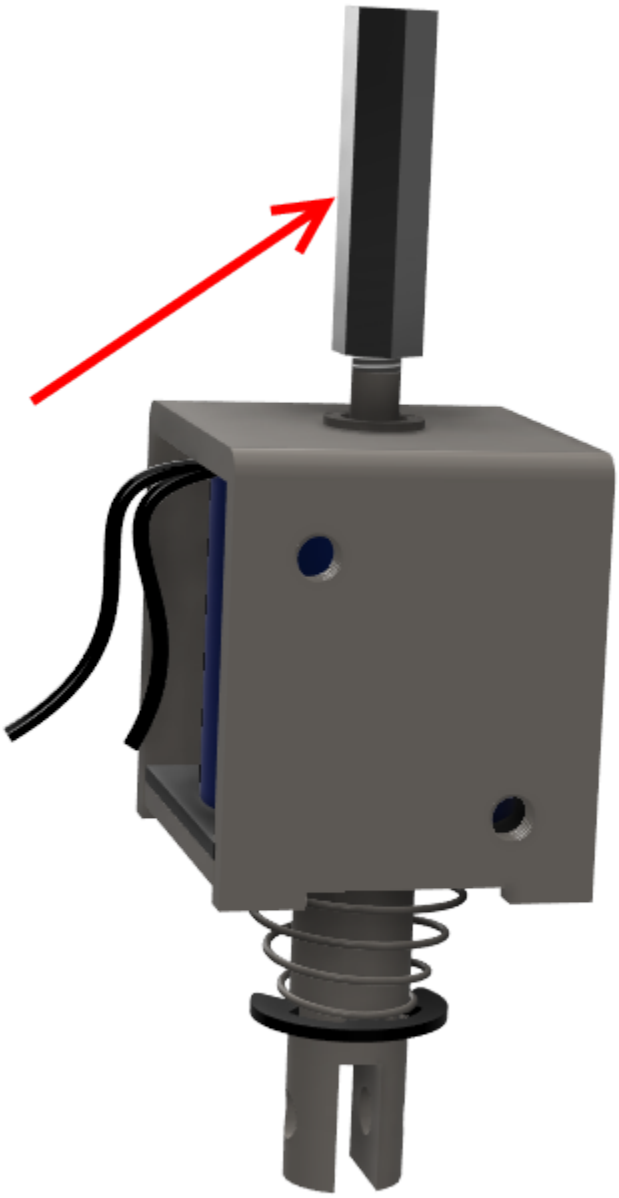


4.12 Electromagnet preparation

Equipment:

- 1 electromagnet
- 1 spacer 18mm
- 1 set screw M3-12 stylus punched (see Preparing the Braille stylus)
- 1 M3 nuts
- 1 M3 medium washer

- Screw the spacer all the way onto the electromagnet.

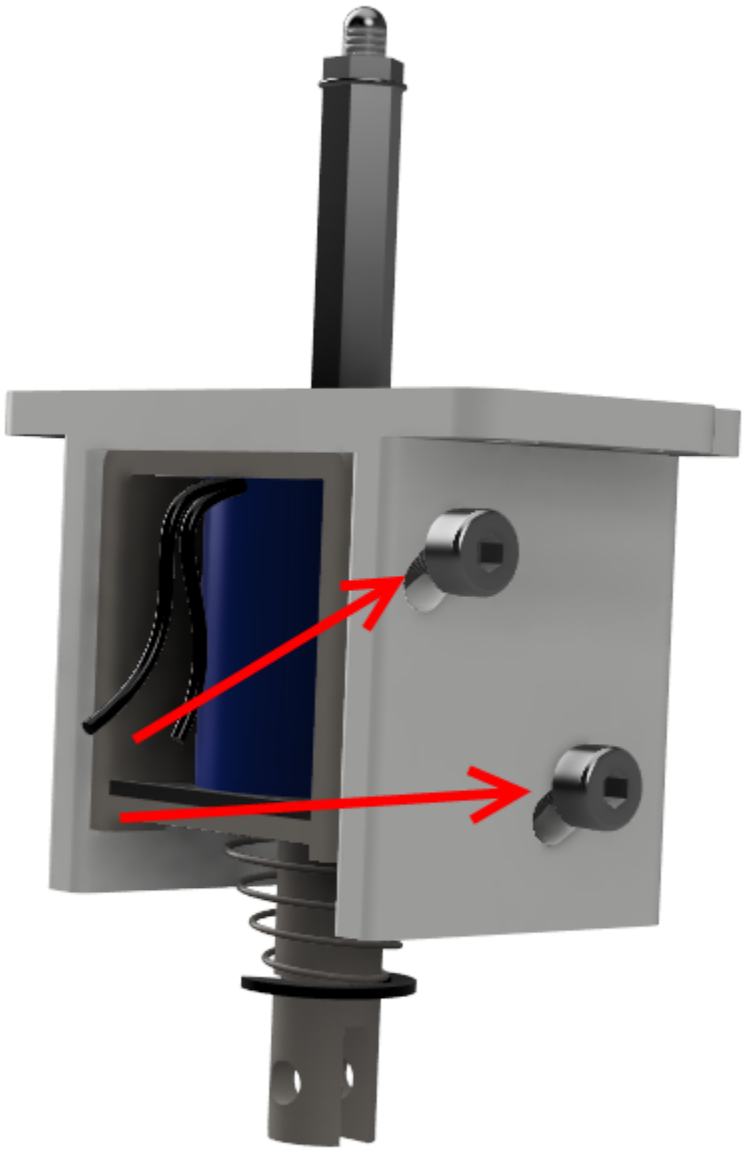


- Tighten the M3-12 screw with the Braille stylus punched out, allowing it to extend ± 6mm beyond the spacer.

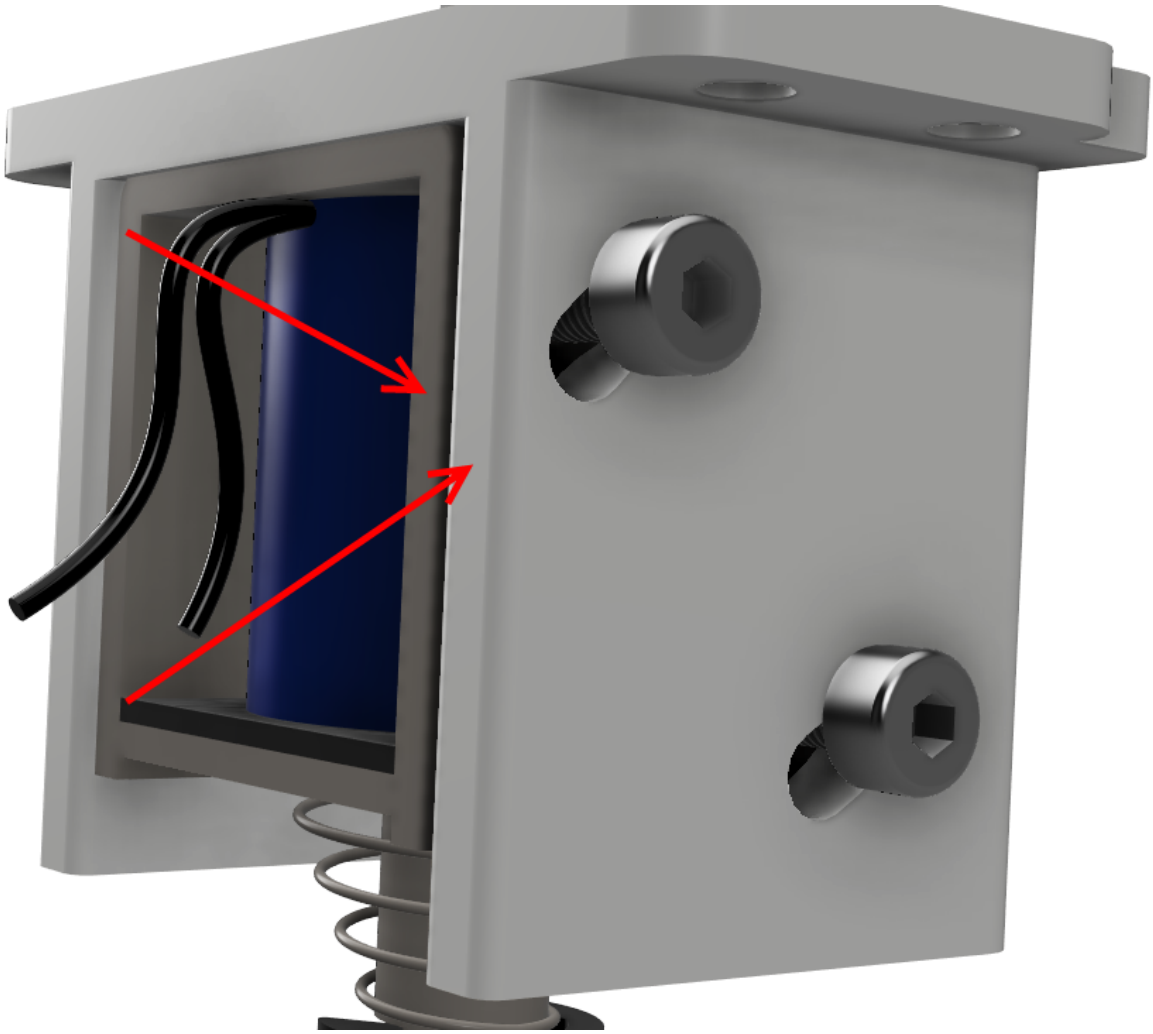
4.13 Electro magnet assembly.

- Pre-assembled electromagnet assembly (see Preparing the electromagnet)
- **3D printed parts** : ELECTRO_MAGNET_housing
- 2 screw M3-8
- Fix the electromagnet on its support with the 2 screws M3-8.

Attention: Observe the exit side of the wires.



Note: Be sure to carefully align the edge of the plastic part and the edge of the electro magnet



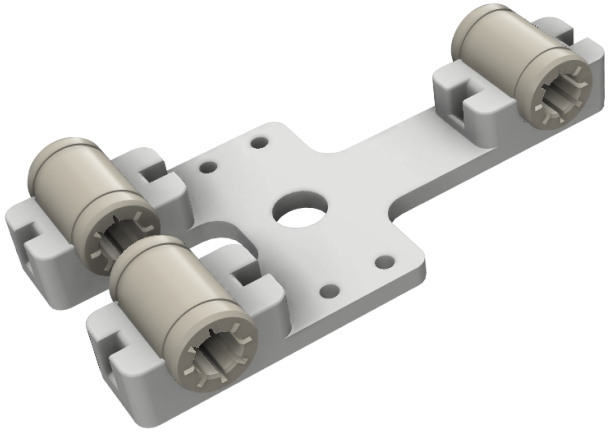
4.14 Bottom truck prepare (step 1)

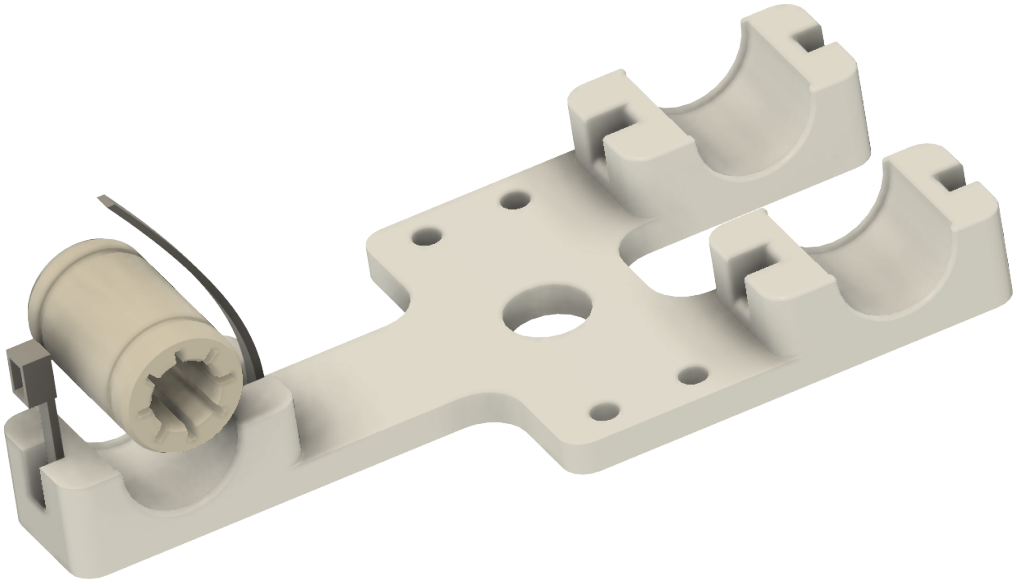
Equipment:

- Electromagnet assembled in its support
- **3D printed part** : BOTTOM_trolley
- **3D printed parts** : ELECTRO_MAGNET_guide
- 3 IGUS linear bearings
- 6 clamps 2.5 x 160
- 4 NYL M3 nuts

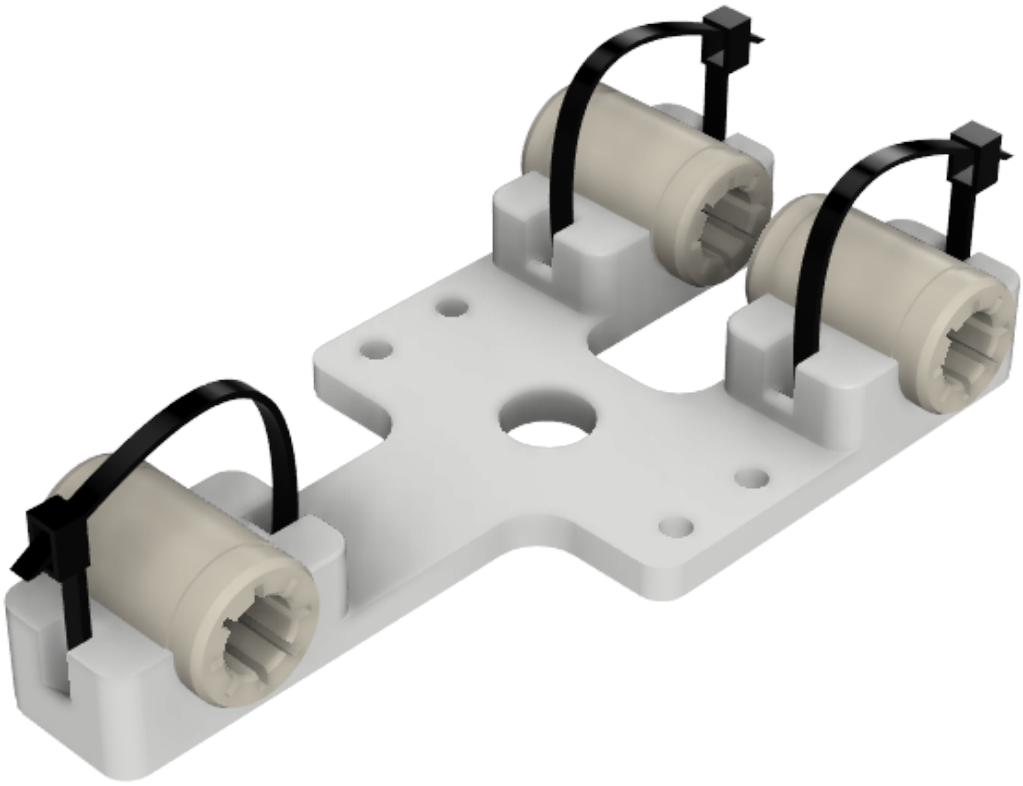
- 2 M3-18 screw
- 2 M3-20 screw
- Introduce the 3 IGUS on the BOTTOM_trolley support. Fix them with clamps

Attention: Lock the IGUS in the groove. Do not overtighten the clamps,they will be adjusted when the carriage is in place on the railslinear





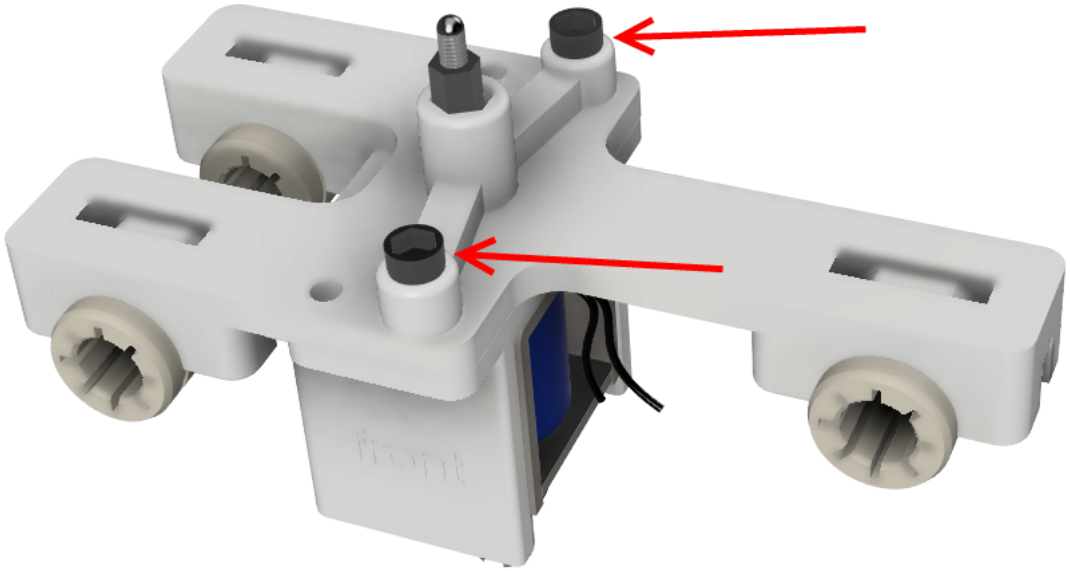
Attention: Respect the position of the clamps. The locking of the clamps must be on the IGUS side and towards the front of the machine.



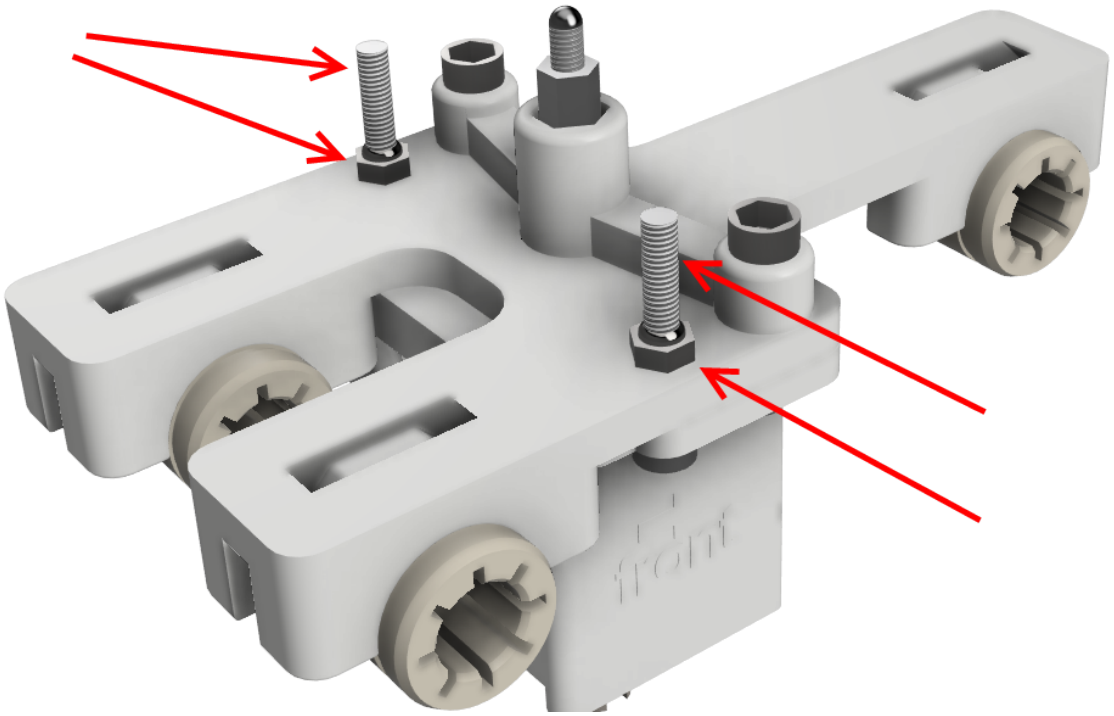
- Assemble the electromagnet (previously mounted in its housing) under the BOTTOM_trolley and the ELECTRO_MAGNET_guide with two M3-18 screws and two M3 NYL nuts.

Attention: Depending on the quality of the print, it may be necessary to file the spacer housing. Also note that the body of the electro-magnet must be as perpendicular as possible to the support plate(the axis must be in the middle of the drilling which allows its passage).

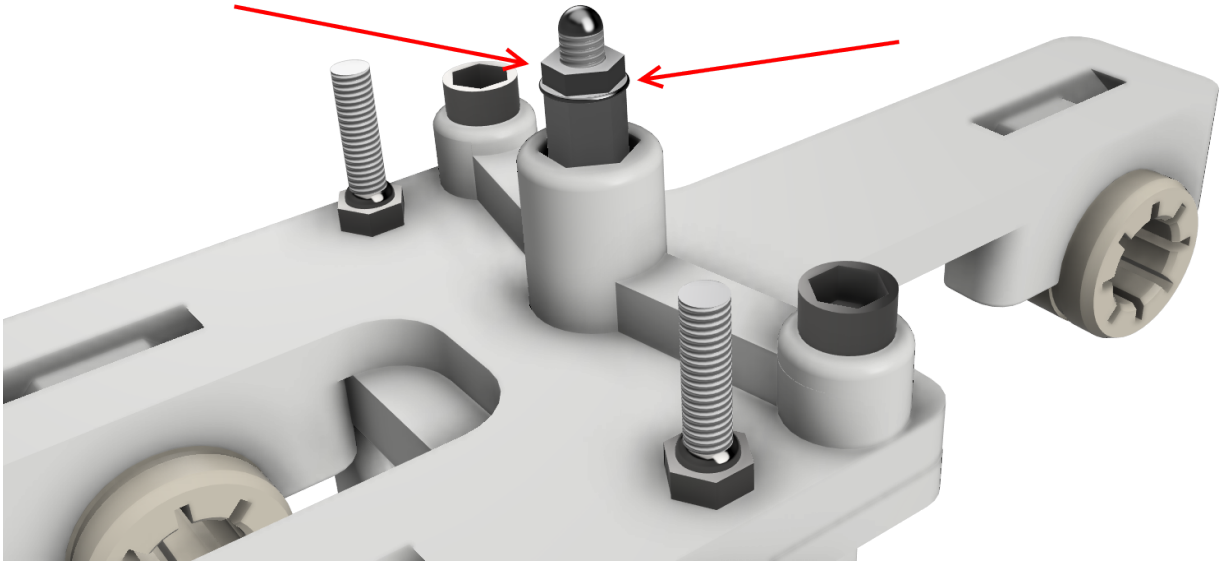
Attention: Note that the wires of the electromagnet must come out of the side where there is a single IGUS bearing.

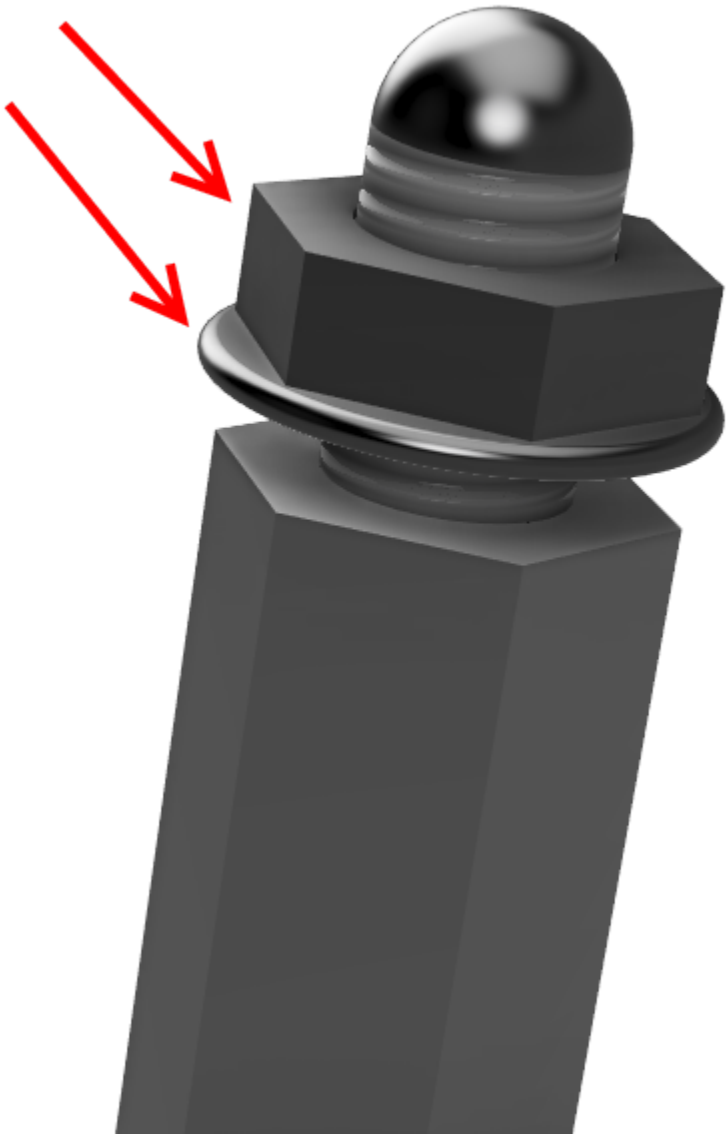


- Screw the two M3-20 screws (which will hold the strap) and 2 M3 NYL nuts with the screw head underneath.



- Fit a washer and tighten the M3 lock nut, ensuring that the stylus screw does not move into the spacer at the same time. The washer prevents the jam nut from getting caught in the spacer guide.



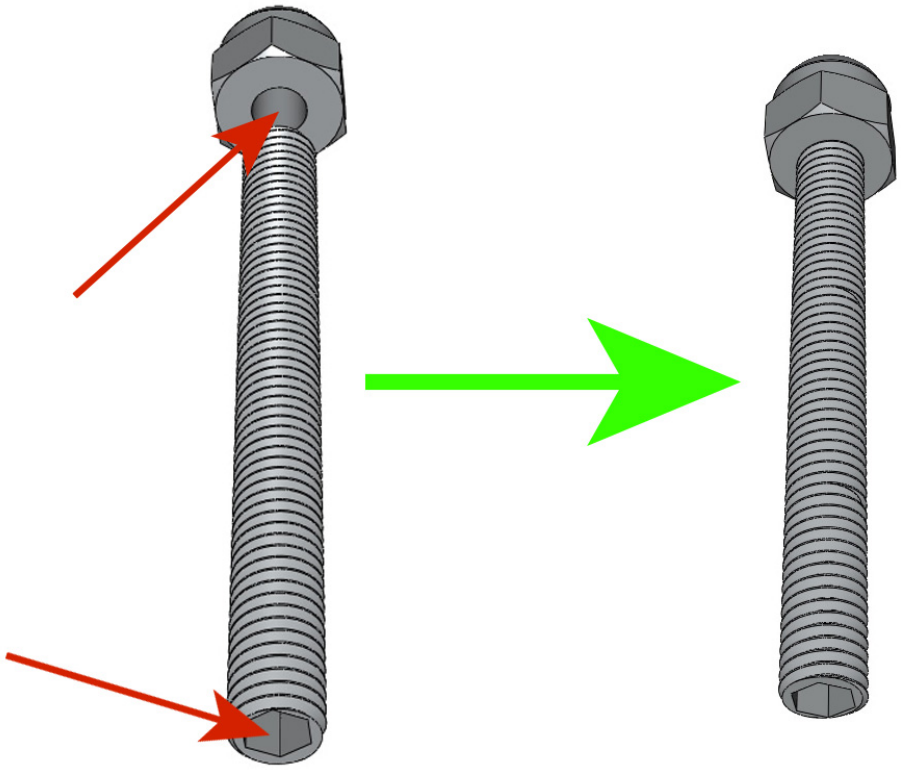


Note: The axis of the electromagnet must be able to move up and down freely without resistance.

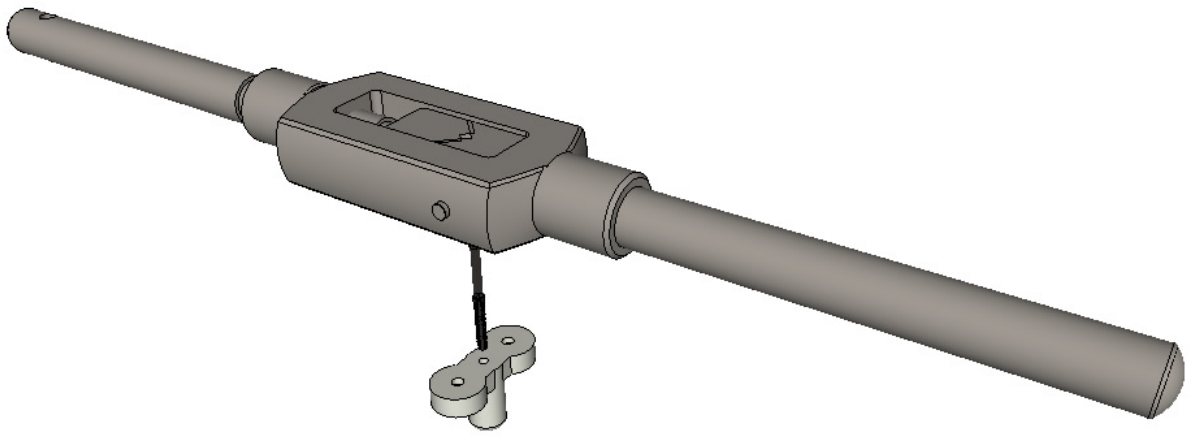
4.15 Mounting the top cart (step 1)

Equipment:

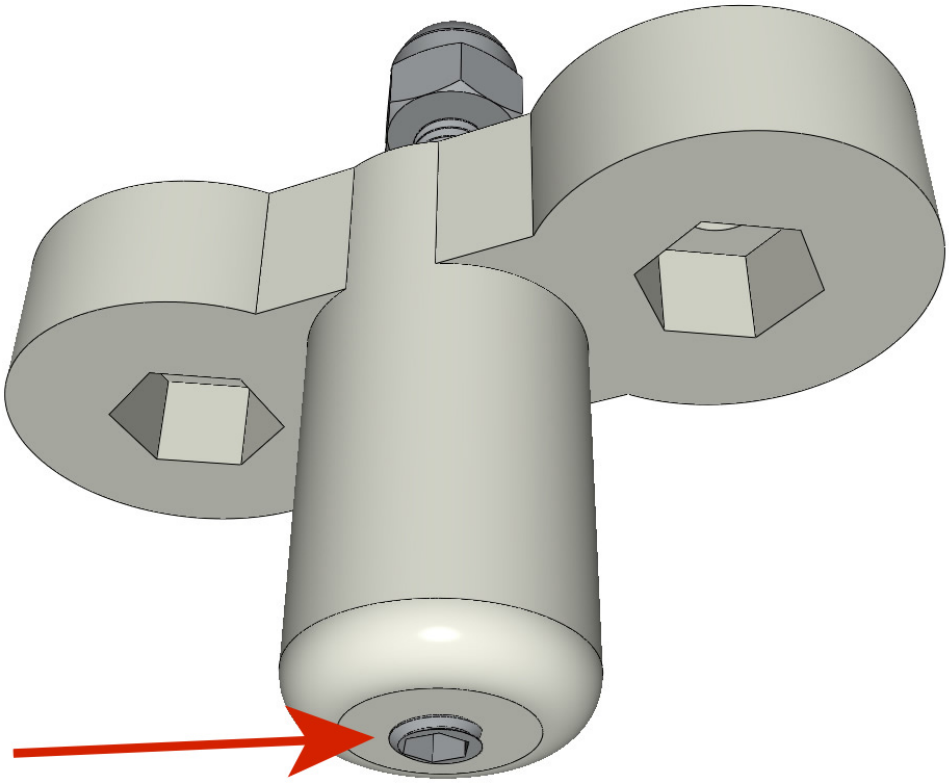
- **3D printed parts**: TOP_trolley
- **3D printed parts**: FEMALE_shape
- M3 tap
- 1 grub screw M3-30
- 1 M3 blind nut
- 2 screws M3-12
- 2 medium M3 washers
- 2 M3-20 screw
- 4 NYL M3 nuts
- 3 IGUS_housing
- 6 screws M3-12
- 6 NYL M3 nuts
- Glue the thread of the cap nut and screw the M3-30 screw without head on the side **WITHOUT** hex hole.



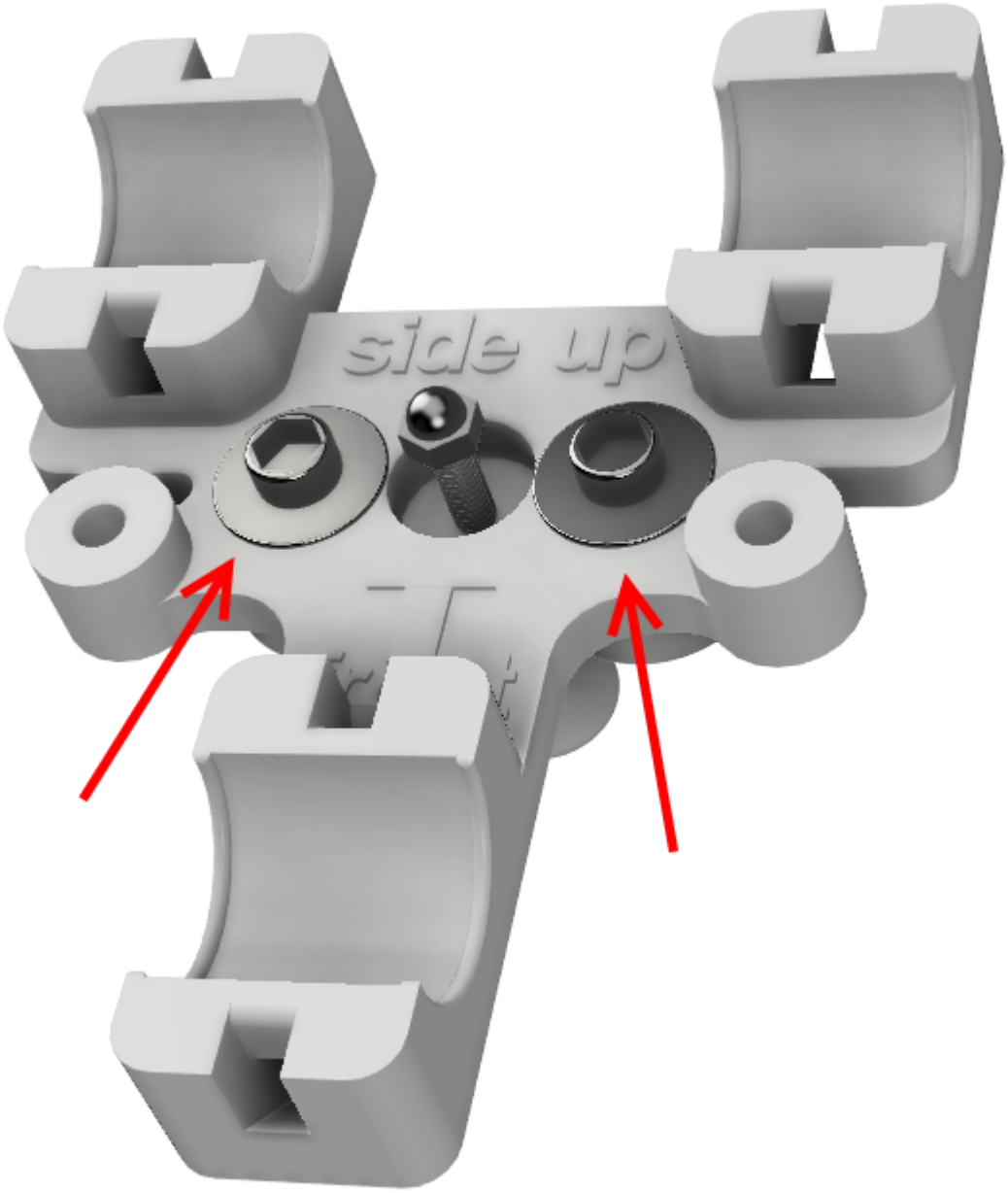
- Tape the FEMALE_shape 2/3 from the top.

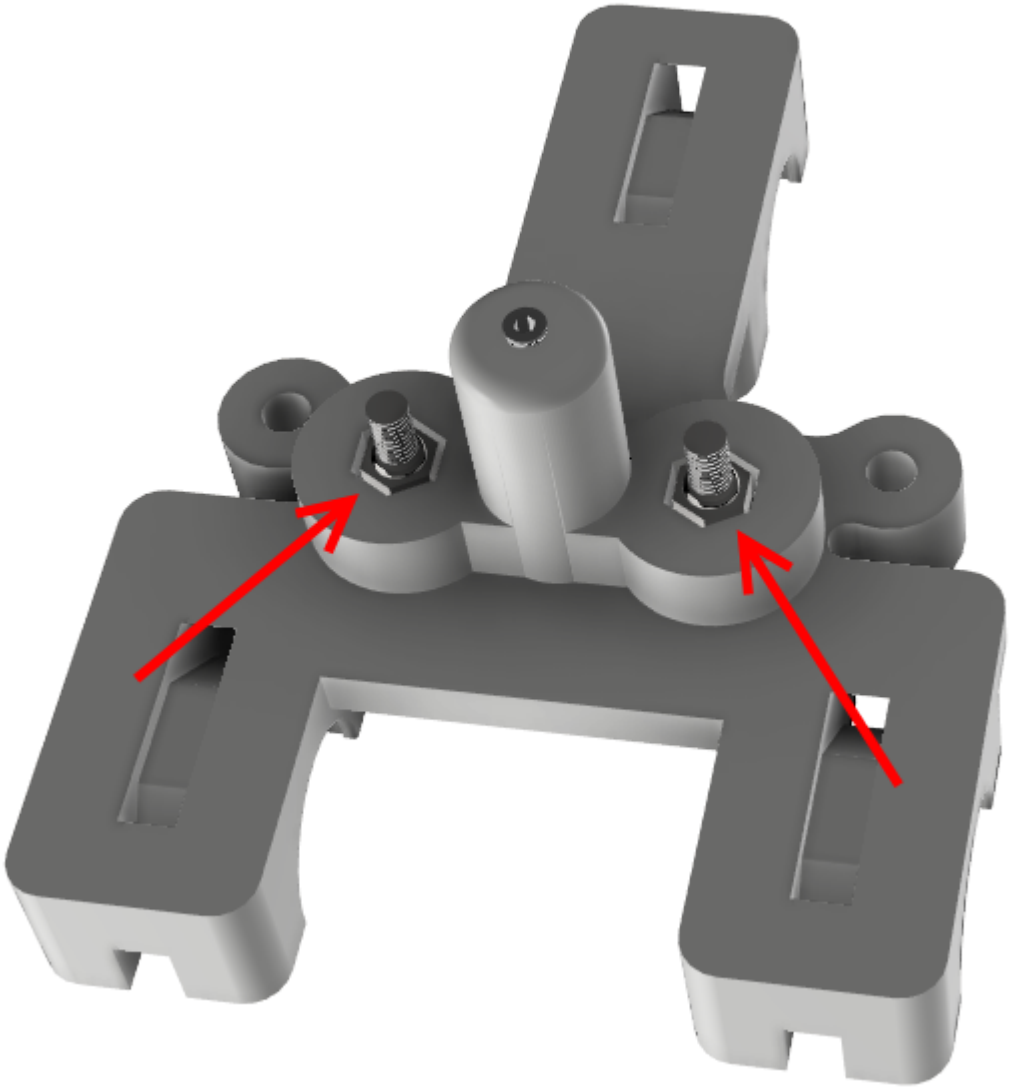


- Tighten the M3-30 screw / blind nut assembly to allow it to exceed $\pm$ 0.5mm.

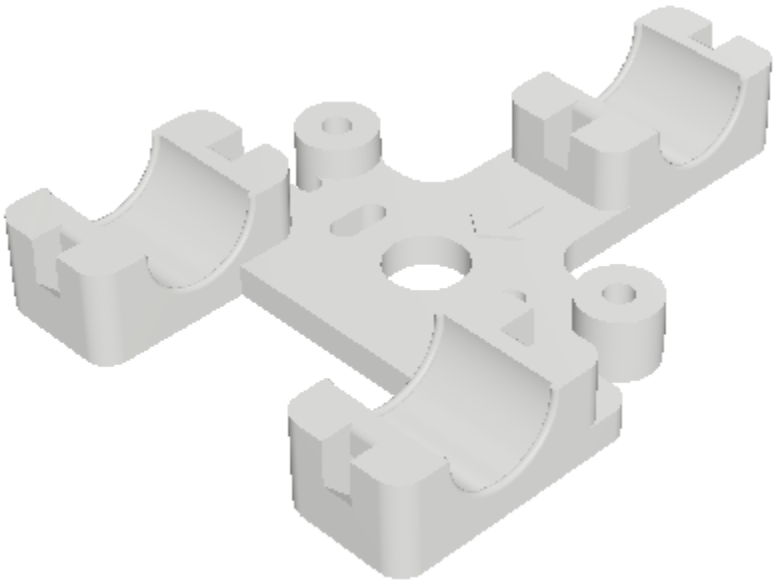


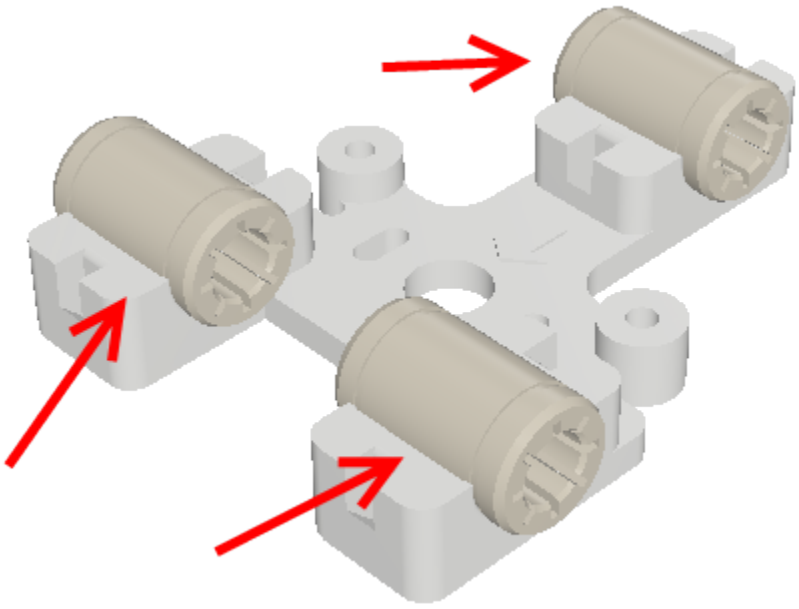
- Assemble the FEMALE_shape on the TOP_trolley with the M3-12 screws, the M3 washers and the NYL M3 nuts.


side up



- Position the IGUS bearings on the TOP_trolley part.

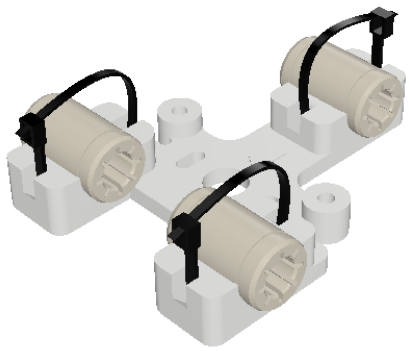




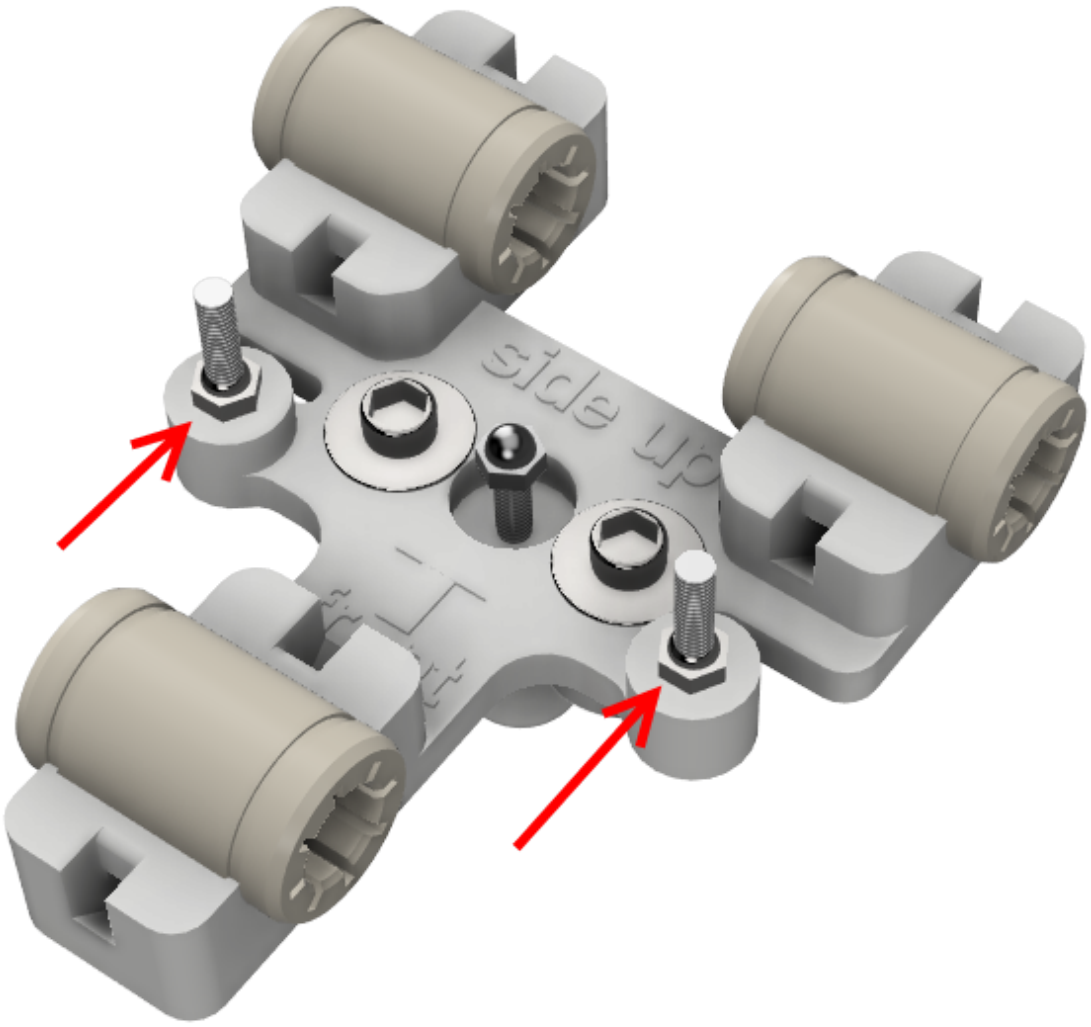
- attach the IGUS bearings with fixing collars

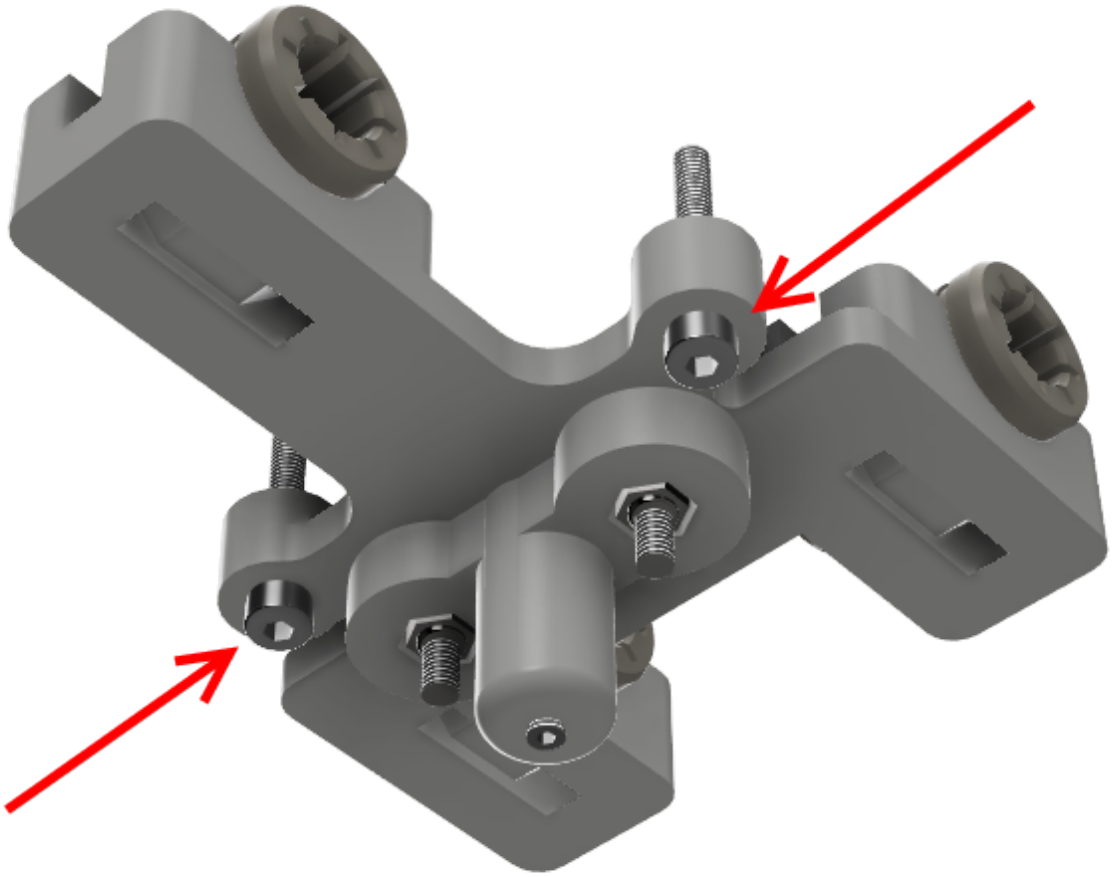
Note: Pay attention to the direction of the clamps. The clamp fixing must be towards thewalls of the machine.

Note: Lock the IGUS in the groove. Do not overtighten the clamps,they will be adjusted when the carriage is in place on the railslinear



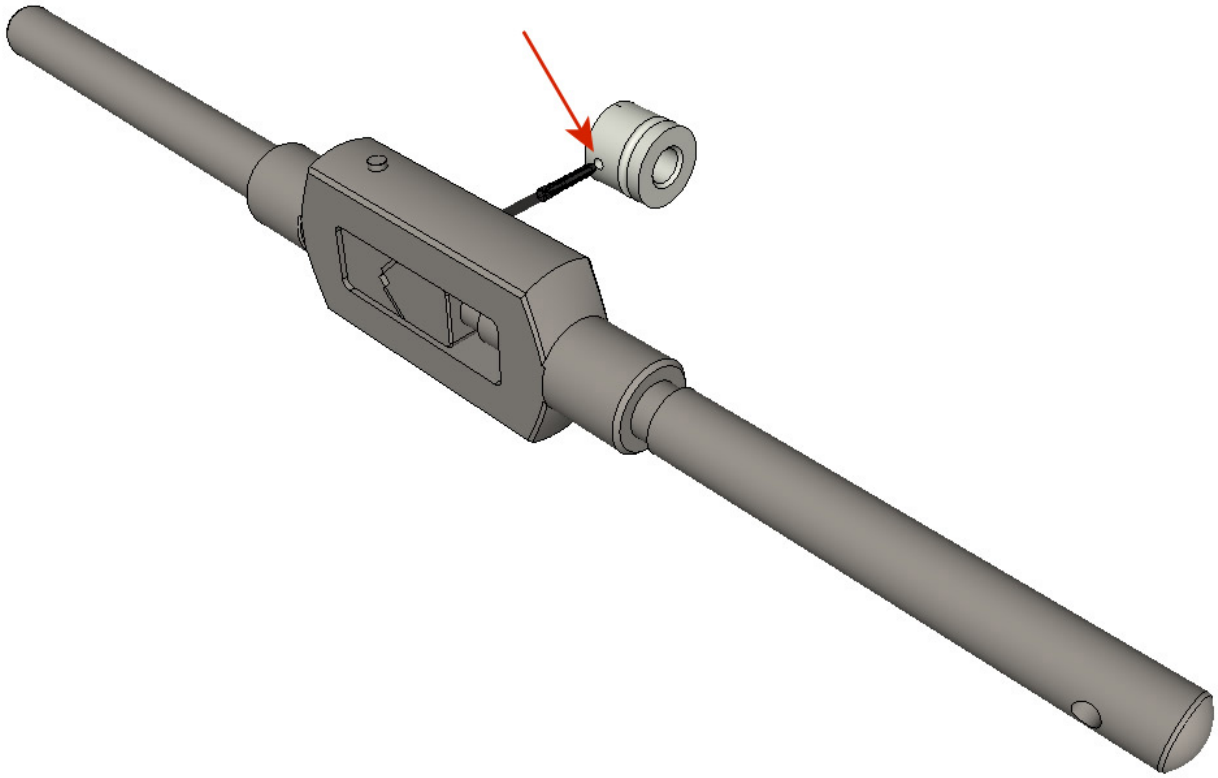
- Fit the M3-20 screws and the M3 nuts.


side up

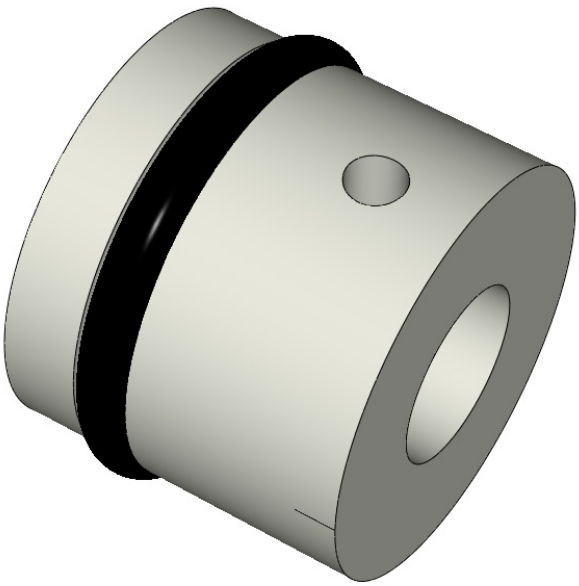


4.16 Paper roll prepare

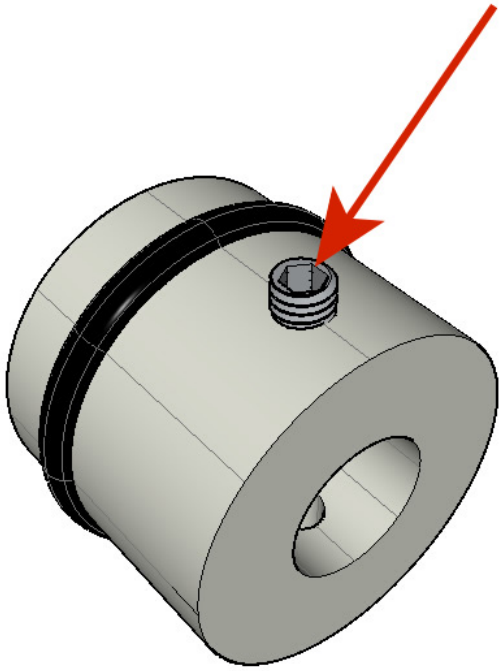
- **3D printed parts**: 3 x ROLL_joint
- 1 tap M3
- 3 O-rings
- 5 M3-6 grub screw
- Tap the 3 ROLL_joint.



- Put the O-rings in the groove of the 3 ROLL_joint.

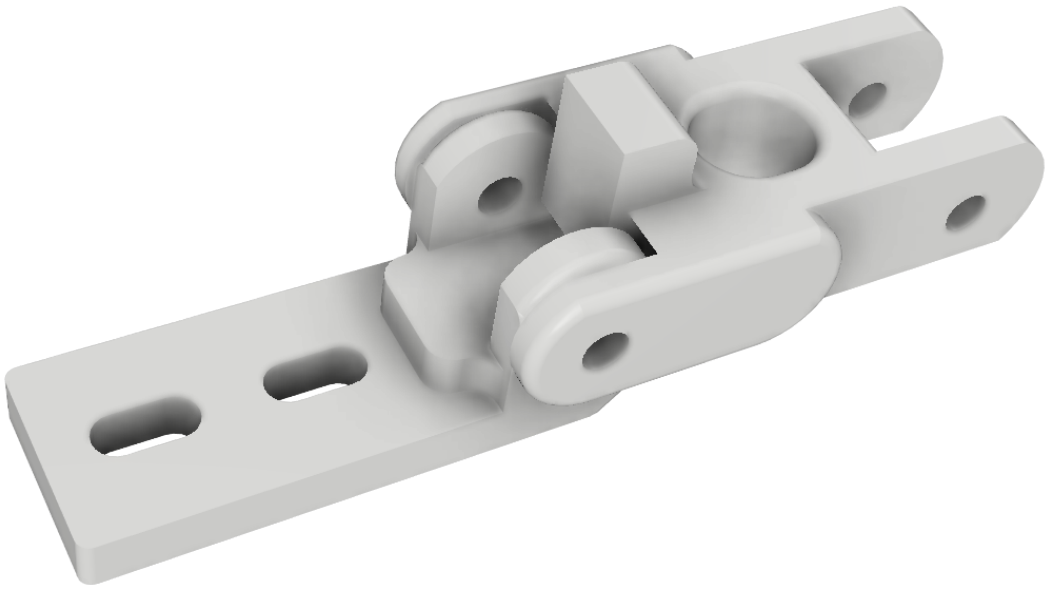


- Screw in the M3-6 grub screws making sure they do not protrude at inside the hole. You need to be able to slide the roll over a8mm axle.

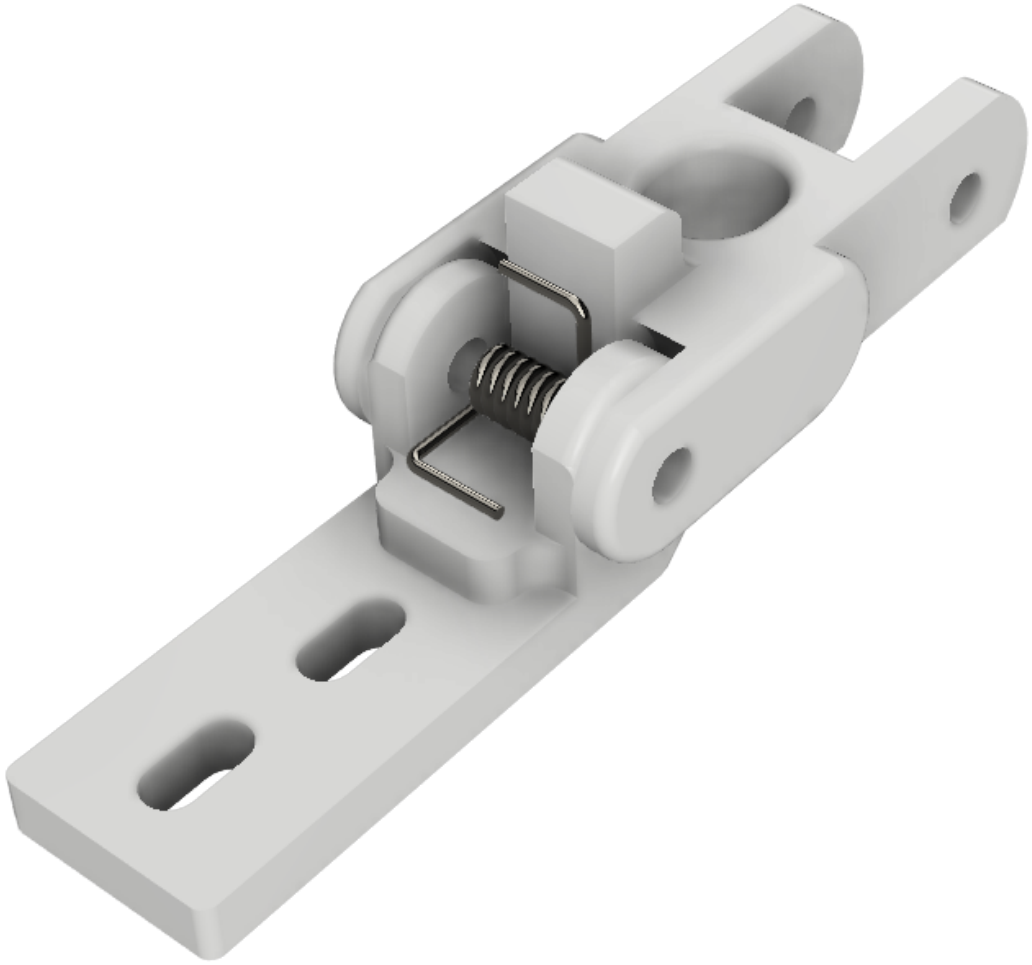


4.17 Assembly of the paperweights (step 1):

- **3D printed part(s)**: 3 x **clipboard2_support** 3 x **clipboard2** 3 x **CLIPBOARD2_WHEEL**
- 3 M3-25 screw
- 3 M3-20 screw
- 3 GT2 belt tensioner springs
- 6 M3-NYL nuts
- Position the clipboard **clipboard2** in relation to the support**clipboard2_support**.

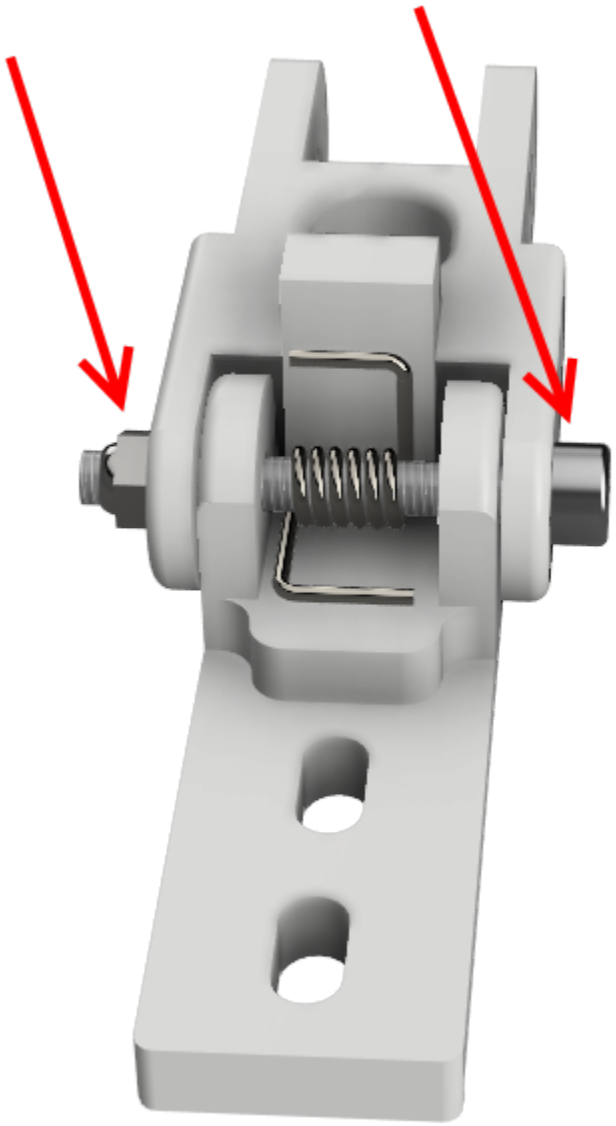


- Position the spring between **clipboard2** and **clipboard2_support**.



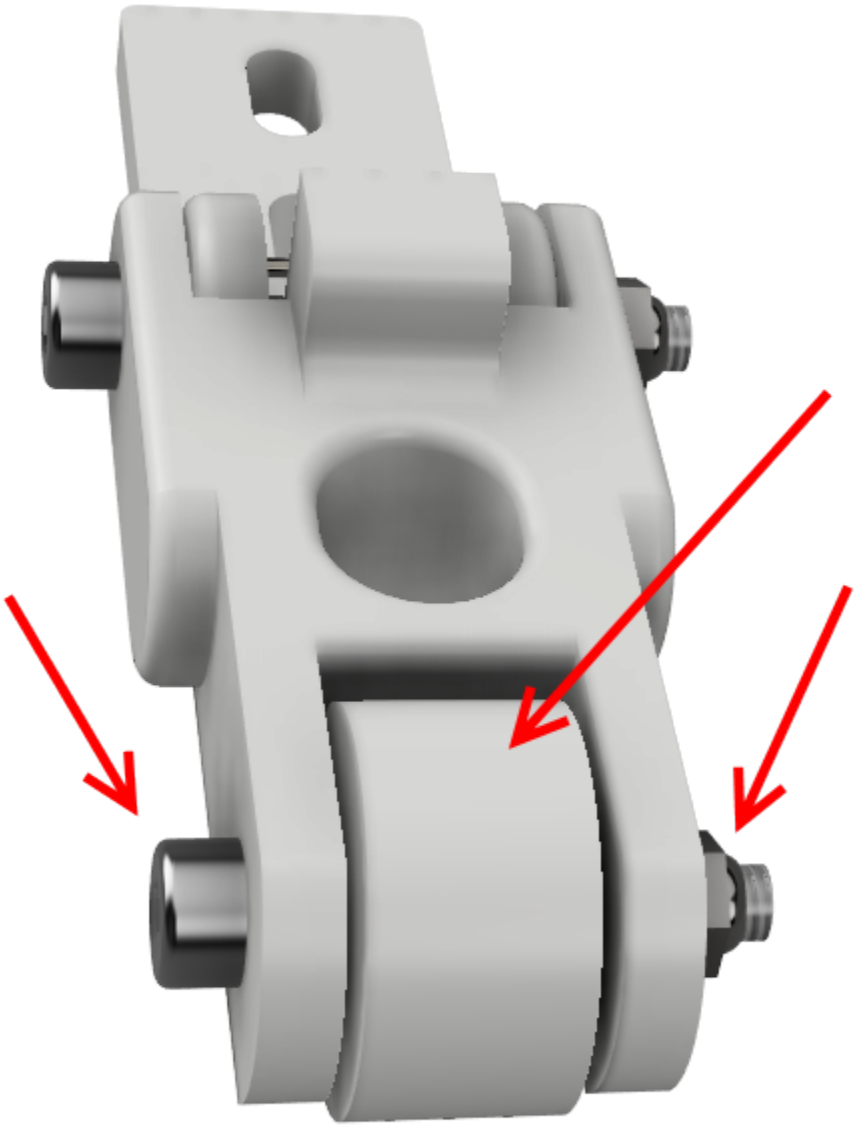
- Assemble the spring with **clipboard2** and **clipboard2_support** with an M3-25 screw and an M3-NYL nut.

Note: Do not tighten the M3-NYL nut **clipboard2** and **clipboard2_support**must be able to move freely.



- Assemble roller with **CLIPBOARD2_WHEEL** with **clipboard2** using an M3-20 screw and an M3-NYL nut.

Note: Do not tighten the M3-NYL nut **CLIPBOARD2_WHEEL** must be able to turnfreely.



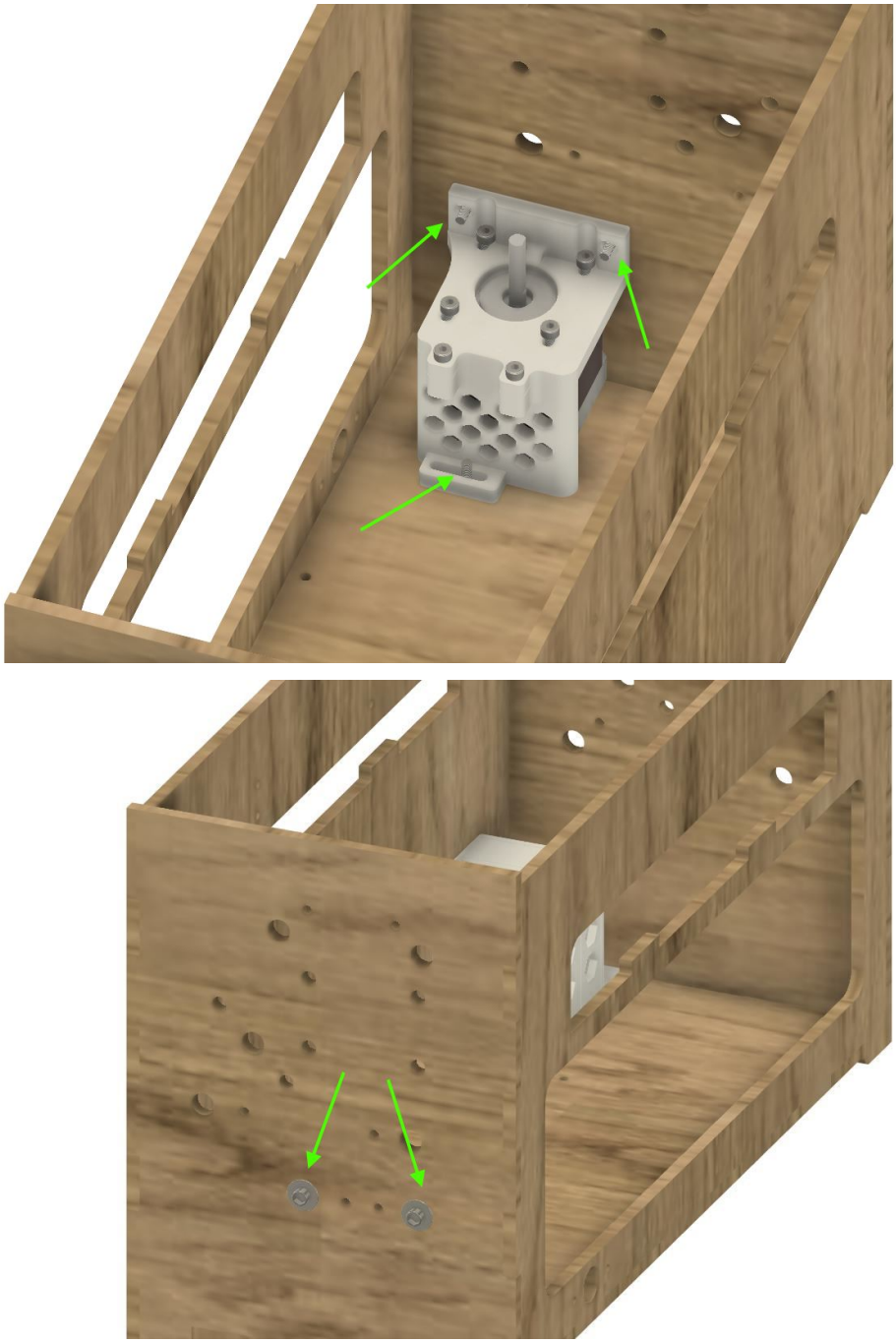
4.18 Mounting the vertical axis (step 1)

Equipment:

- **Pièces** : ensemble XMOTOR_support2, XMOTOR_support2_1 et Moteur
- 3 M3-16 screws
- 3 M3-NYL nuts
- 3 wide M3 washers

- Insert the 3 screws and the 3 washers from the outside. And attach the bracket with 3 NYL nuts without tightening.

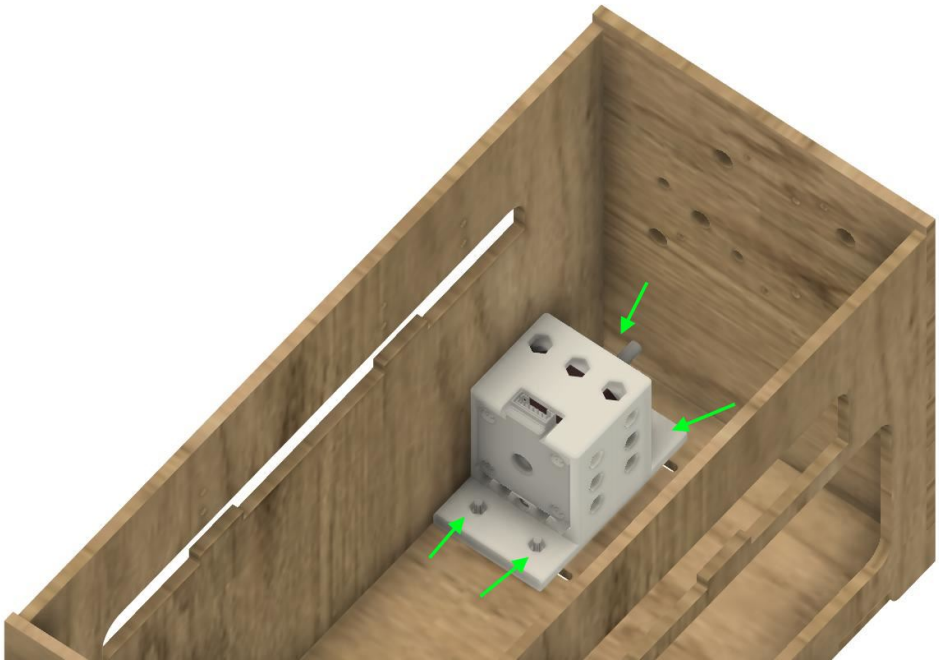
Note: The gap will then allow to align the motor shaft with the vertical axis.

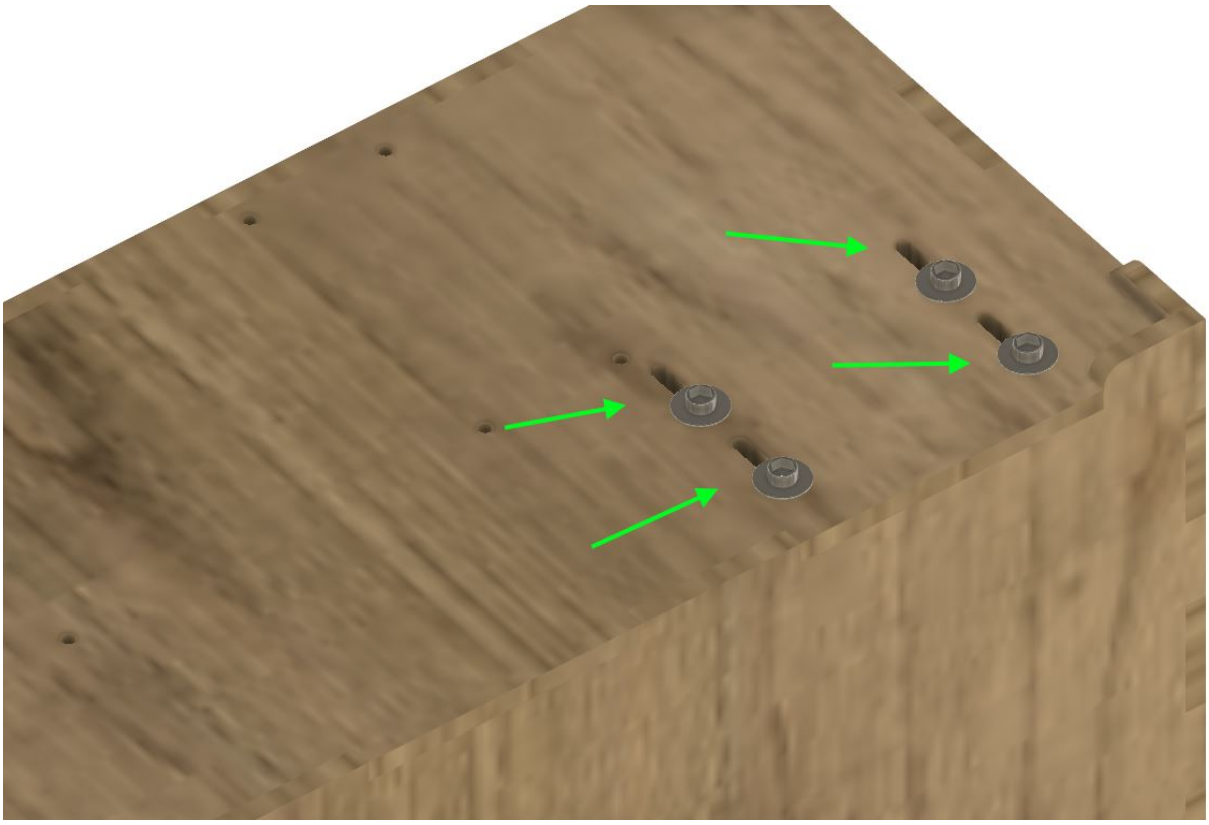


4.19 Y Motor Mount:

Equipment:

- le moteur Nema 17 monté sur la pièce **YMOTOR_support2_200 + YMOTOR_support2_200_1 + YMOTOR_support2_200_2**
- 4 M3-14 screws
- 4 wide M3 washers
- Insert the screws and washers from the outside and screw the support onto the crate so that it can still slide in the oblong holes.

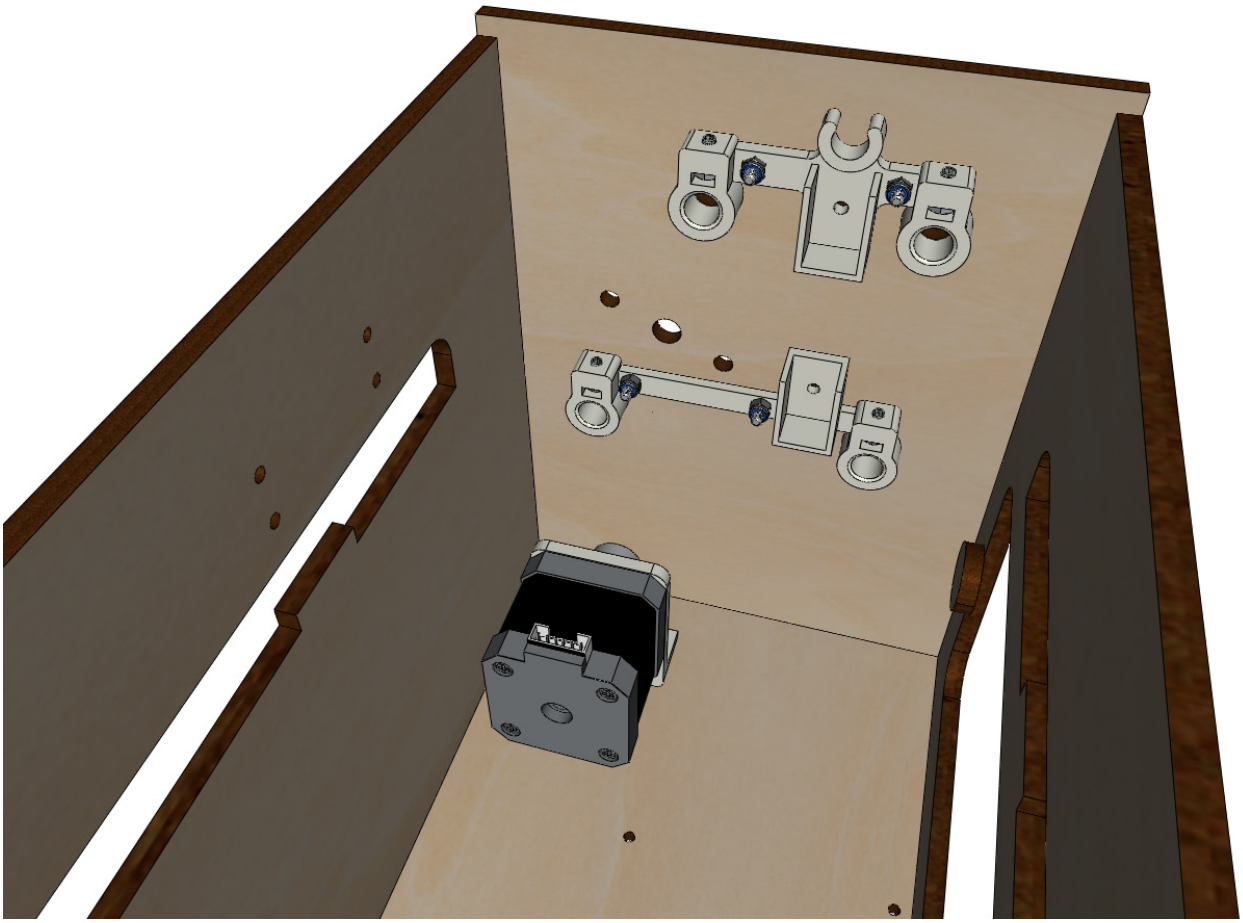


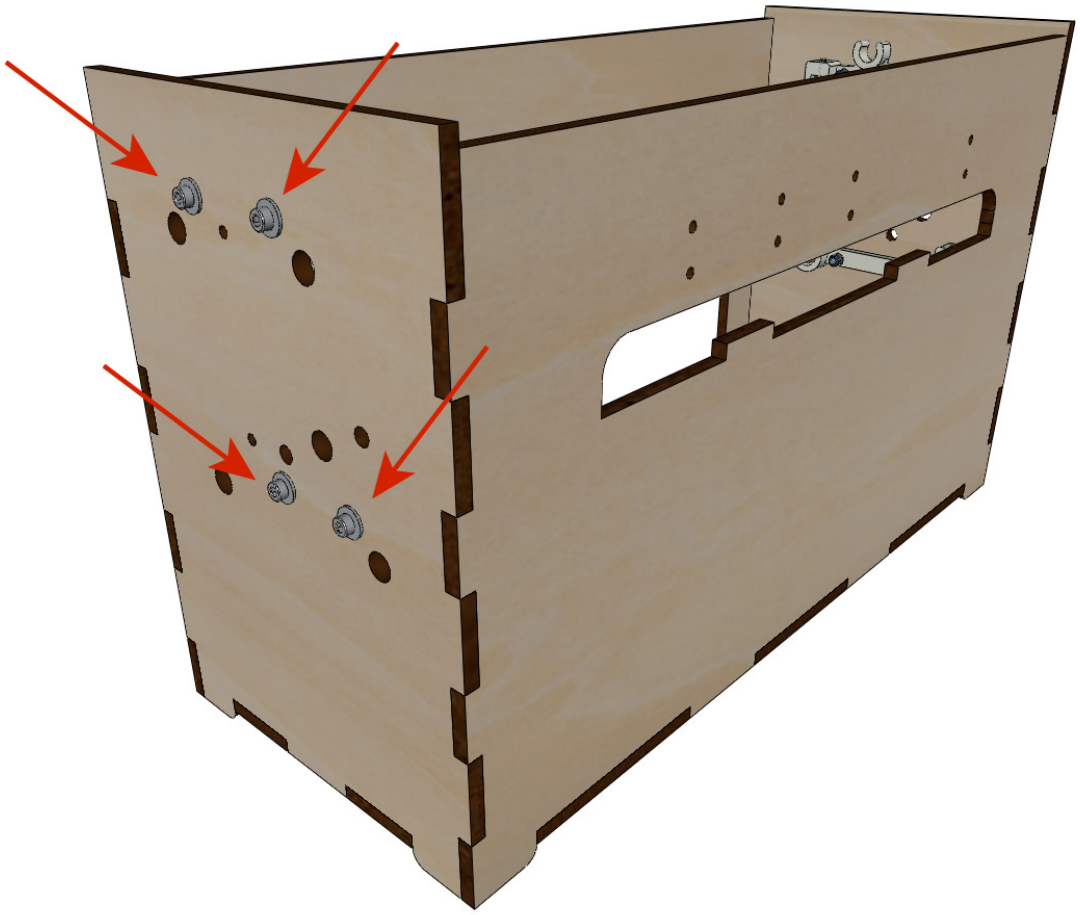


4.20 Assembling LEFT shafts supports

Equipment:

- **3D printed parts**: BOTTOM_AXIS_left prepared with nut and grub screw (cf Preparation of axis supports)
- **3D printed parts**: TOP_AXIS_left prepared with nut and grub screw (see Preparation of axle supports)
- 4 M3-14 screws
- 4 wide M3 washers
- 4 M3 NYL nuts
- Fix the supports of axis on the box the BOTTOM_AXIS_left and TOP_AXIS_left on the left leaving a little game (screw + washer outside and nut inside). The screws will be tight when the assembly is in place.

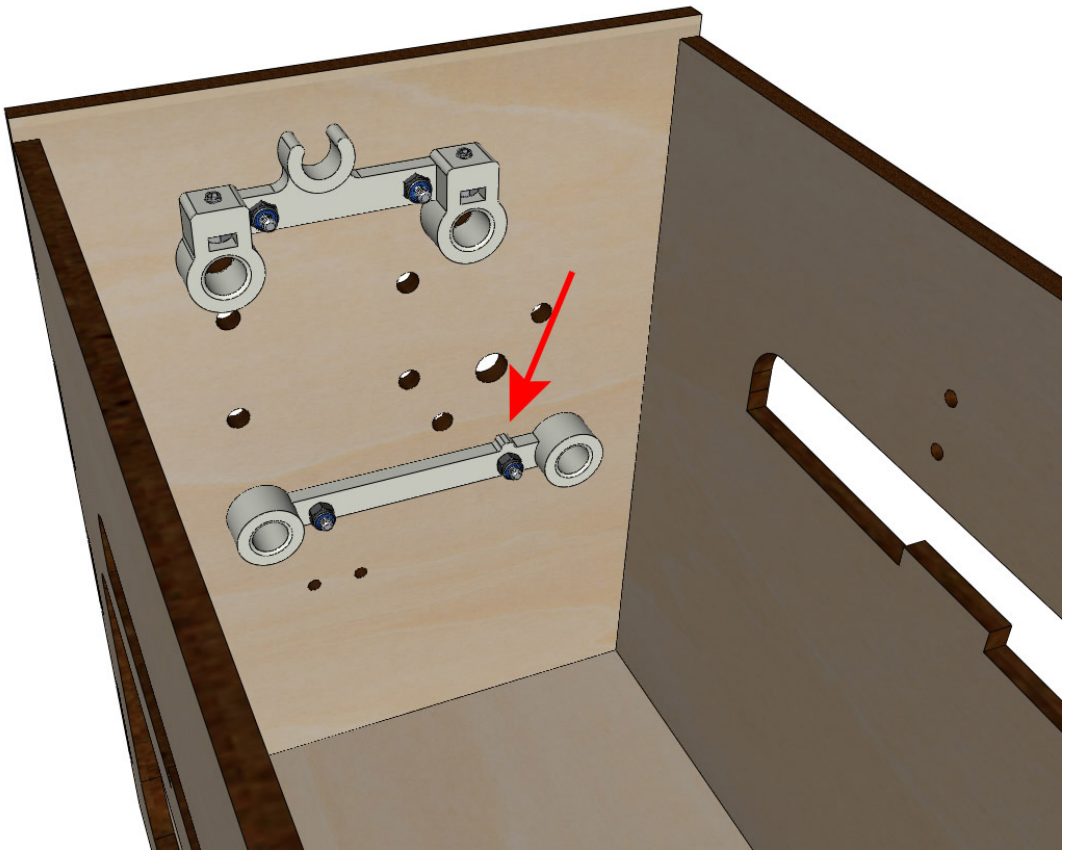


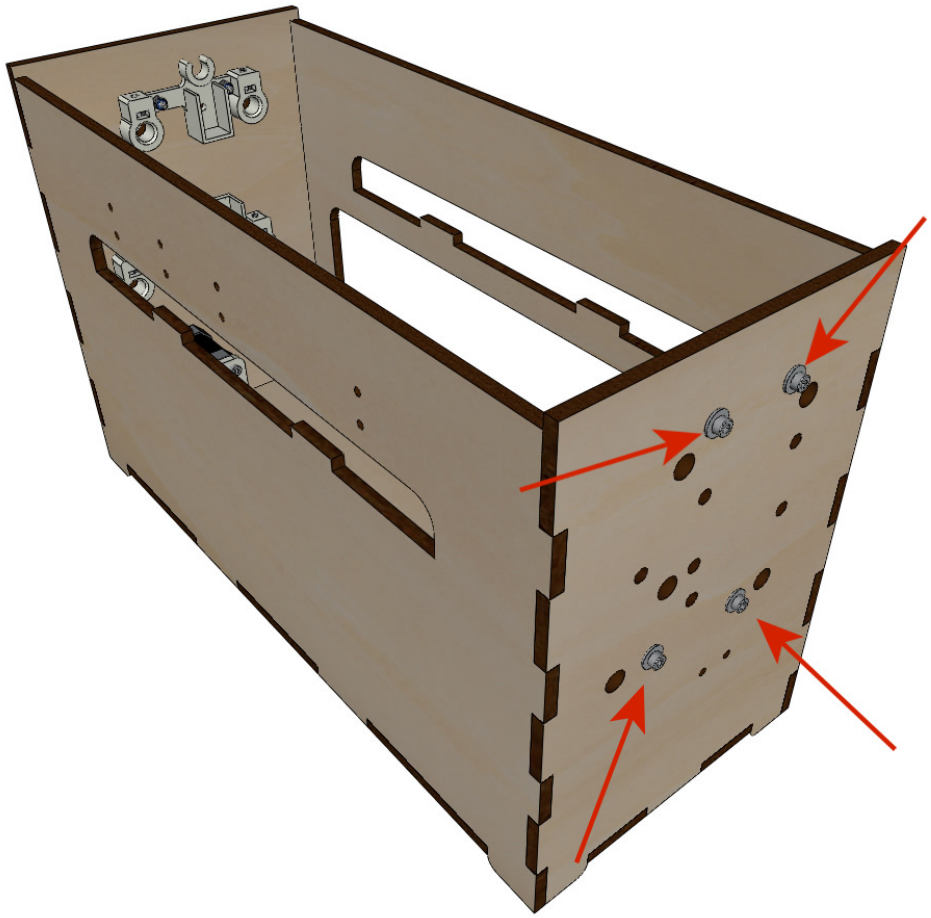


4.21 Assembling RIGHT rod supports

Equipment:

- **3D printed parts** : BOTTOM_AXIS_right
- **3D printed parts**: TOP_AXIS_right prepared with nut and grub screws (see Preparation of axle supports)
- 4 M3-14 screws
- 4 wide M3 washers
- 4 M3 NYL nuts
- Fix rod supports on the box with BOTTOM_AXIS_right and TOP_AXIS_right on the right with leaving some mechanical clearance (screw + washer outside and nut inside). The screws will be tight when all parts will be in place.

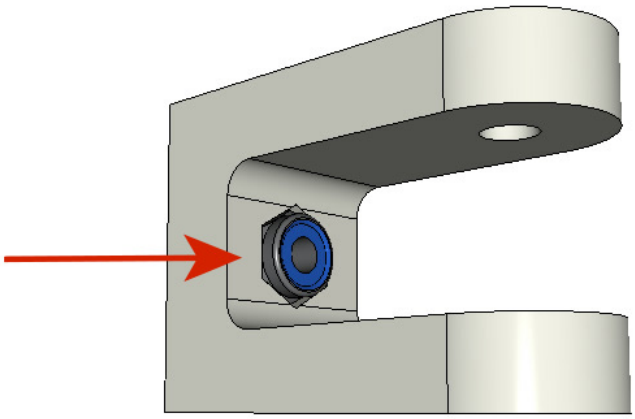


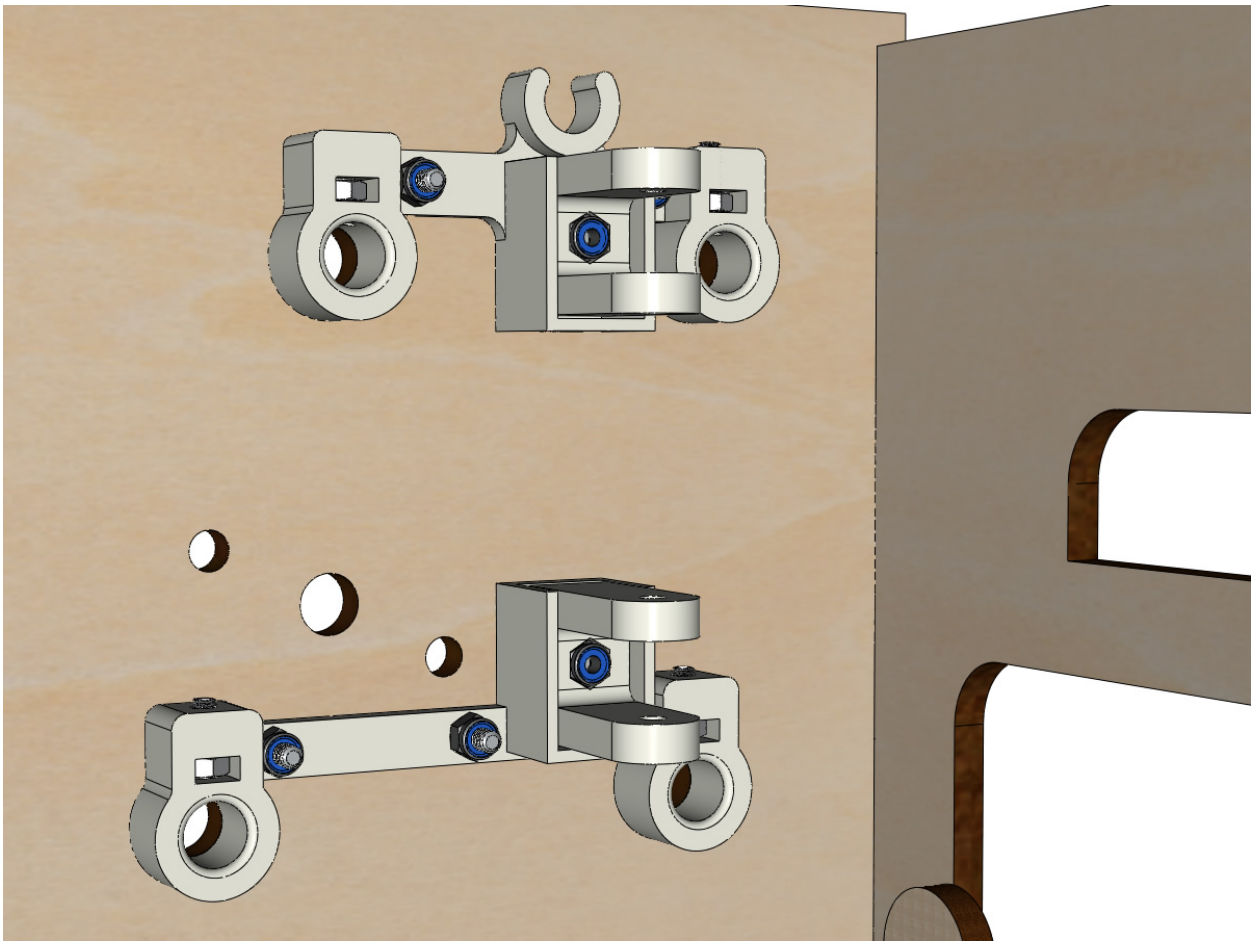


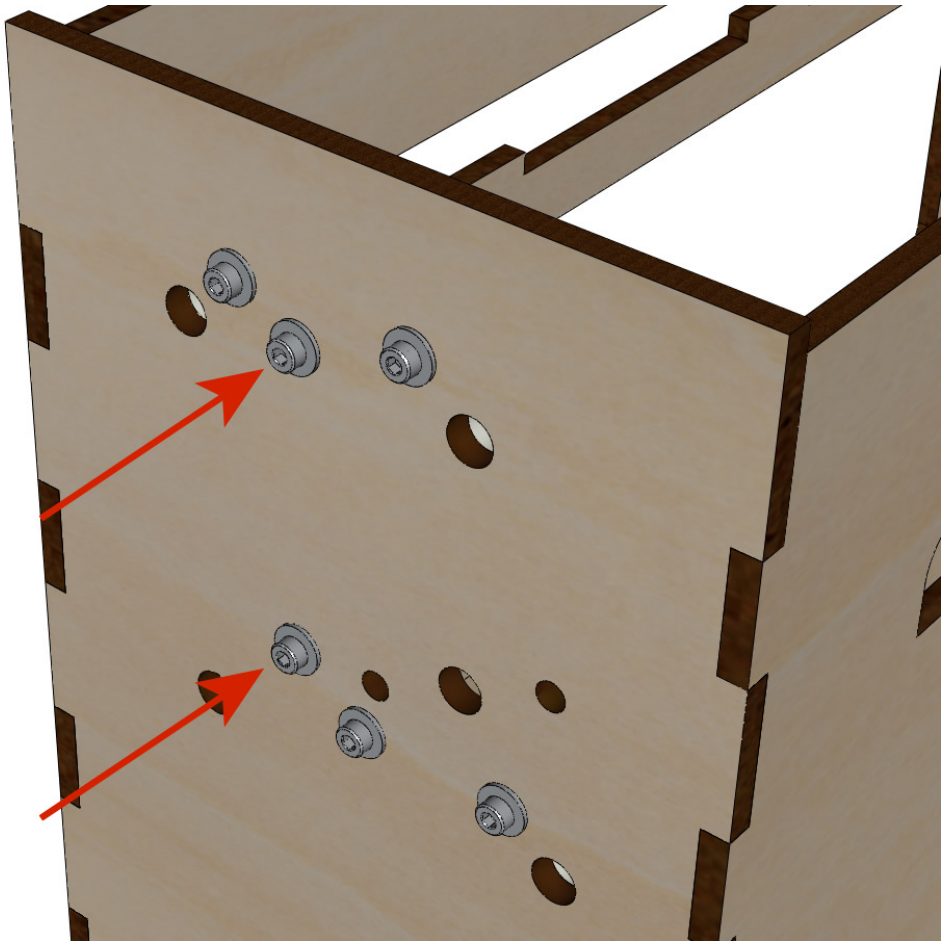
4.22 Fastening the belt tensioners

Equipment:

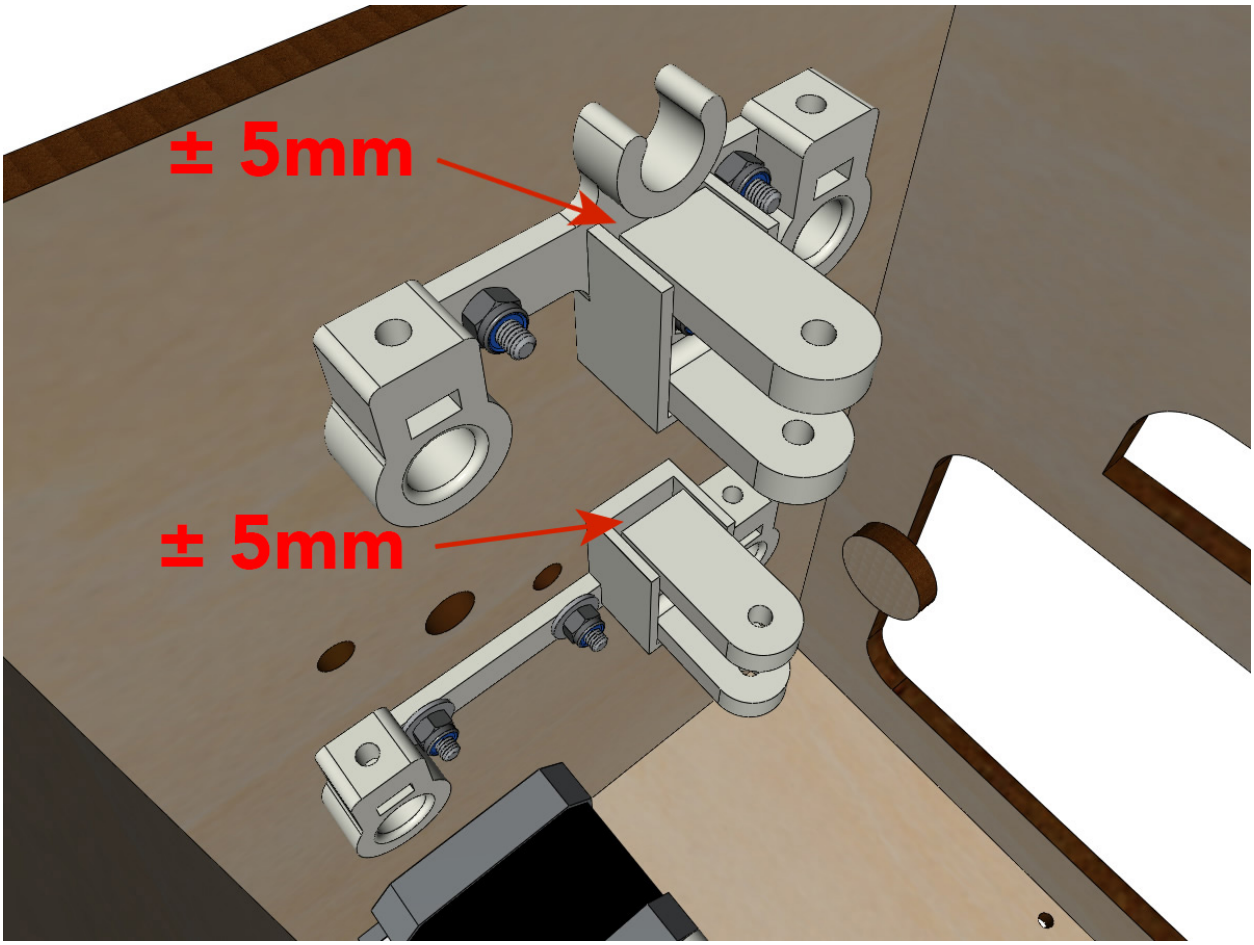
- **3D printed parts** : 2 x DRIVEN_PULLEY_housing
- 2 M3-20 screw
- 2 wide M3 washers
- 2 NYLSTOP M3
- Insert a NYL M3 nut into its housing and secure the DRIVEN_PULLEY_housing with a M3-20 screw and washer.







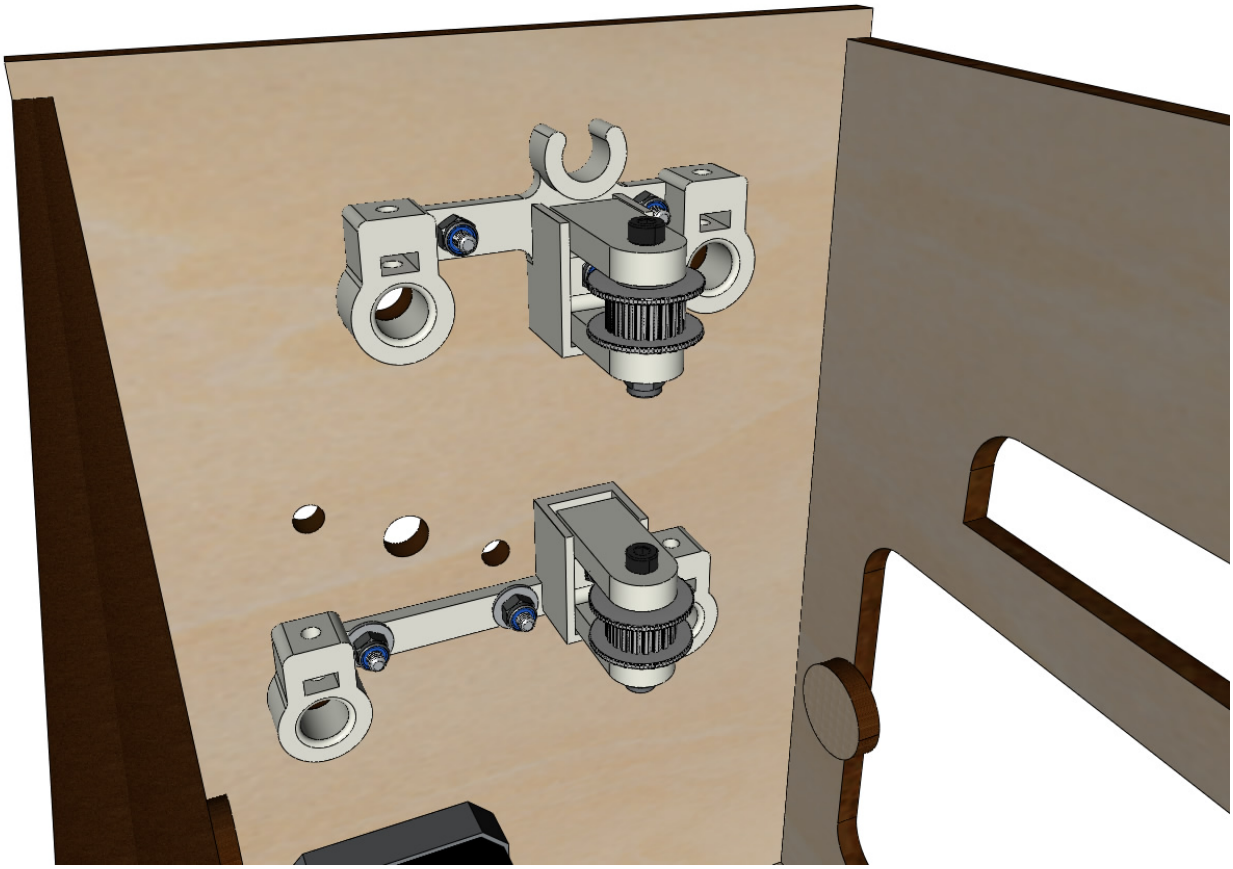
- Leave a gap of ± 5mm.



4.23 Free pulleys assembly

Equipment:

- 2 free pulleys 20 teeth 3mm bore
- 2 M3-25 screw
- 2 NYLSTOP M3
- Start by inserting the pulley then the M3-25 screw. Screw with a NYL M3 nut without tightening too much.



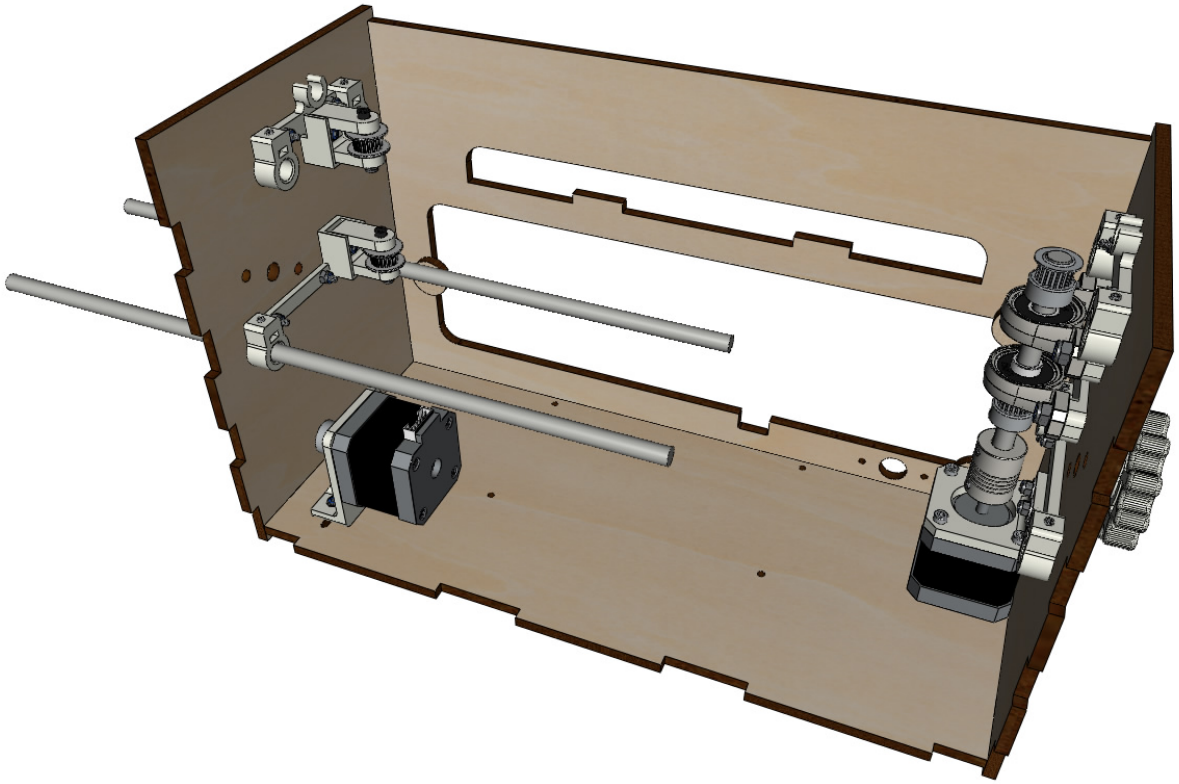
4.24 Bottom trolley assembly (step 2)

Equipment:

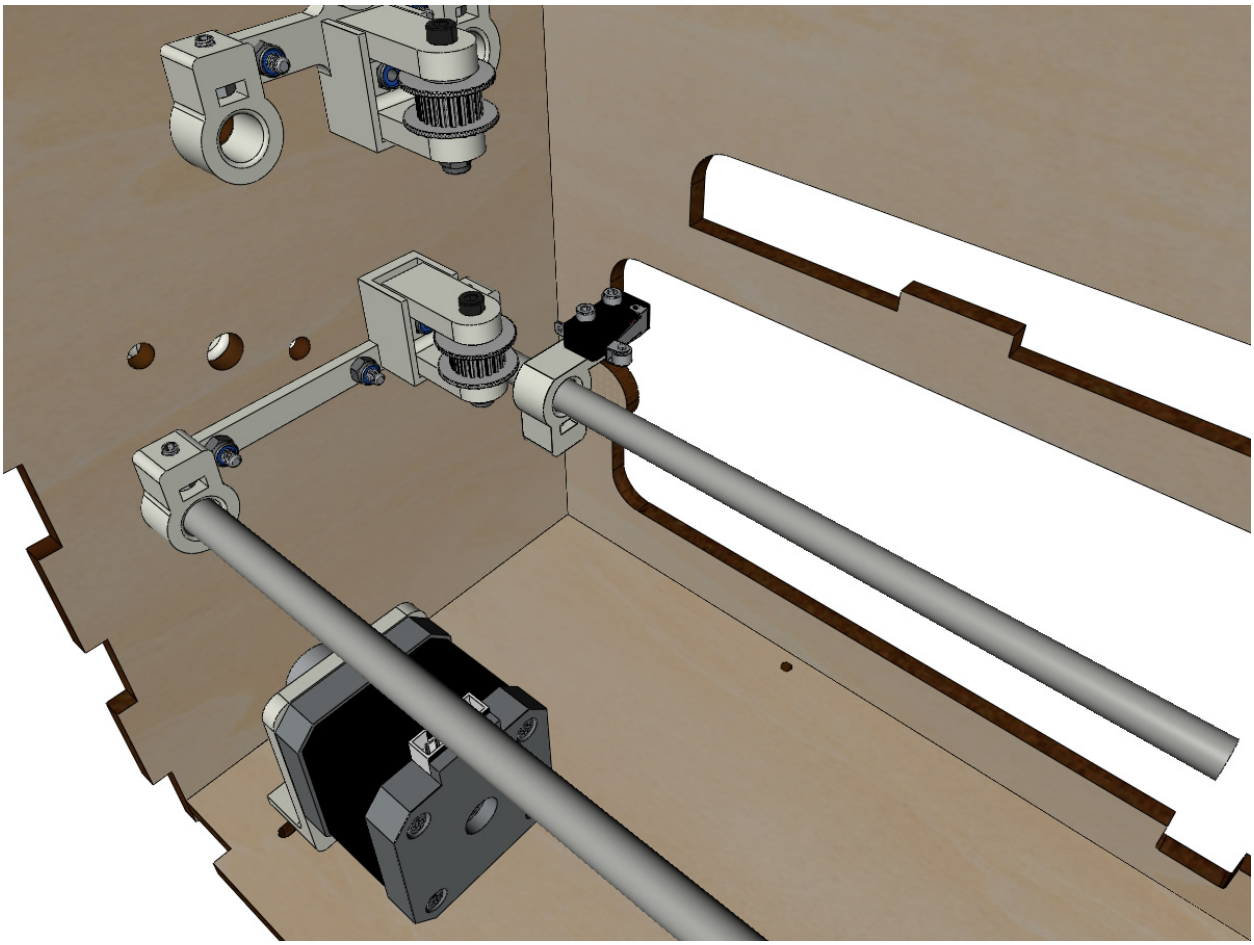
- 2 linear shaft Ø8mm, length: 330mm

Note: We did not represent the facade for readability reasons.

- Thread the bars halfway through the outside of the crate.

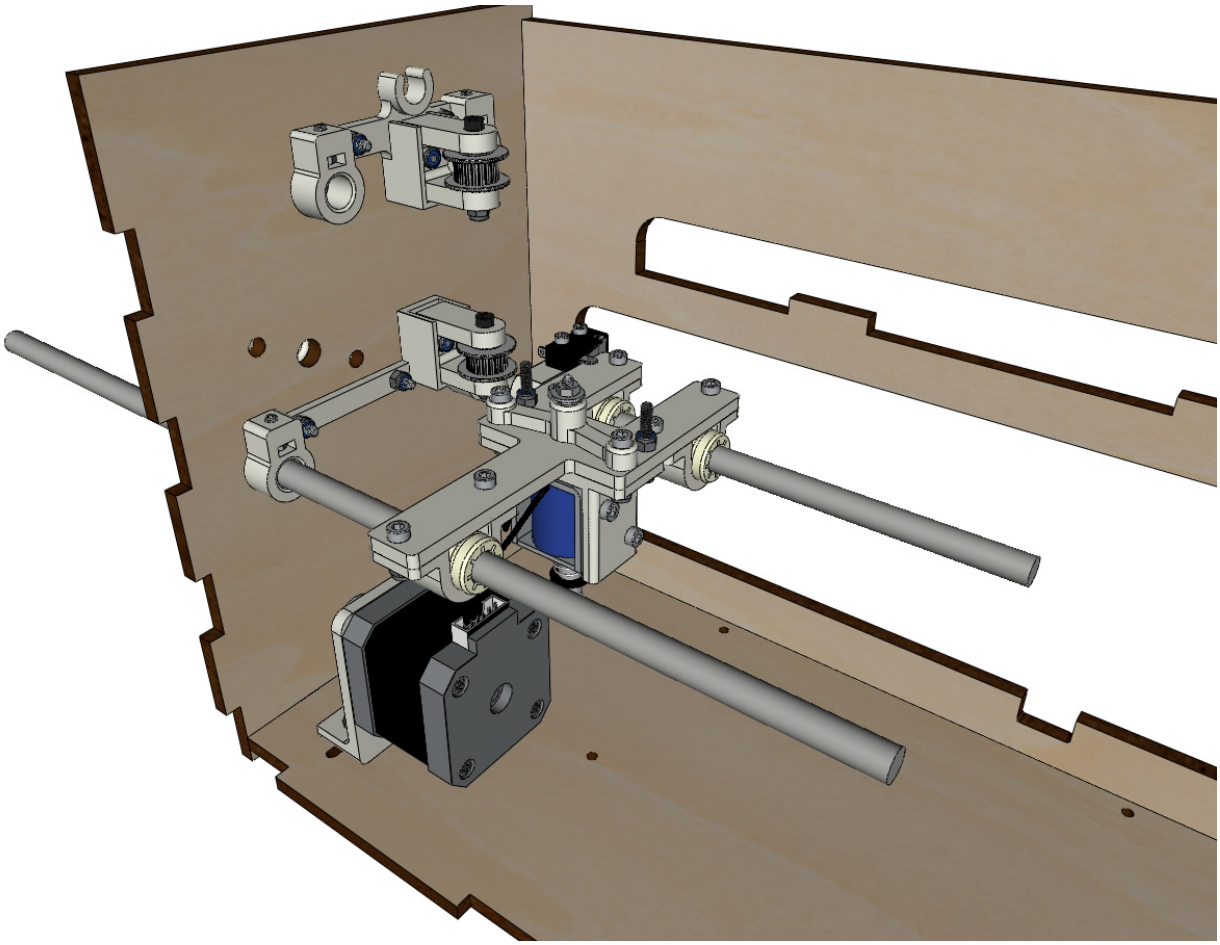


- Thread the switch and its support on the Ø8mm bar on the back side.

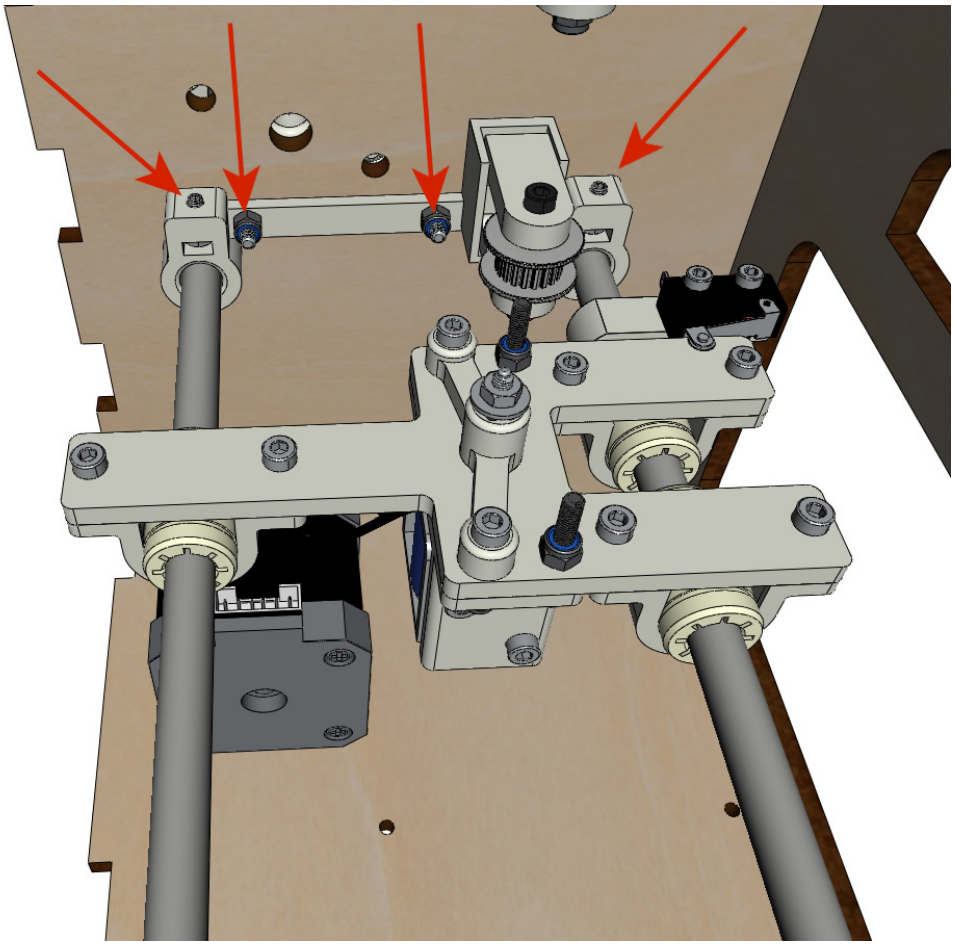


Note: The screw on the switch bracket will be tightened later during adjustment.

- Thread the trolley down over the smooth bars.



- Finish putting on the bars (the bars must not protrude into the wood of the box).
- Tighten the 4 axle holder screws on the body (2 on the left side and 2 on the right side) and the 4 grub screws on the axle brackets so that the pins do not slide into their seats.

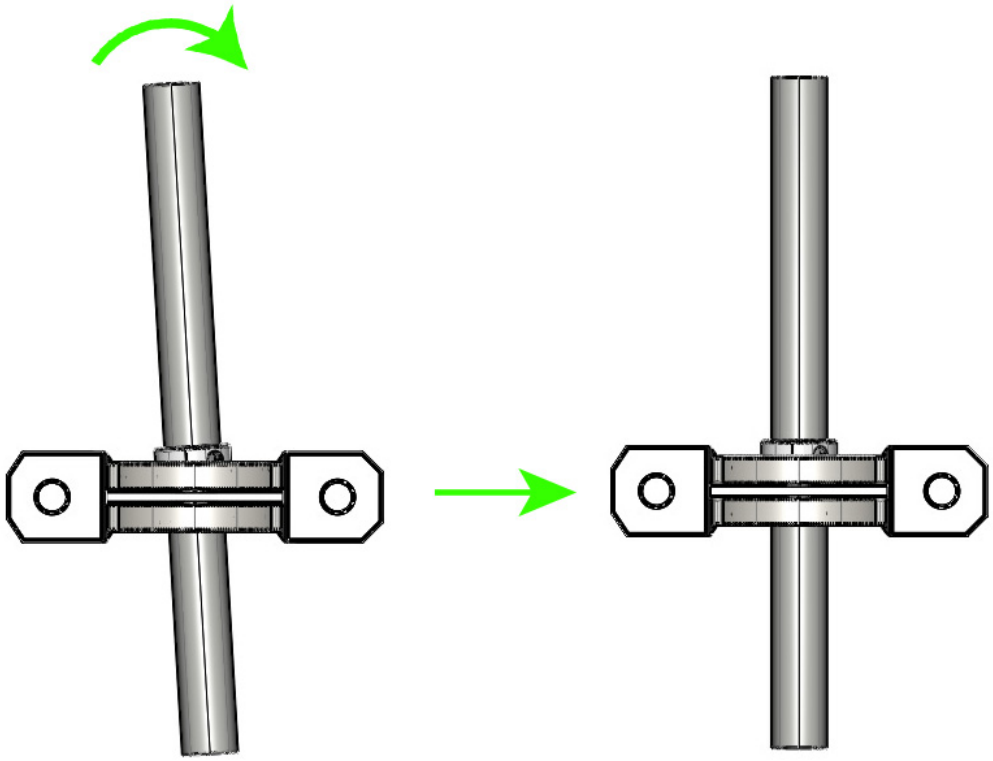


4.25 Mounting the vertical axis (step 1)

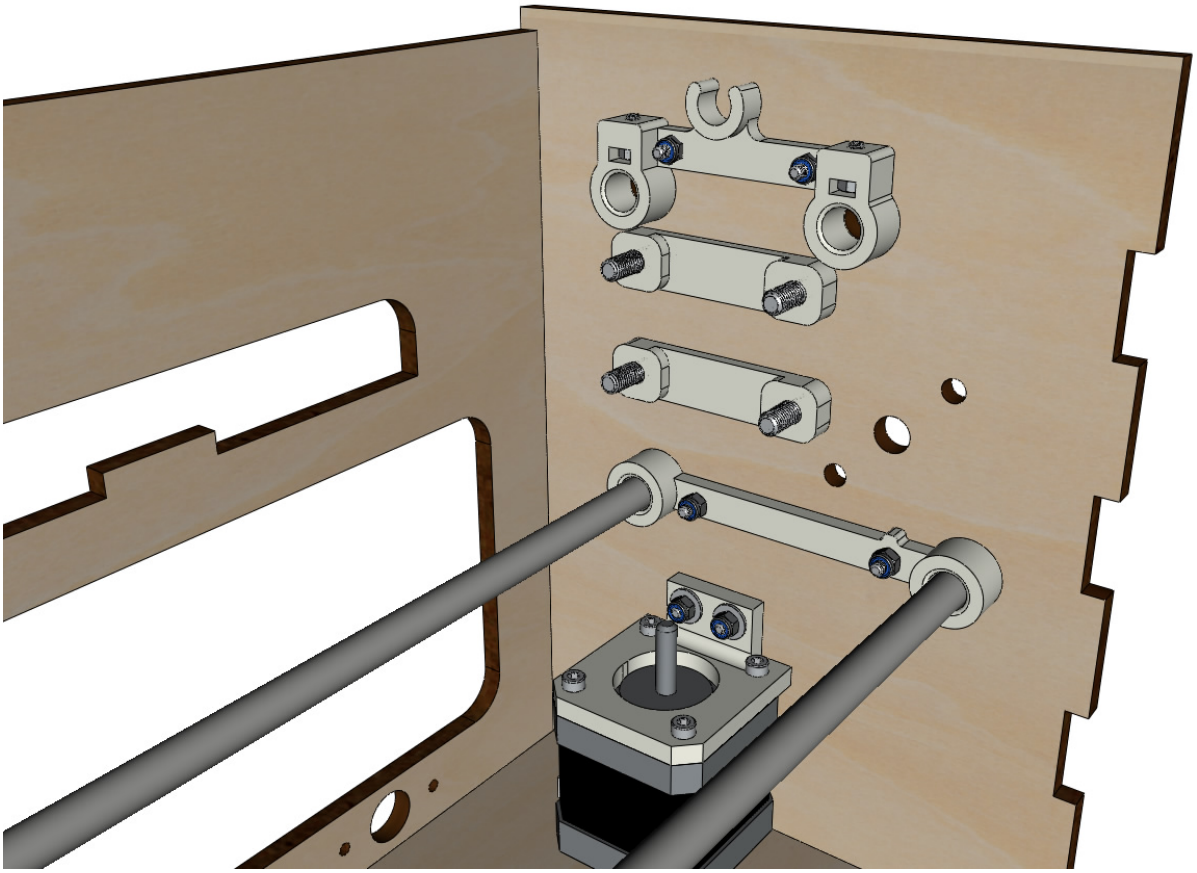
Equipment:

- **3D printed parts** : 2 X KP08_support
- 2 KP08
- 4 M5-25 screw
- 4 rondelles M5
- 4 M5 NYL nuts

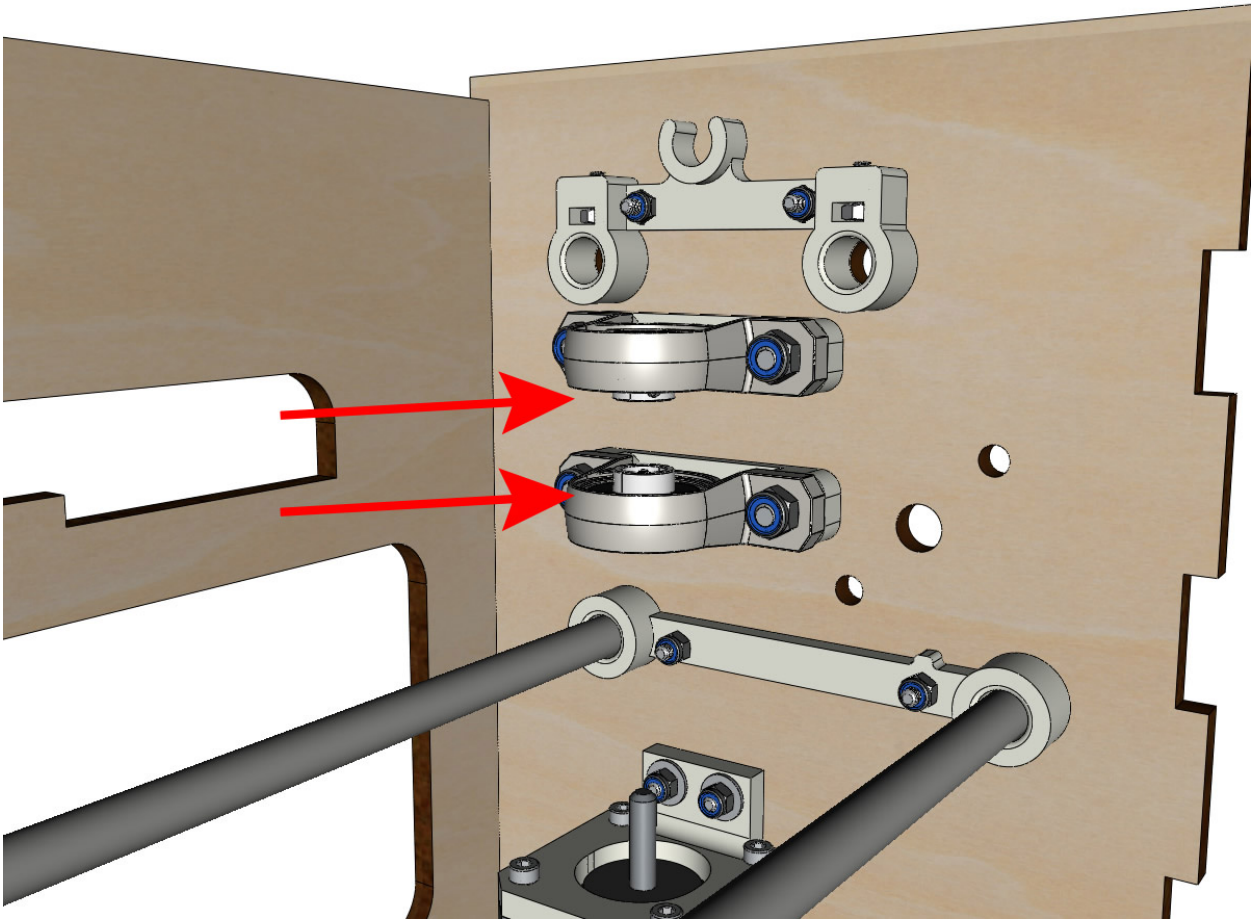
Note: Before attaching the KP08, make sure the bearings are aligned in their housing. They may be delivered a little misaligned. In this case, insert a Ø 8mm bar and manually actuate it to straighten them.

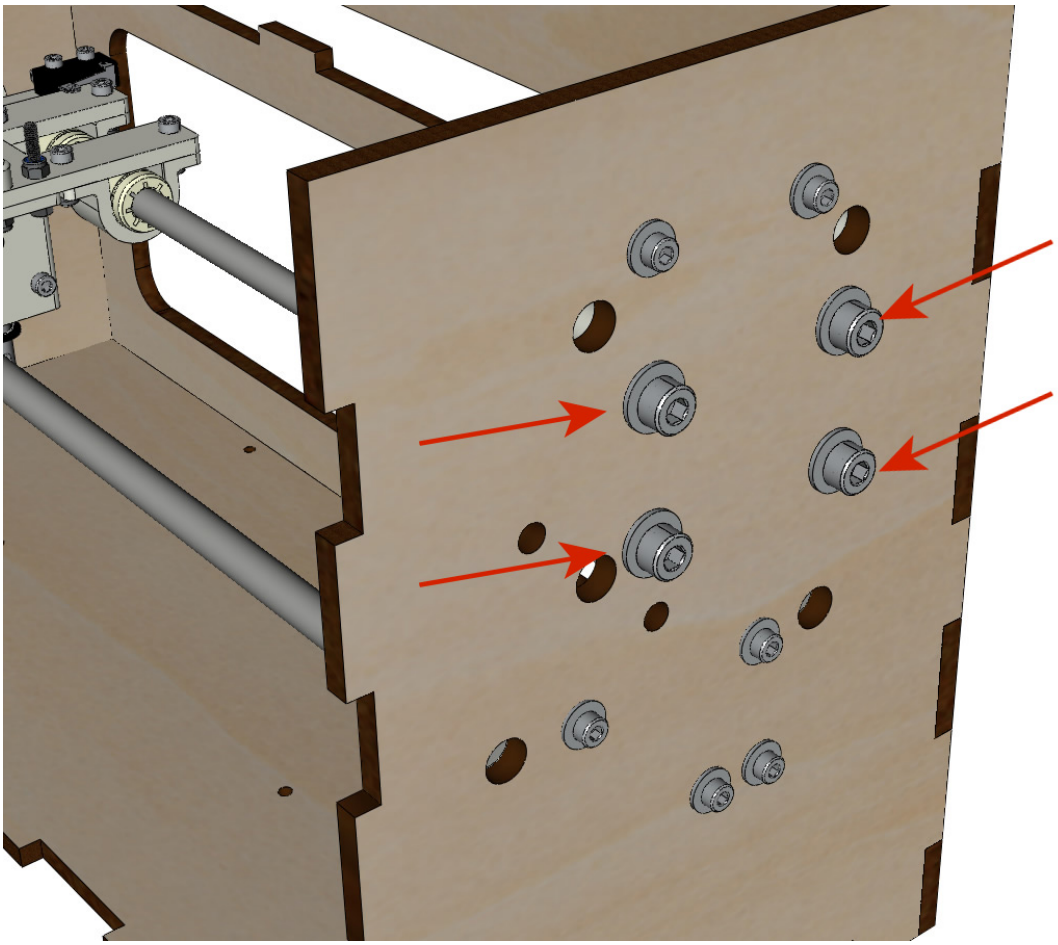


- Screw the KP08_support and the KP08 on the body a bit with the M5-25 screws, M5 washers and M5 NYL nuts.



- Observe the position of the KP08 clamping rings.

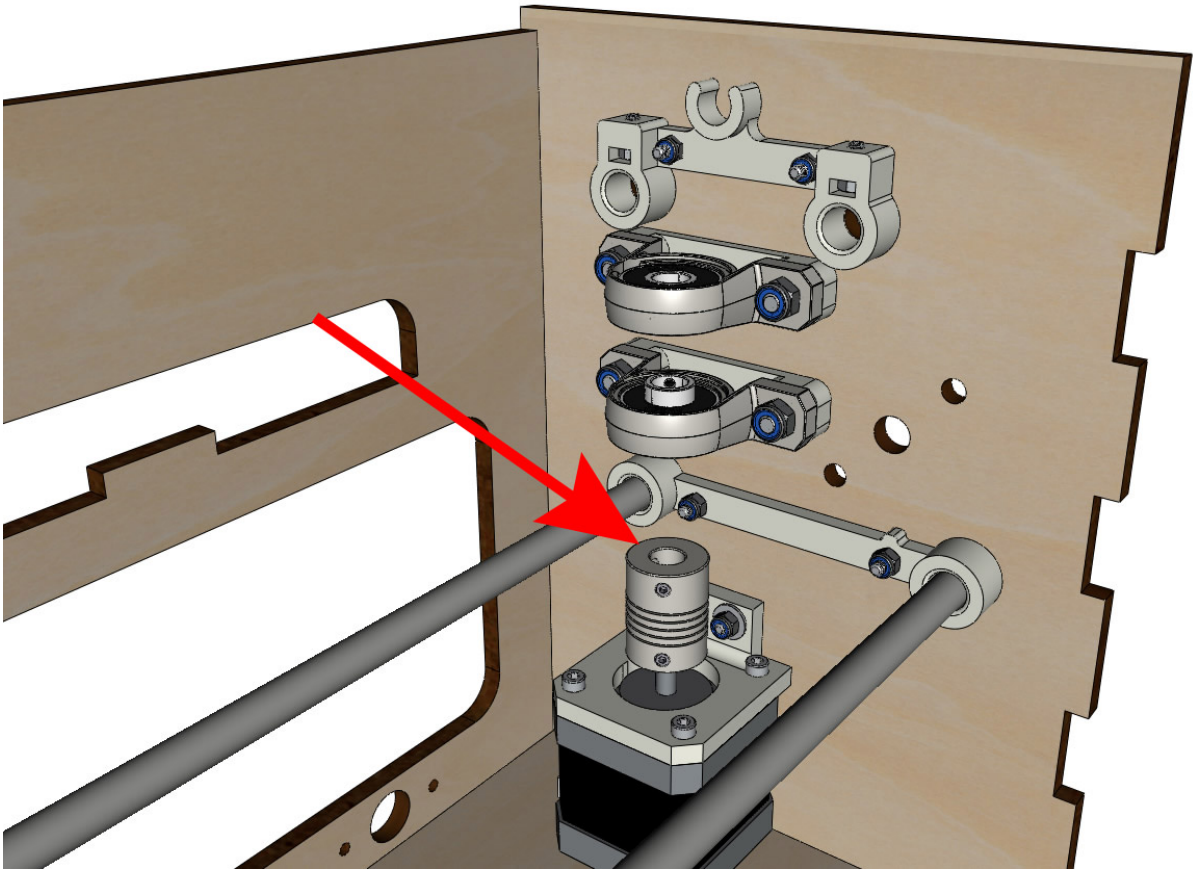




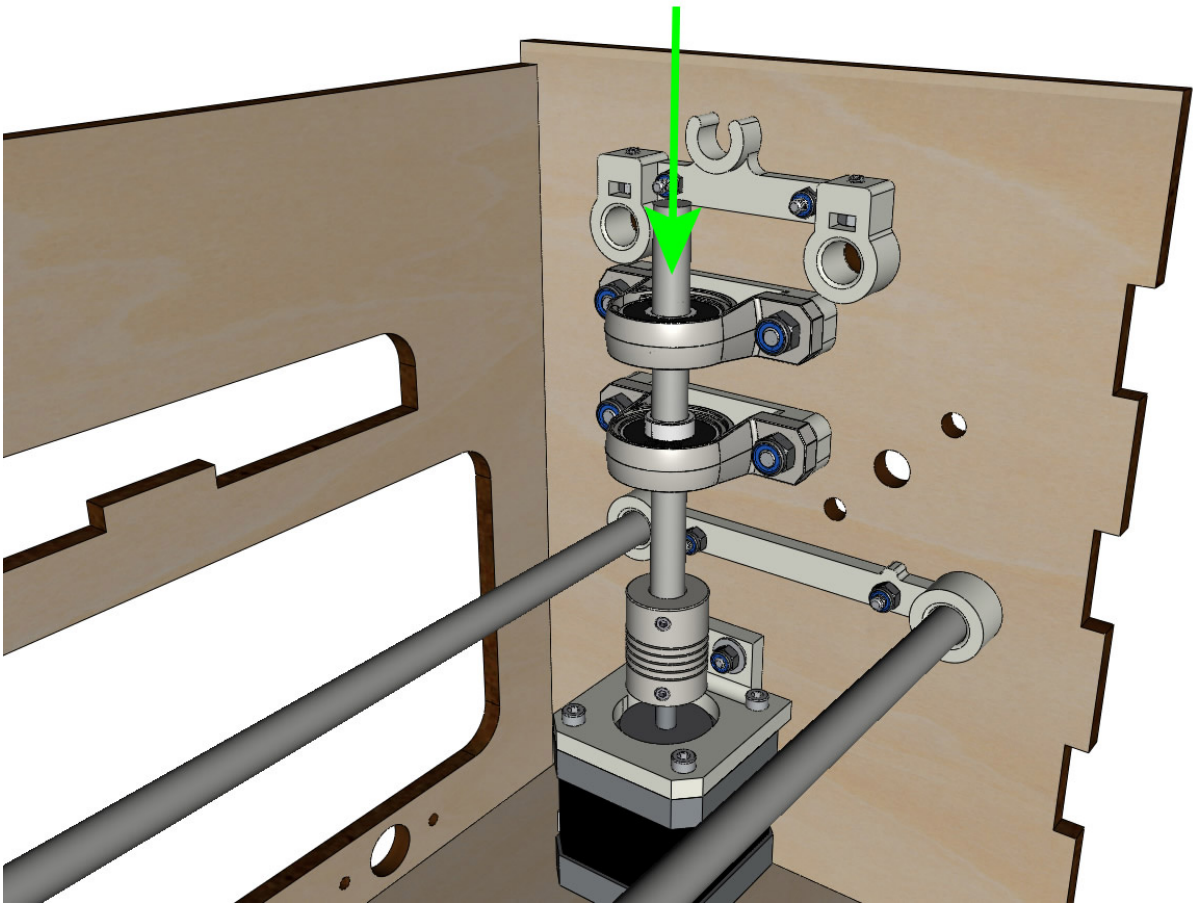
4.26 Mounting the vertical axis (step 3)

Equipment:

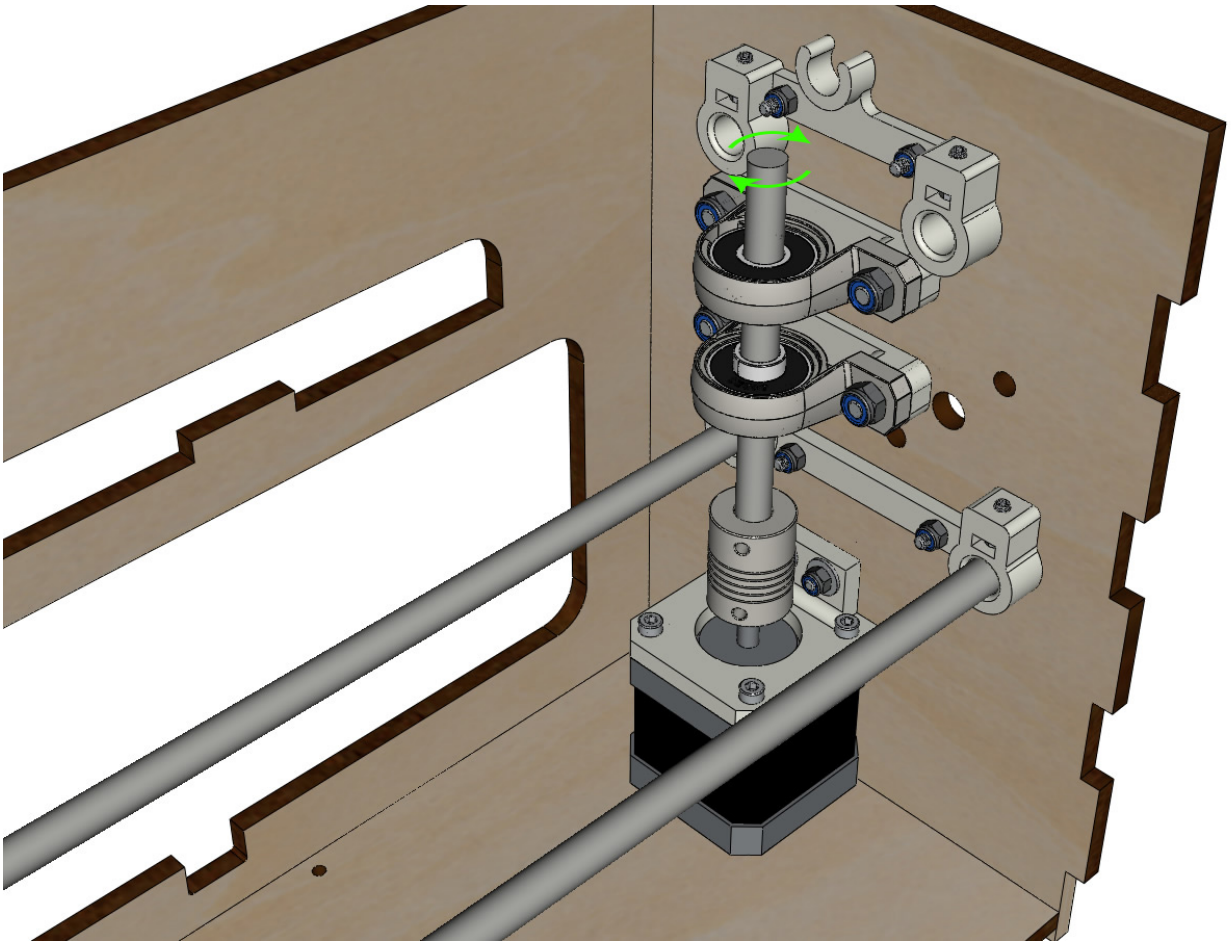
- 1 linear shaft Ø 8mm, length : 100mm
- 1 5*8mm Coupler
- Thread the coupler onto the motor shaft (Ø 5mm hole at the bottom).



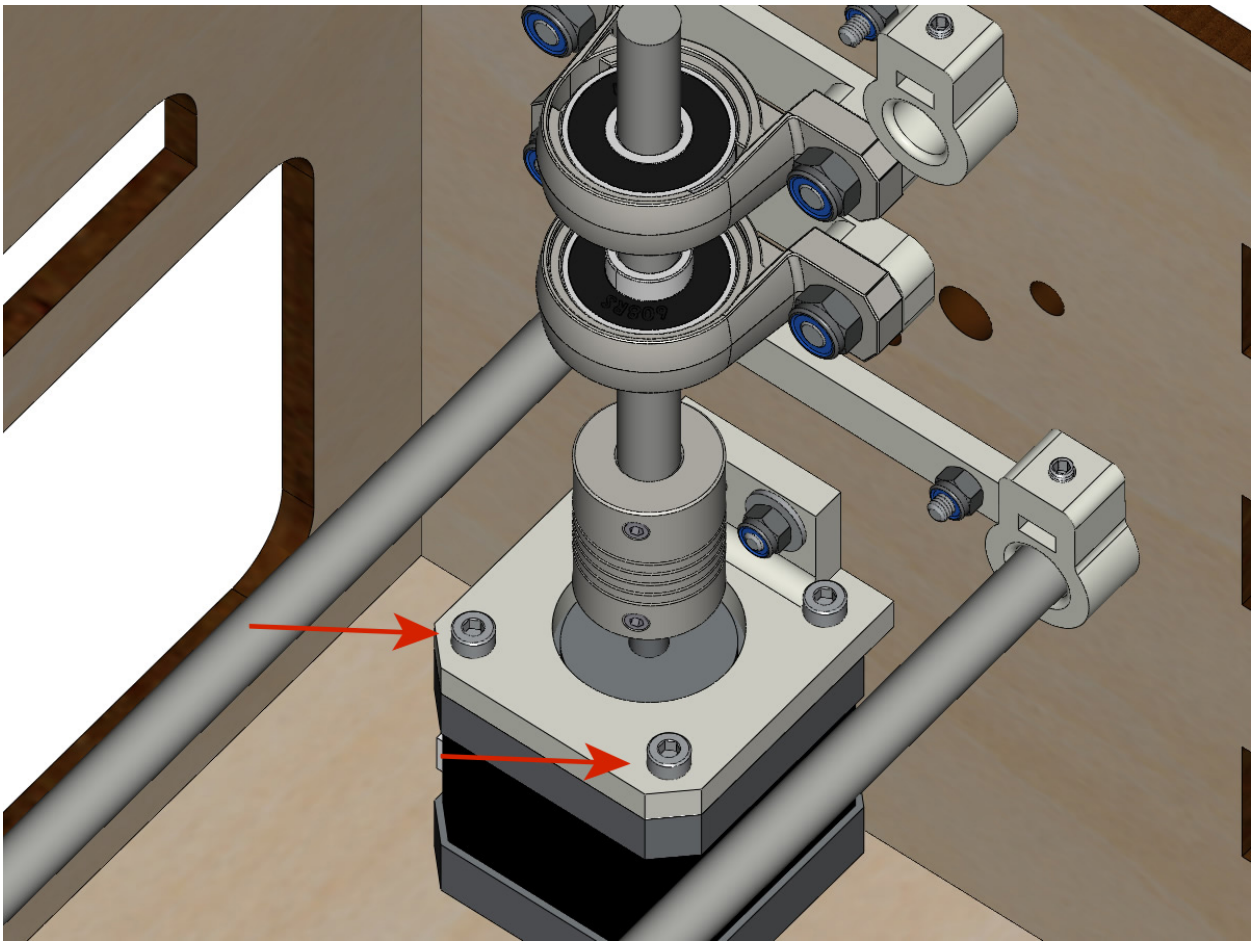
- Thread the 100mm linear shaft from the top through the KP08 and into the coupler.



- Rotate the linear shaft by hand to ensure that all elements are aligned and that the spindle continues to rotate freely.



- The holes of the motor support are oblong and allow to align the motor with the vertical axis in the 2 dimensions.
- Screw the first 2 screws of the motor on its support.

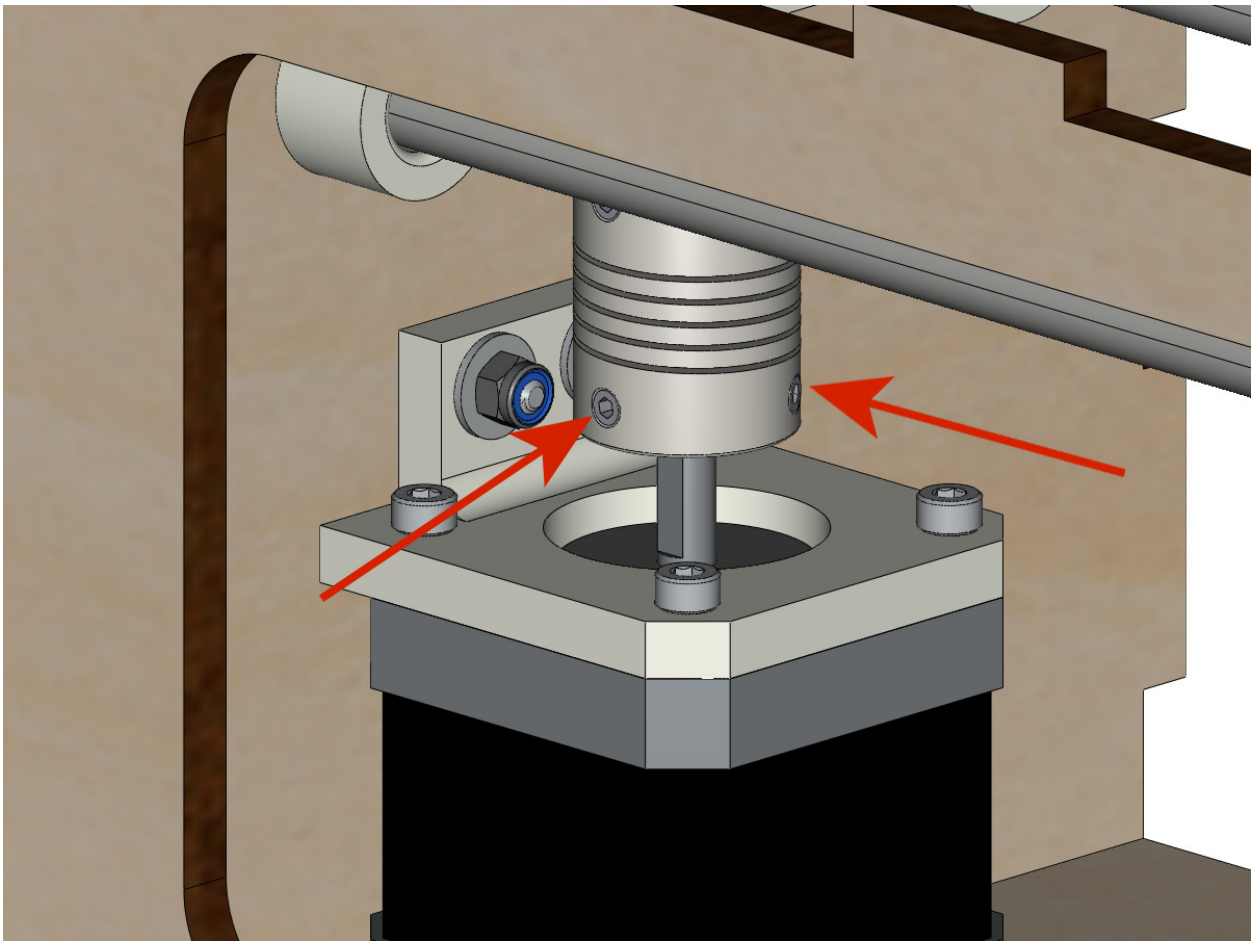


- Slowly tighten the KP08 screws by turning the shaft by hand.
- Screw the motor support screws onto the body slowly by turning the shaft by hand. ** ADD PICTURE **
- Remove the pin and finish screwing the last 2 screws of the motor on its support, then the support on the body.

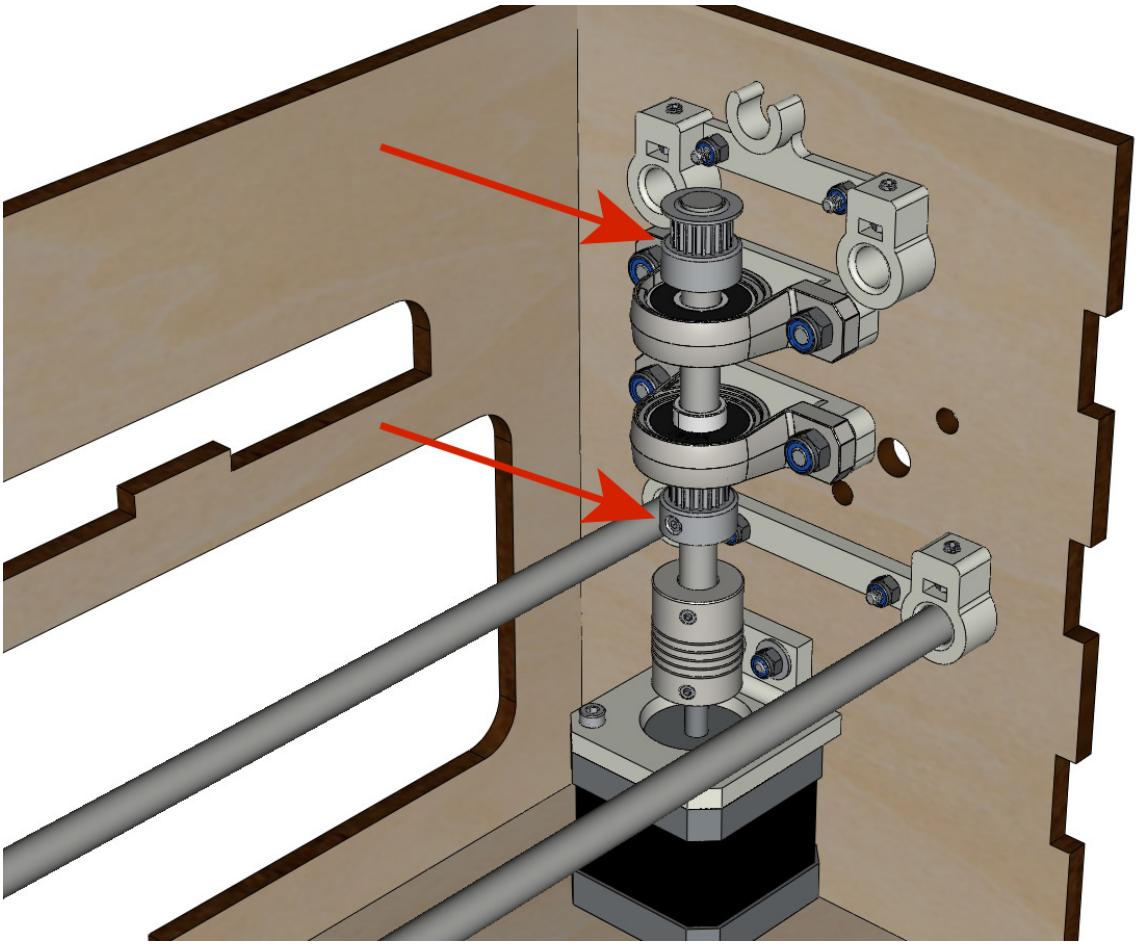
4.27 Mount the vertical axis (step 4)

Equipment:

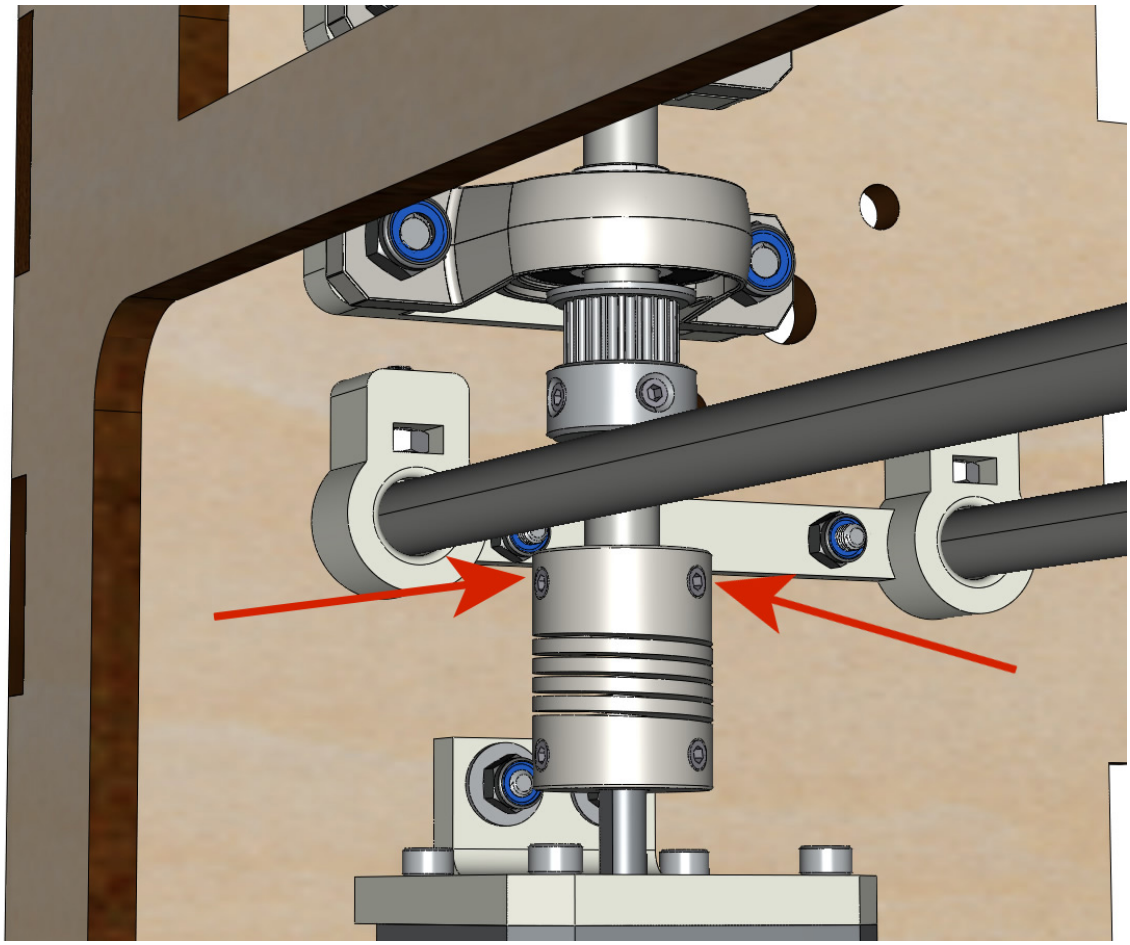
- 2 pulleys GT2 20 teeth bore 8mm
- Screw the 2 screws at the bottom of the coupler onto the motor shaft, making sure that one of the screws is in front of the flat part of the motor shaft and that the bottom of the coupler is not resting on the motor.



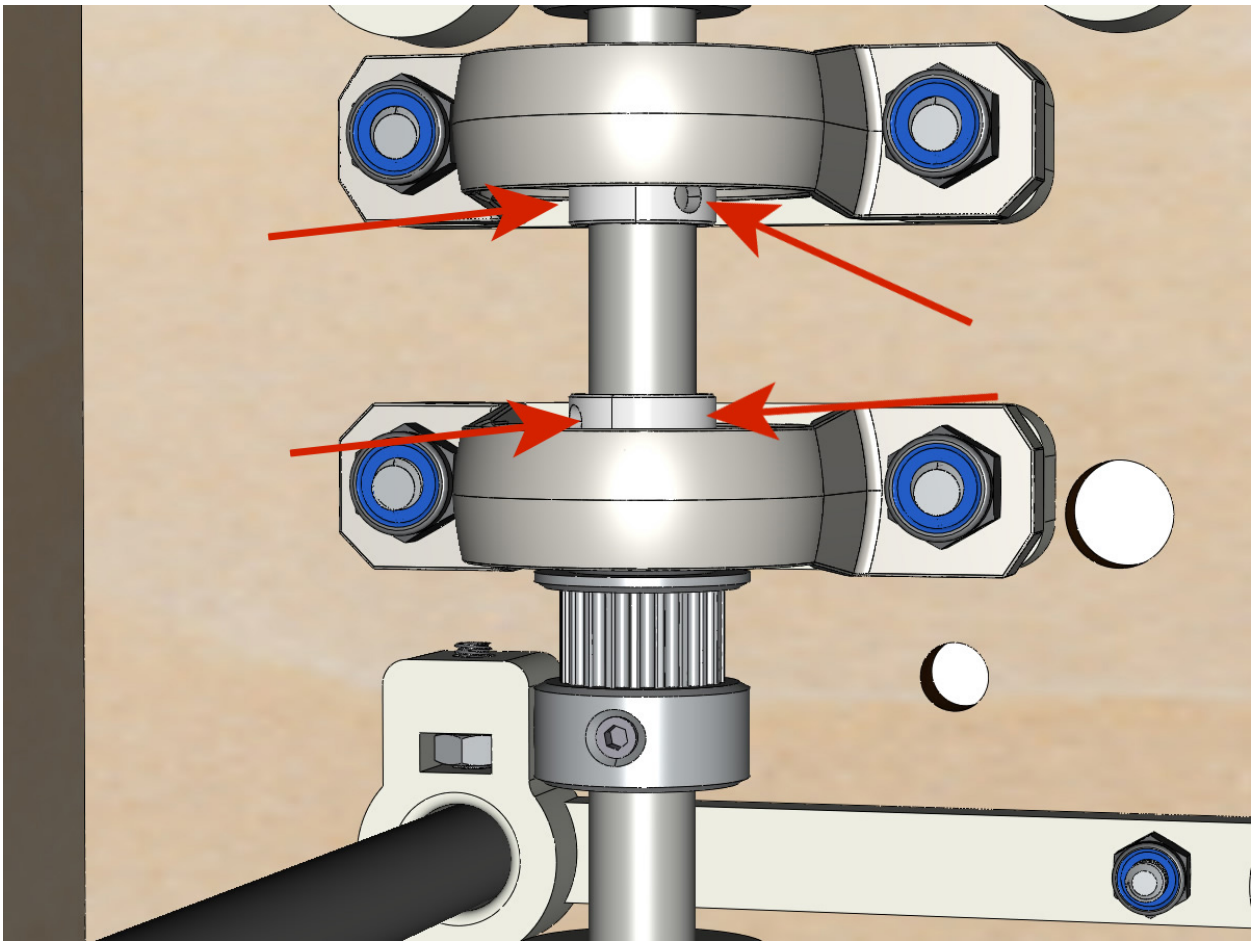
- Thread the 100mm axle into the KP08, the pulleys (respecting their positions) and the coupler.



- Screw the 2 screws at the top of the coupler onto the vertical axis.



- Leave the pulleys free without screwing them onto the axle. They will be screwed when the belt is in place.
- Screw the screws of the KP08 clamping rings (2 screws per ring).

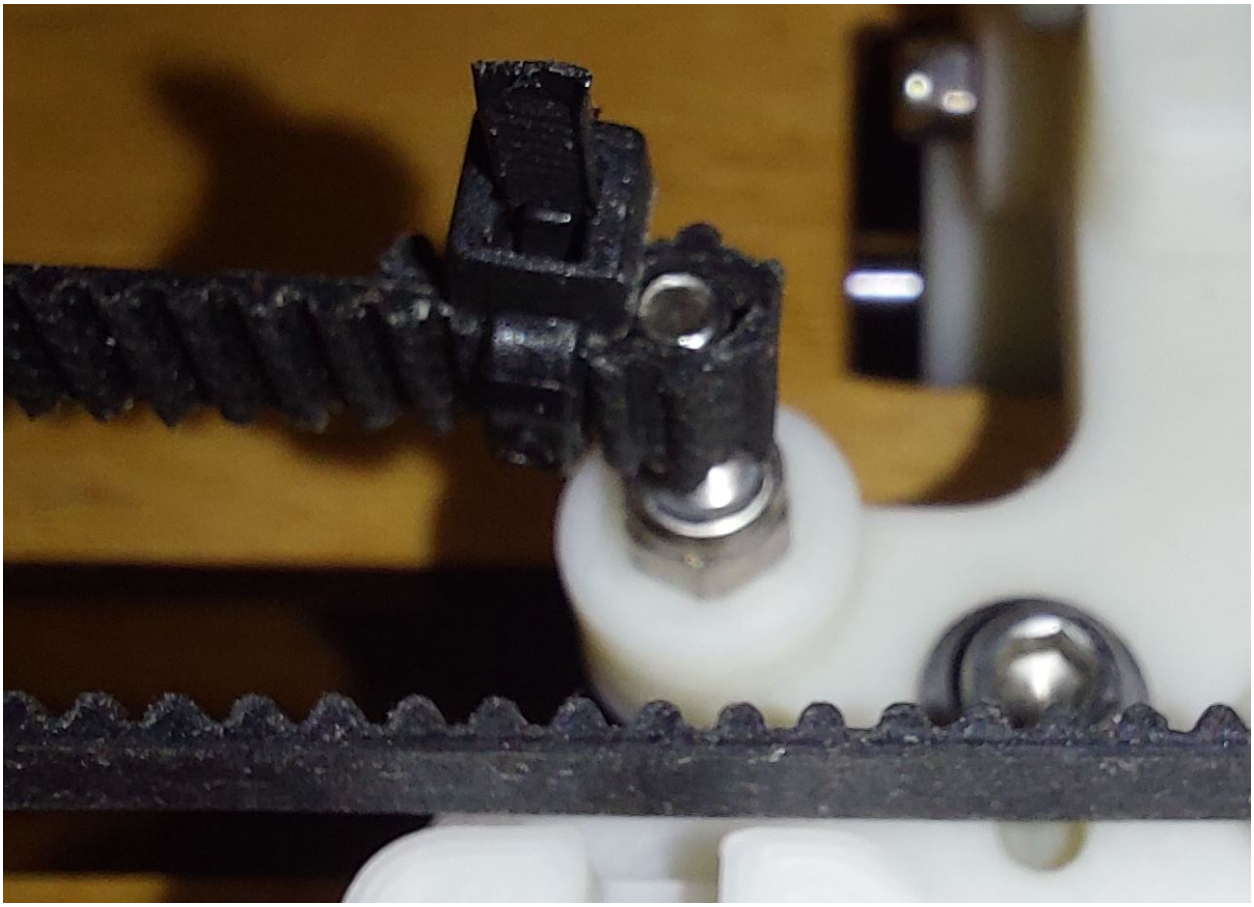


- Make sure that the axle rotates easily and that the motor does not oscillate. If necessary, loosen the motor and support screws on the body to give them play and re-align.

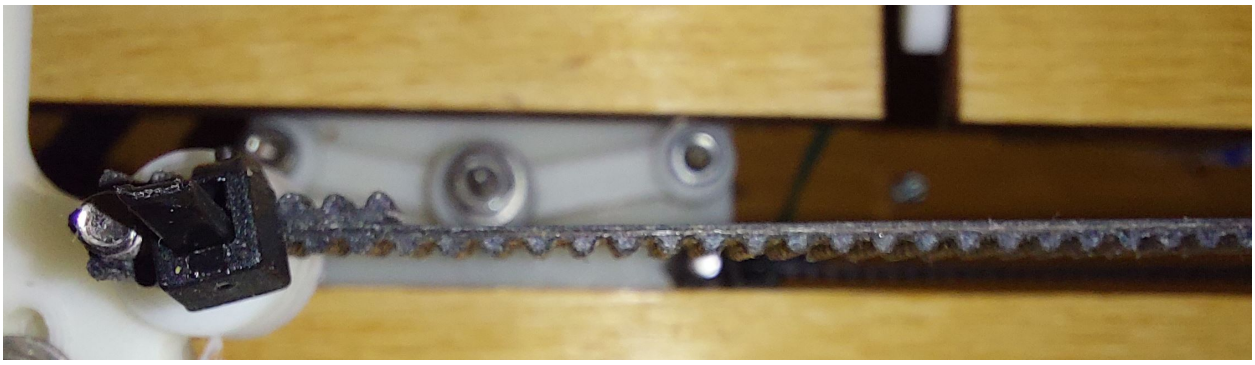
4.28 Mounting the low carriage belt

Equipment:

- 1 belt GT2 length ± 620mm
- 2 necklaces
- Using a collar, attach the strap around the carriage screw with the teeth facing out.

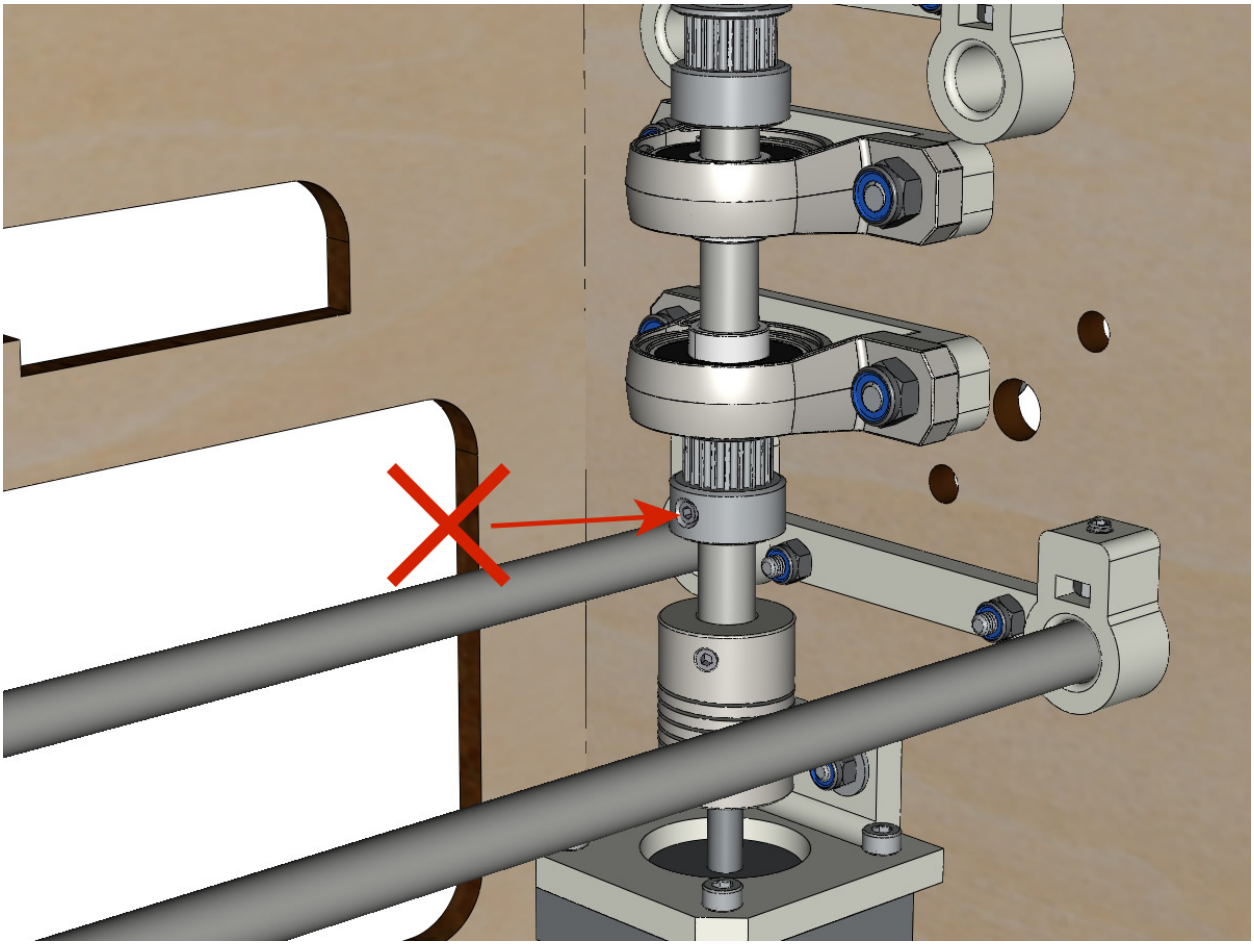


- Pass the belt in the free pulley then the pulley of the vertical axis.



- Tension the belt while holding the carriage and secure the second end of the belt to its screw with a collar.
- Finish stretching the belt with the screw on the outside of the body.

Note: For now, do not tighten the pulley bolts on the axle.

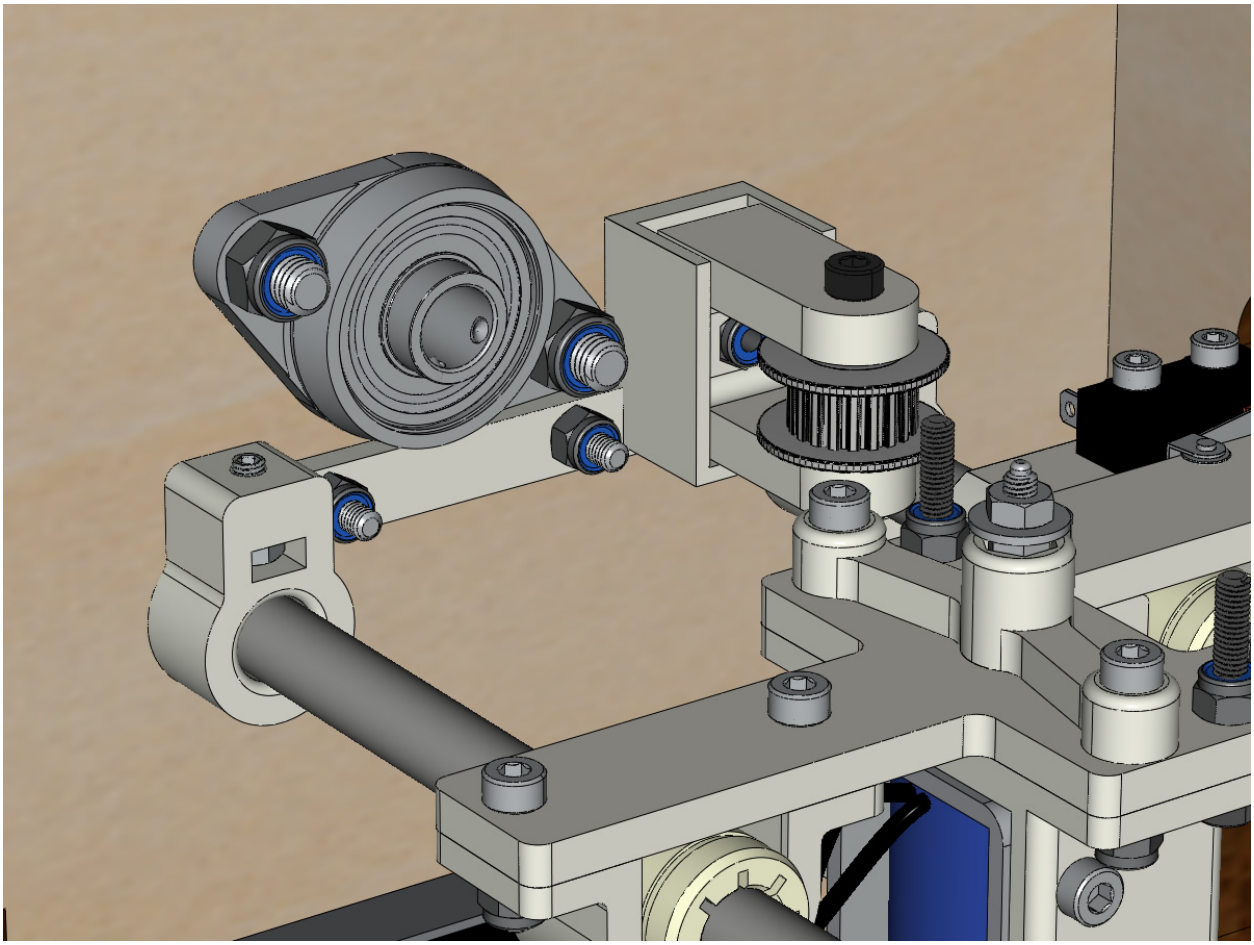


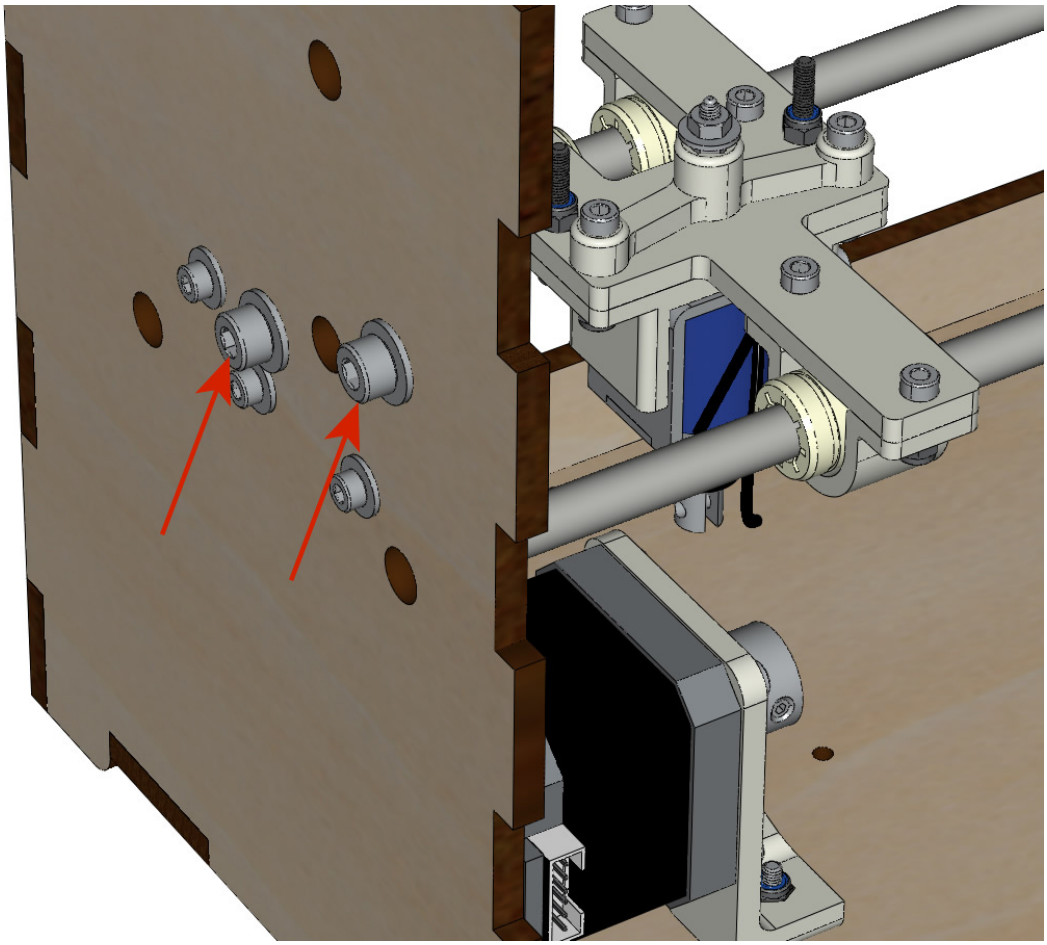
4.29 Y axis mounting (step 1)

Equipment:

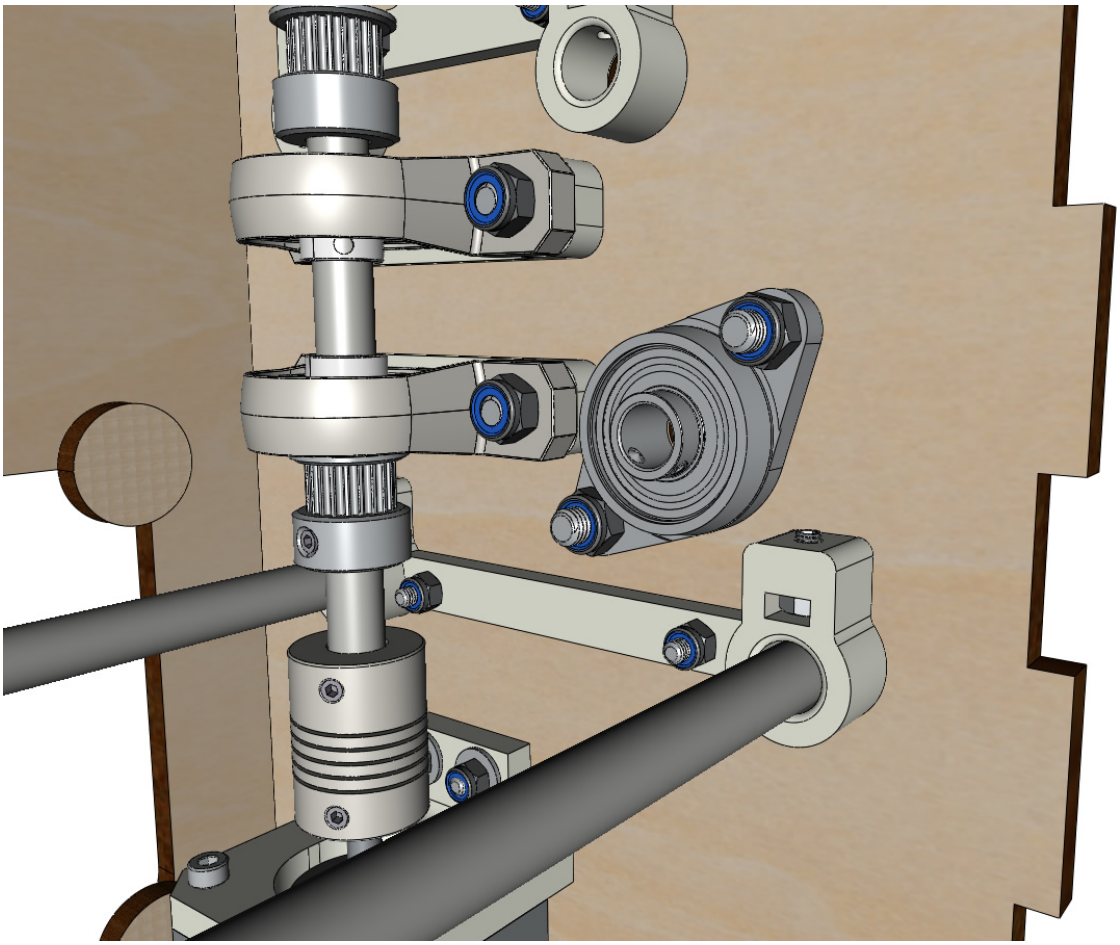
- 2 KFL8
- 4 screws M5-18
- 4 M5 NYL nuts
- 4 rondelles M5
- 1 GT2 20 teeth boron 8mm pulley
- 1 smooth rod Ø 8mm, length: 364mm

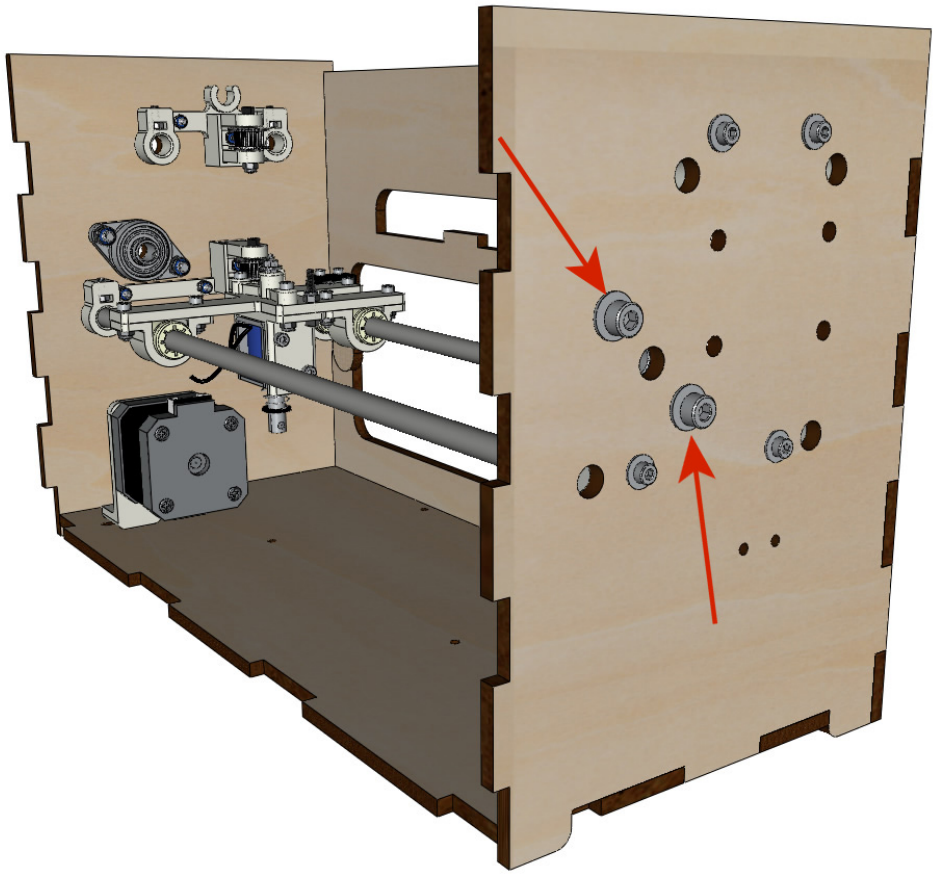
  - 1 closed GT2 belt 200 or 220 mm (according to the Y motor support)
- Fix the KFL8 on the left side with 2 M5-18 screws, 2 M5 washers and 2 M5 NYL nuts.



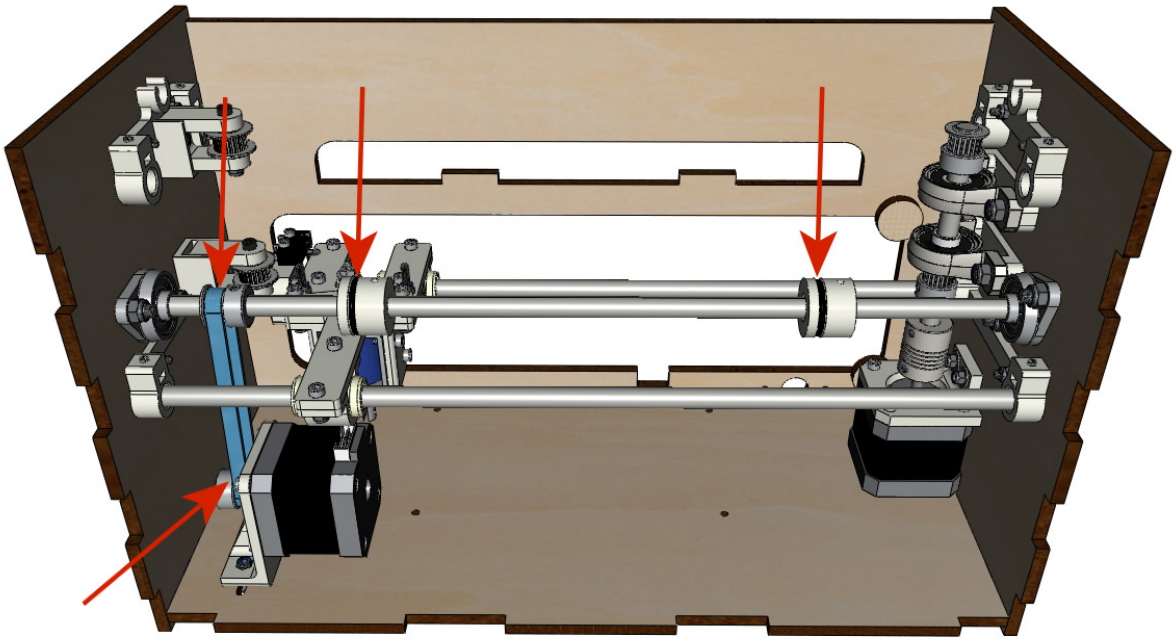


- Fix the KFL8 right on the body with the KFL8_support, 2 screws M5-18, 2 washers M5 and the 2 nuts M5 NYL.

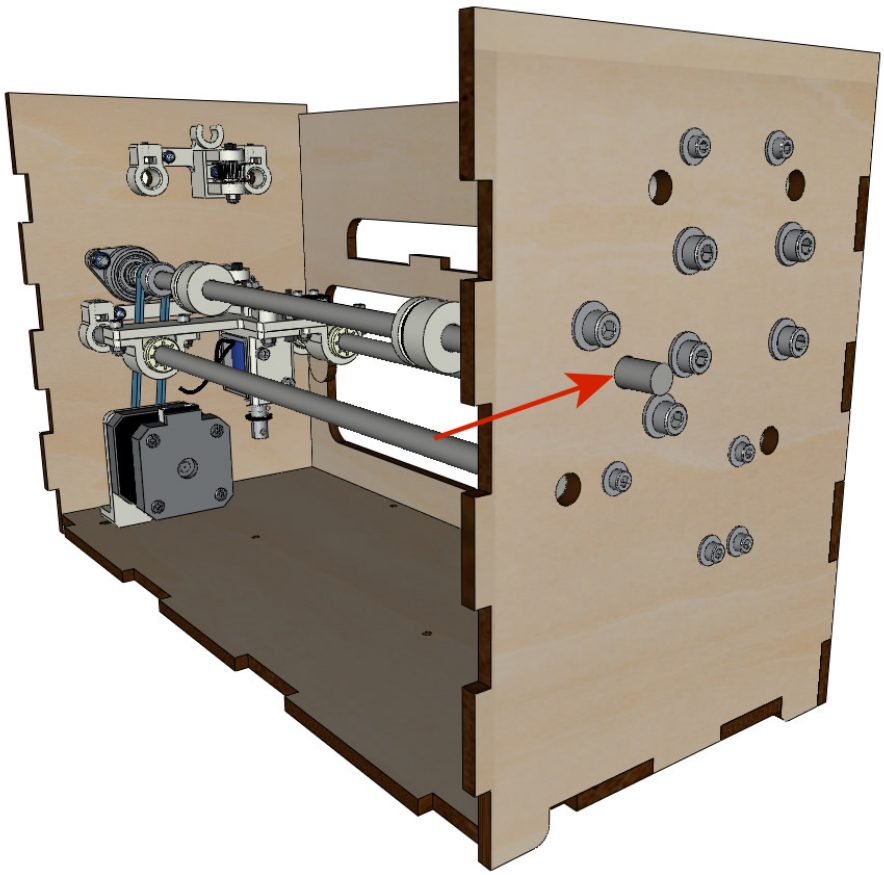




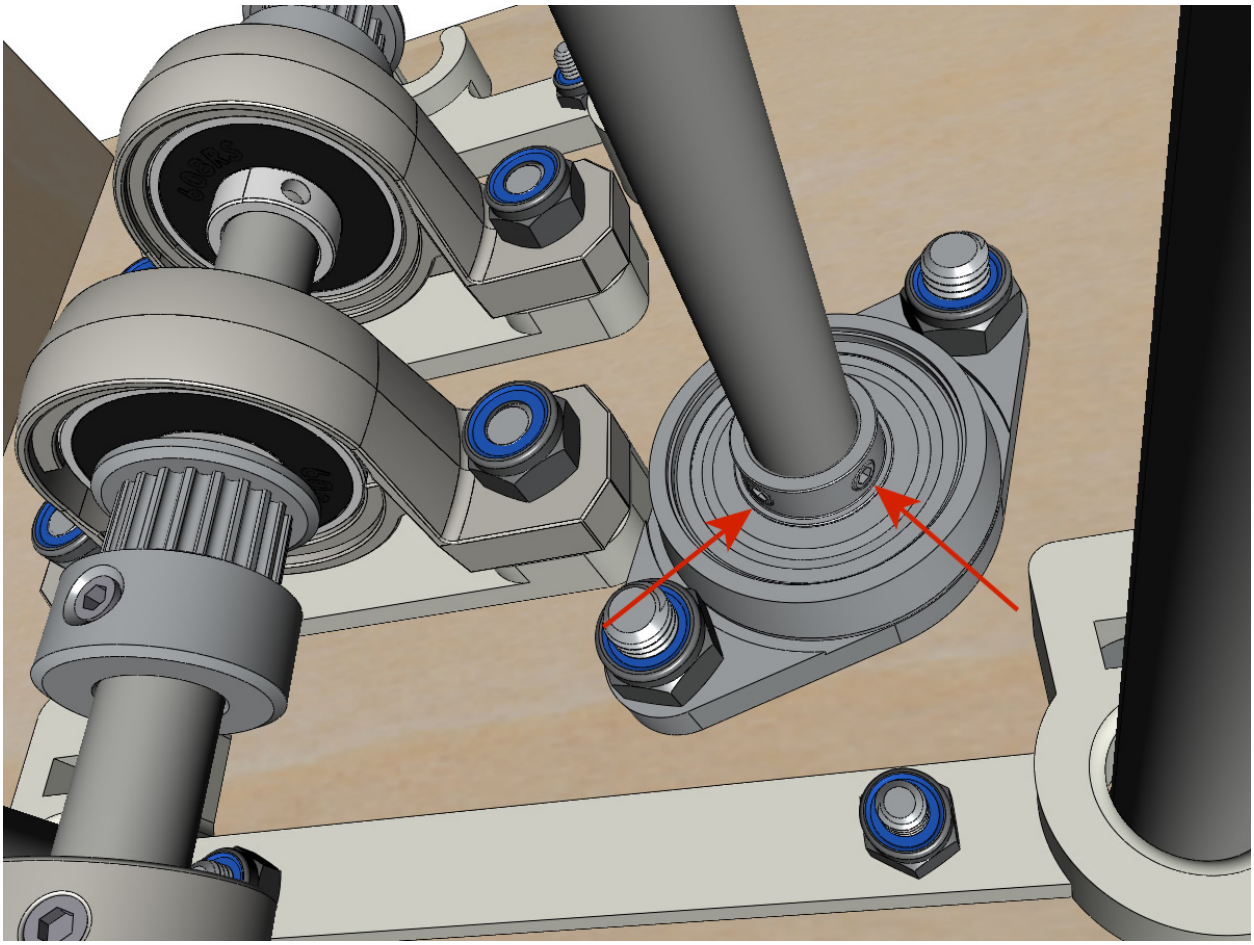
- Thread the smooth bar halfway through the left side through the body and the KFL8.
- In order, thread the GT2 20 tooth boron 8mm pulley, the closed belt and the 2 ROLL_joint (pay attention to the position of the O-ring). Put the belt closed on the pulley of motor Y and on the pulley of the axle.



- Press the axle into the right KFL8 and cross it so that it protrudes ± 12mm from the body.

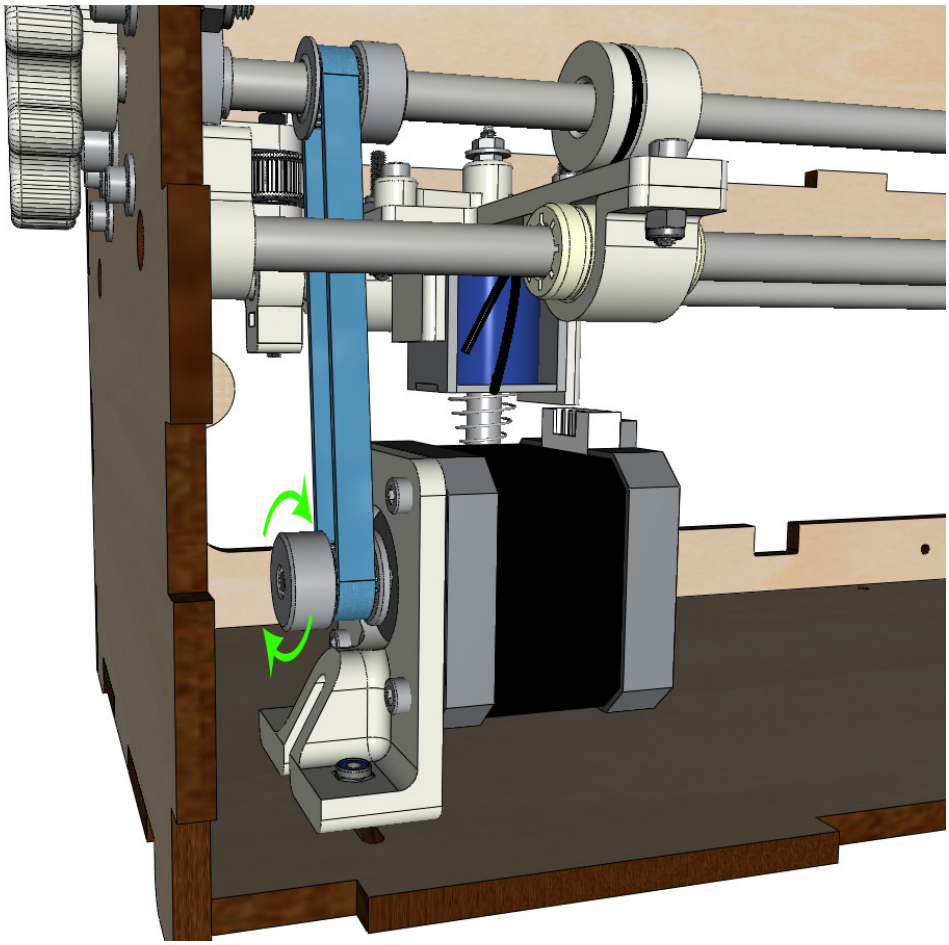


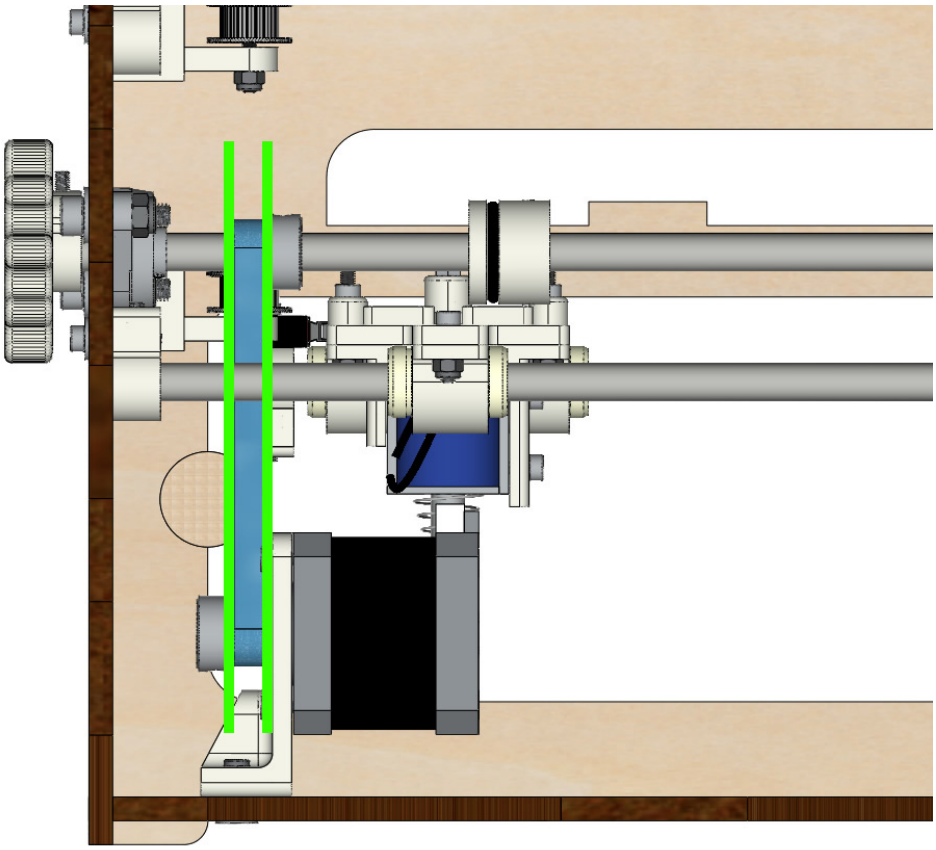
- Tighten the screws of the KFL8 rings.



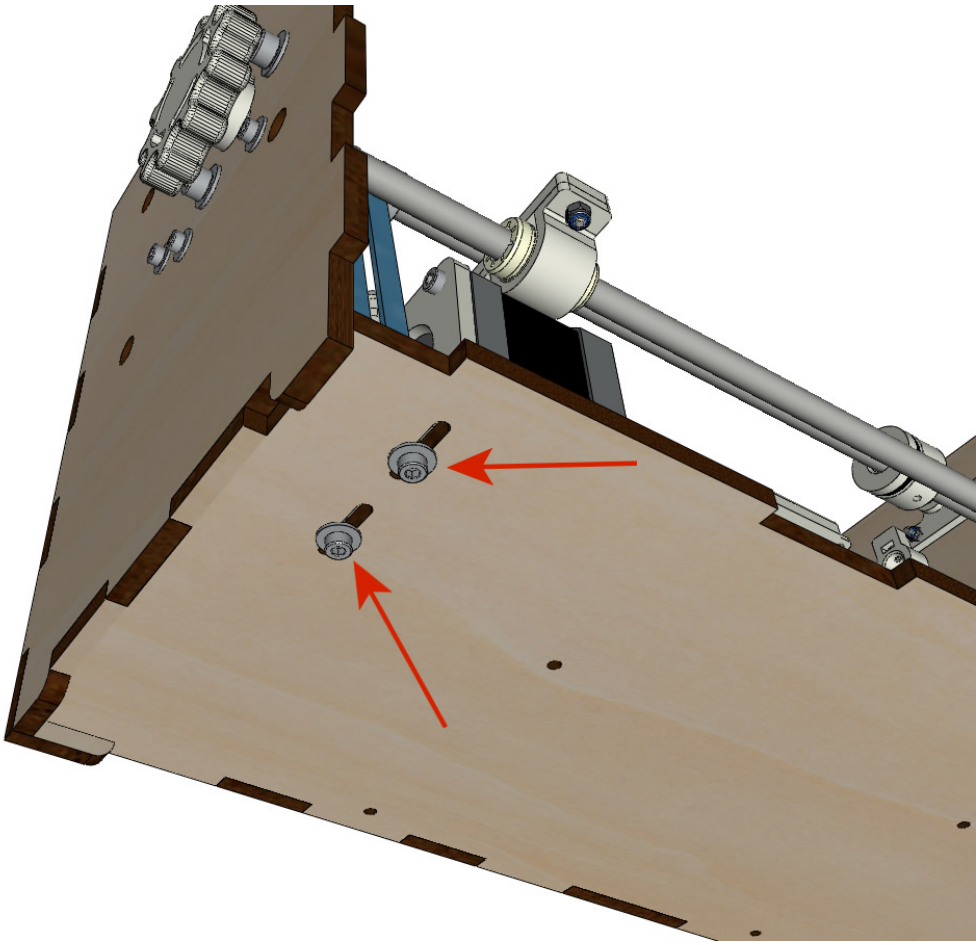
4.30 Mounting the Y axis (step 2)

- Rotate the motor pulley by hand so that the pulley on the shaft aligns vertically with the motor pulley.

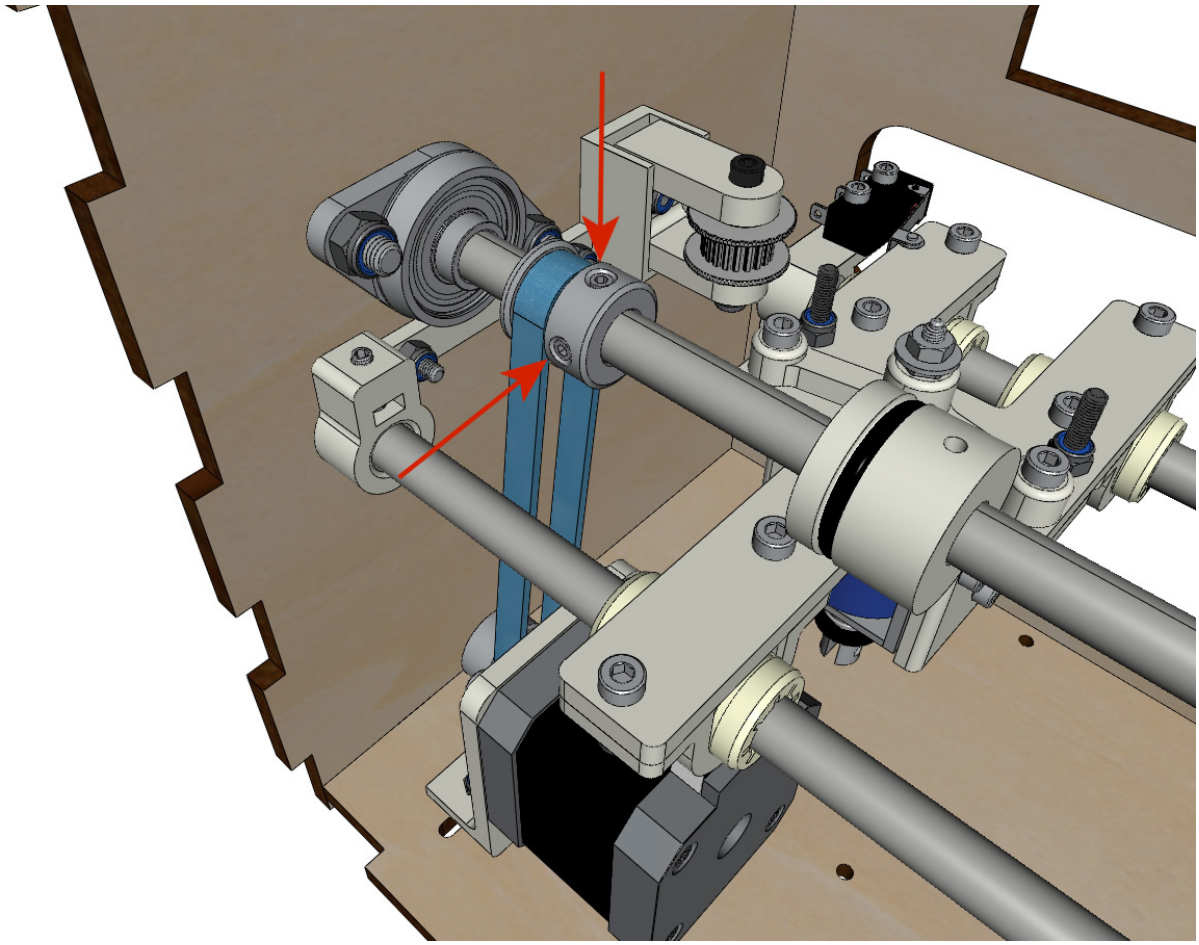




- Move the Y motor / support assembly along the oblong holes under the body to tension the closed belt and tighten the 2 screws.



- Tighten the 2 screws of the pulley of the axle.



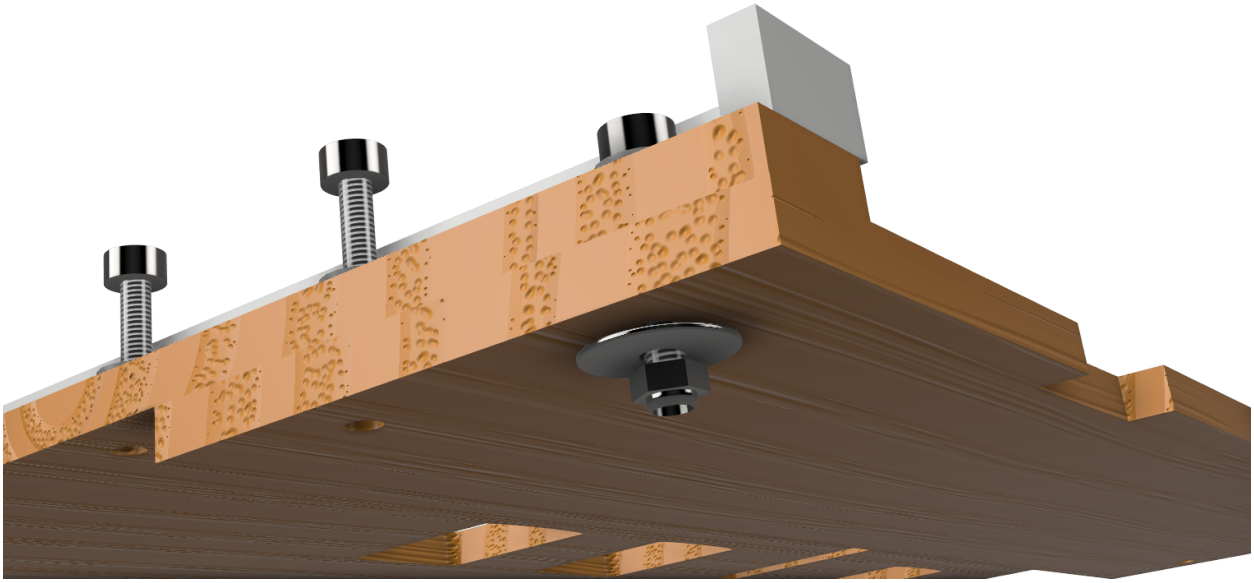
4.31 Assembling paper guides on the plate

Equipment:

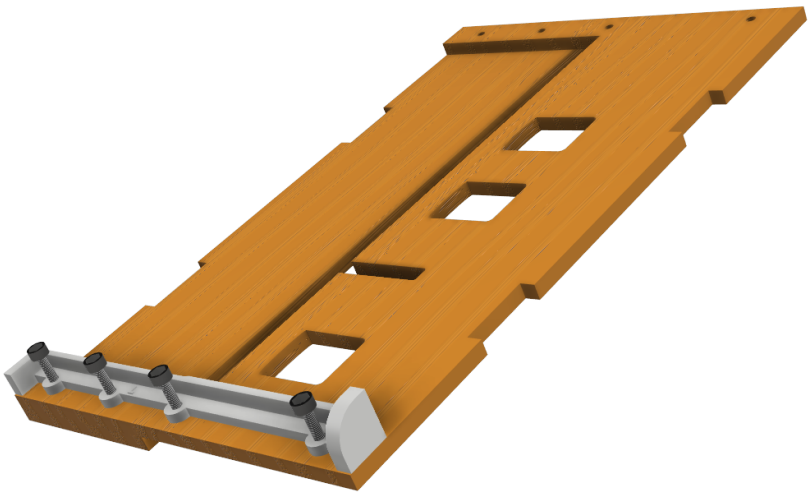
- **3D printed parts** : PAPER_GUIDE_left
- **3D printed parts** : PAPER_GUIDE_right
- **PAPER_support** (laser cut 5mm plywood).
- 4 M3-16 screws
- 4 M3-14 screws
- 8 wide M3 washers
- 8 M3 NYL nuts

Note: M3-16 screws (M3-18 if you don't have M3_16) are used for the holes where there are 2 thicknesses of wood.

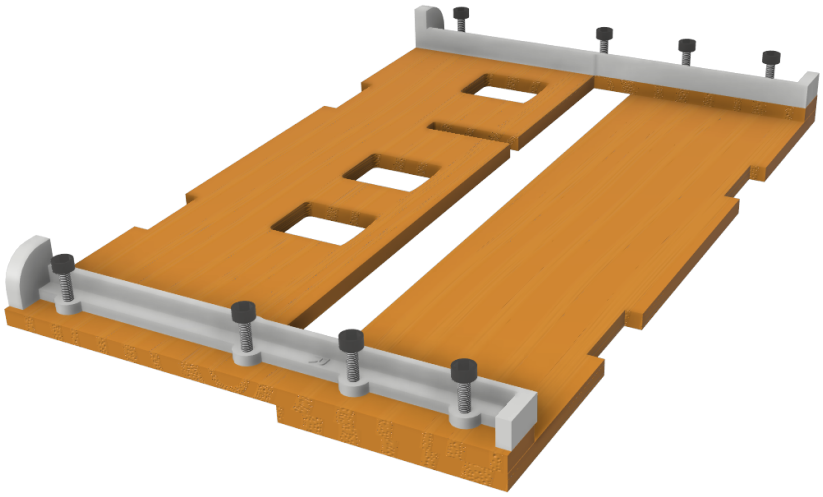
- Assemble the paper guides on the plate with the M3-16 screws and M3 NYL nuts.



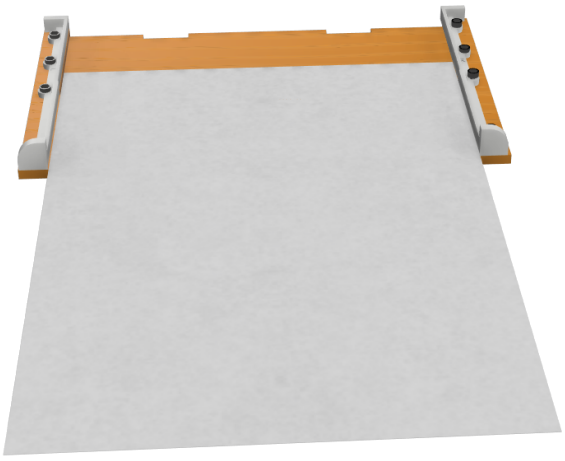
- Left part.



- Repeat the operation for the right side.



- Check that you can put a sheet of paper on the tray without that the sheet warps. If the sheet warps, try to remove the paper guides before clamping.



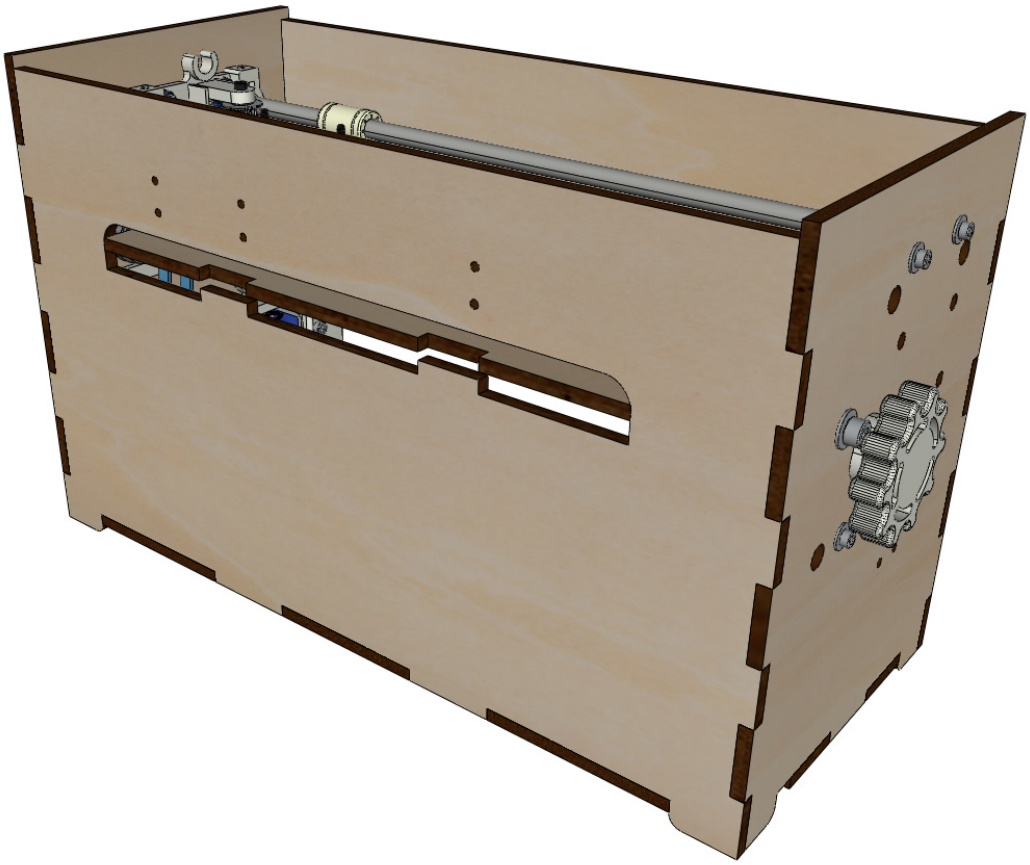
4.32 Bonding of the paper plate

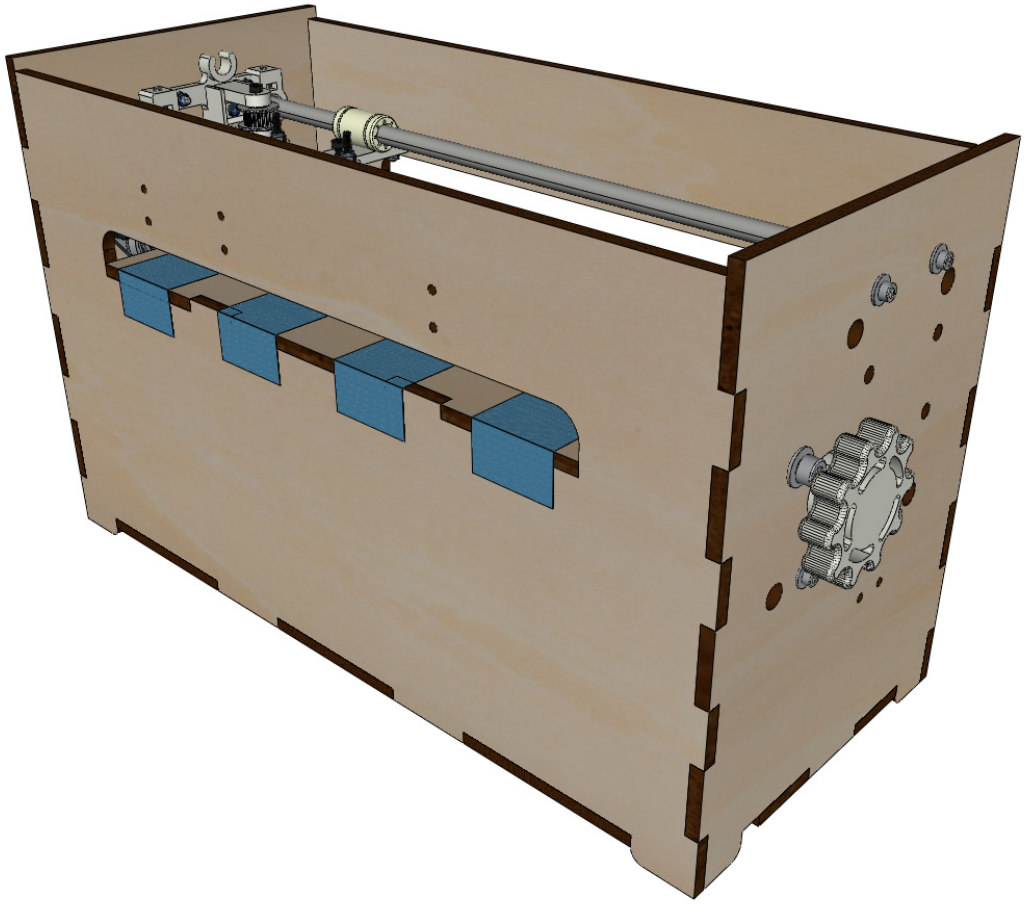
Equipment:

- PAPER_support (laser cut 5mm plywood).
- 3 Prepared paper rolls (with gasket and screws)

Note: Glue the plate only if you are sure of the mounting that is in below. If you're not sure, you can just position the support plate, you will bond it at the end when The embosser will work.

- Glue the notches that will be in contact. Insert the plate from the front and hold it firmly with tape during the drying time.

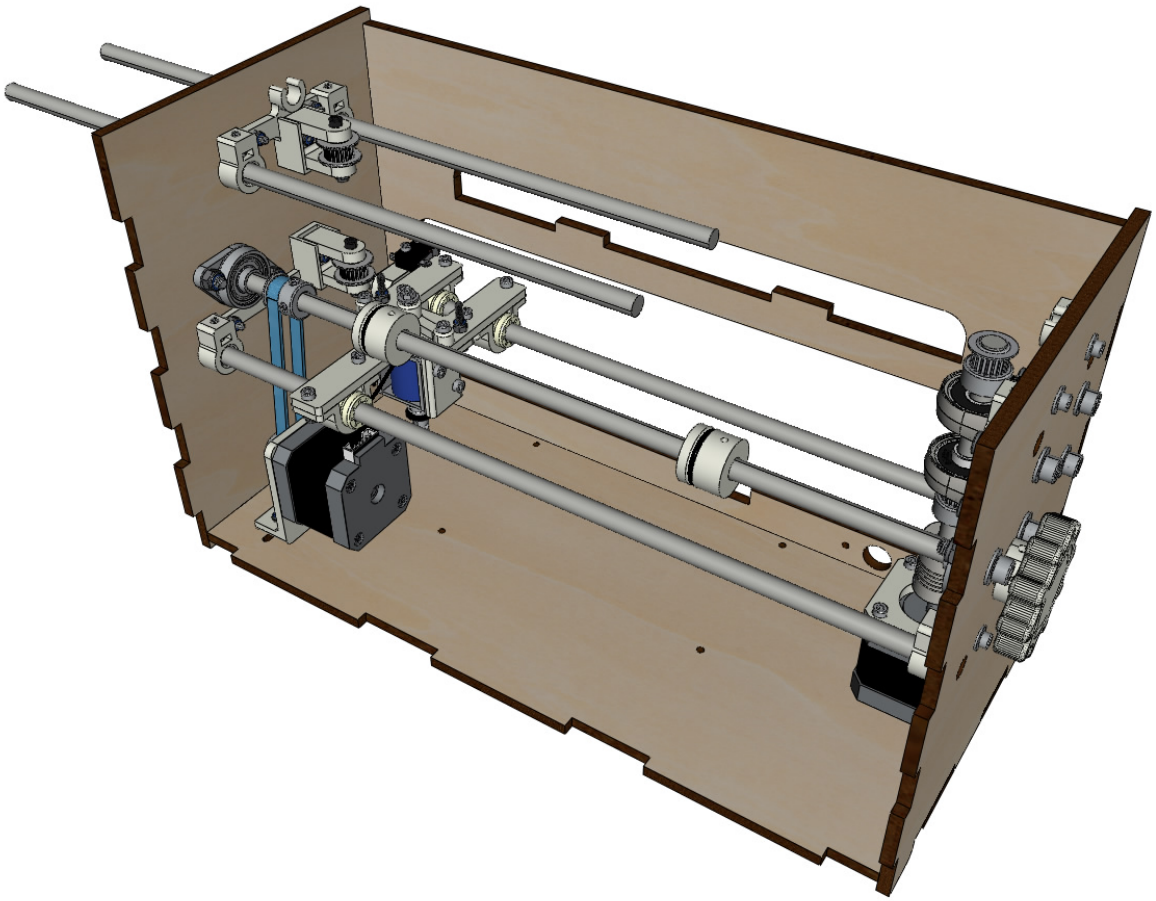




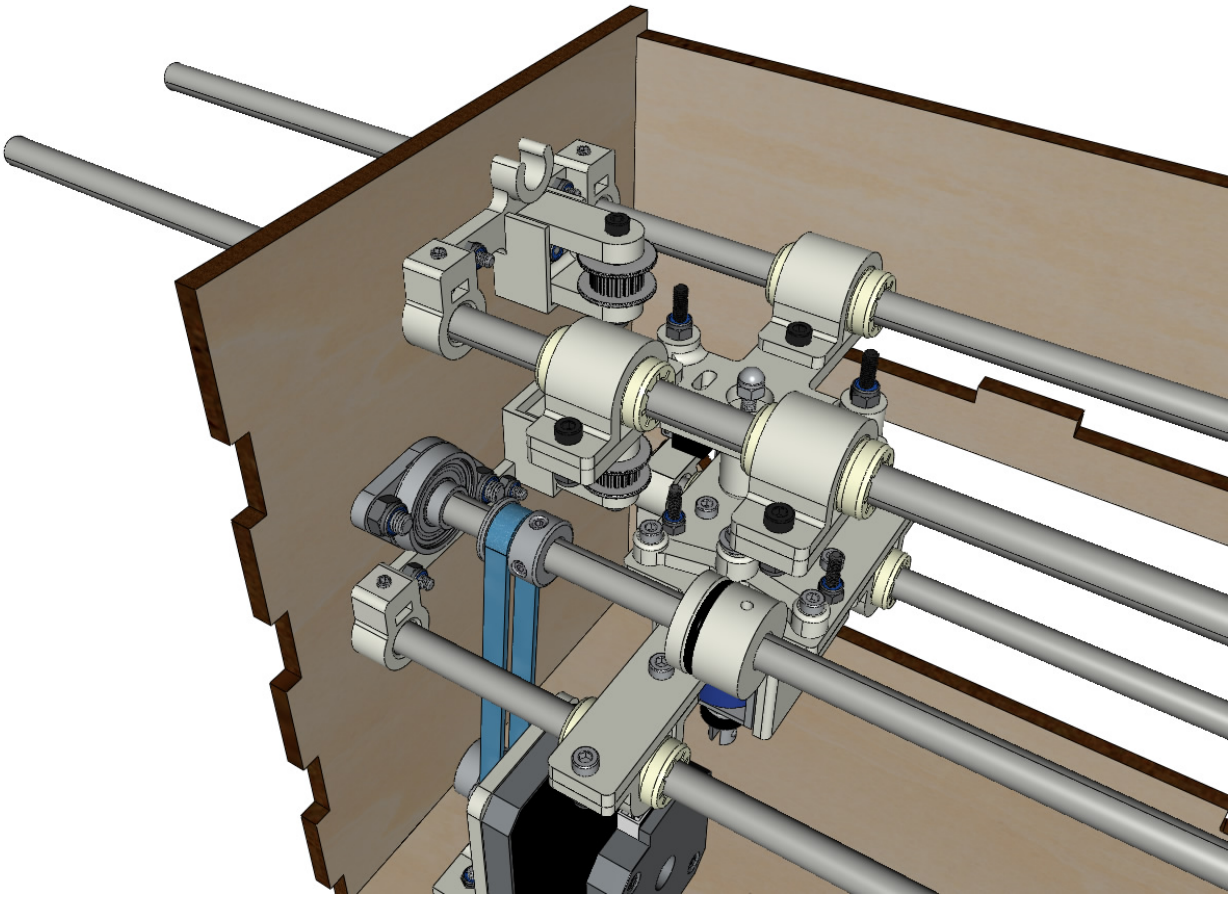
4.33 Mounting the top cart (step 2)

Equipment:

- 2 smooth bars Ø 8mm, length: 330mm
- Thread the bars halfway through the outside of the crate.

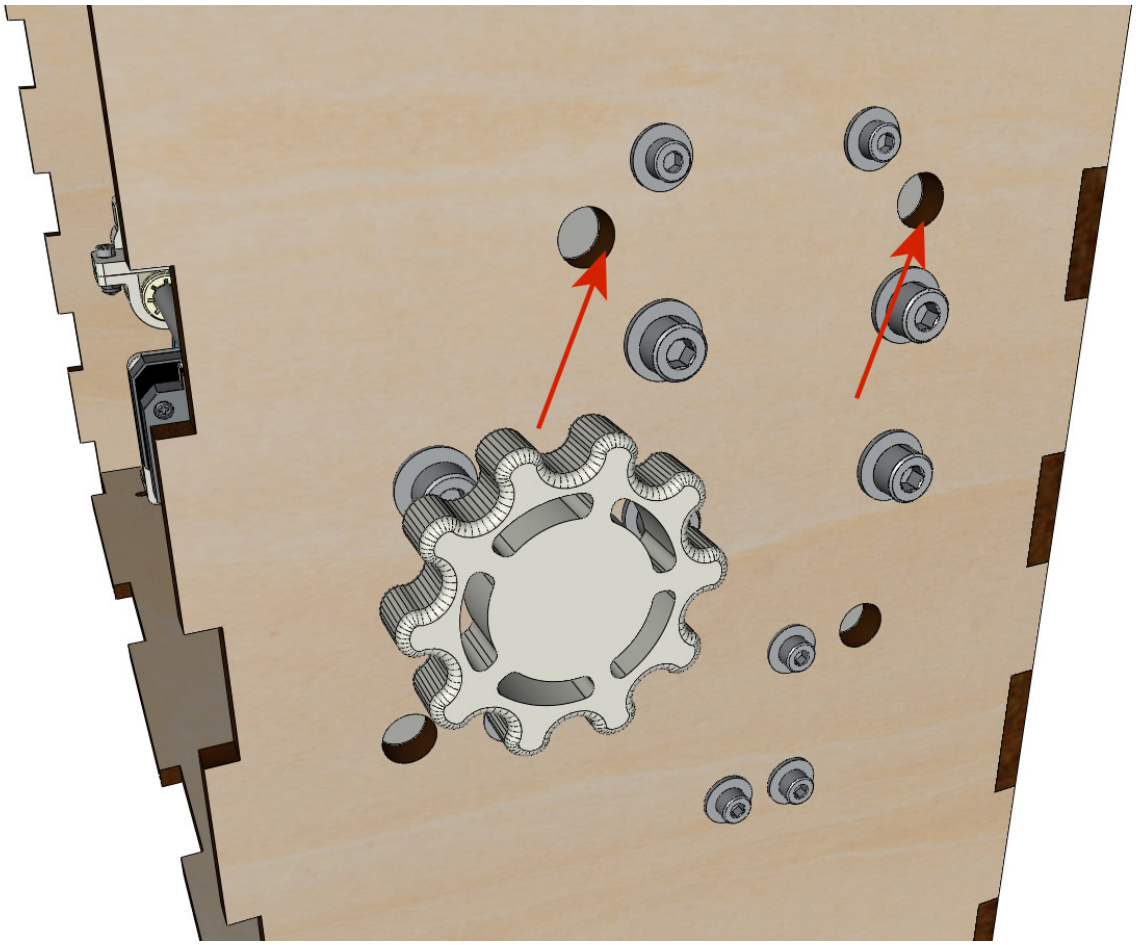


- Thread the top trolley over the rods.

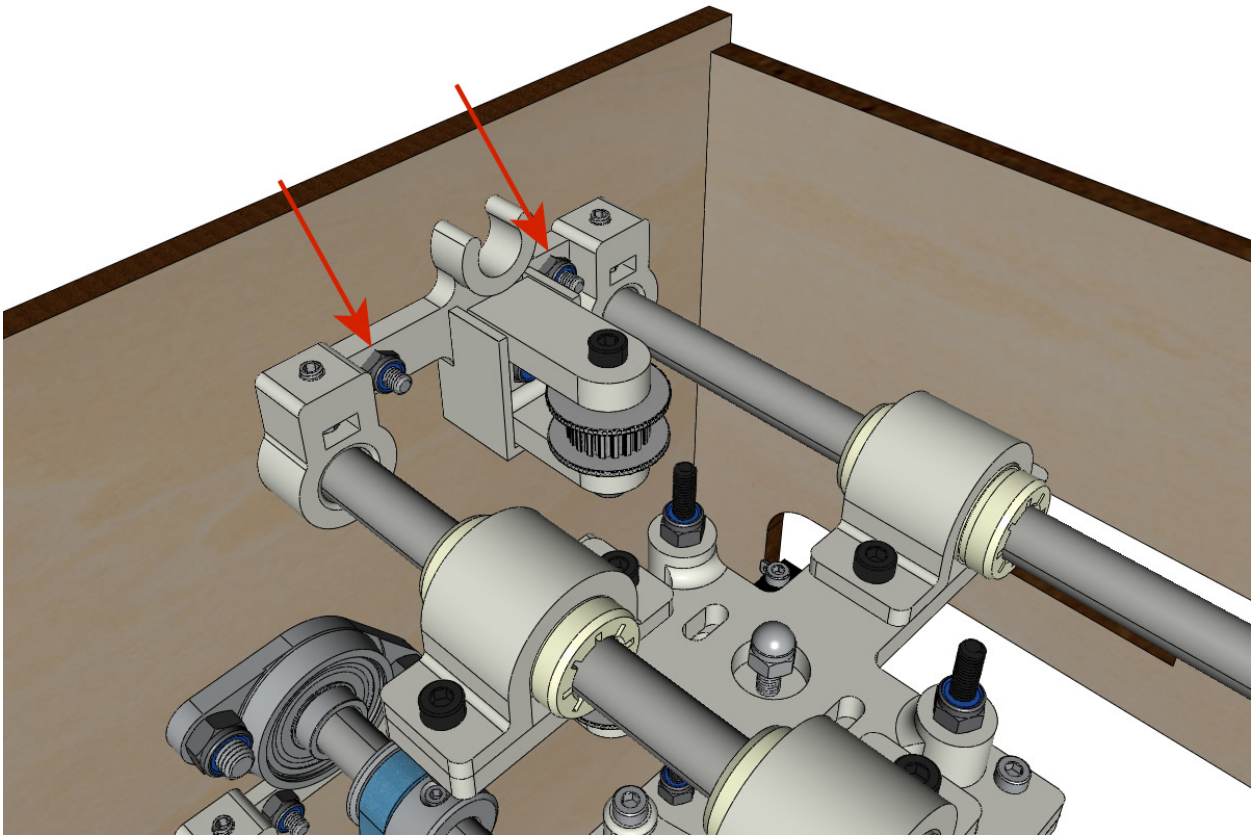


- Finish putting on the bars.

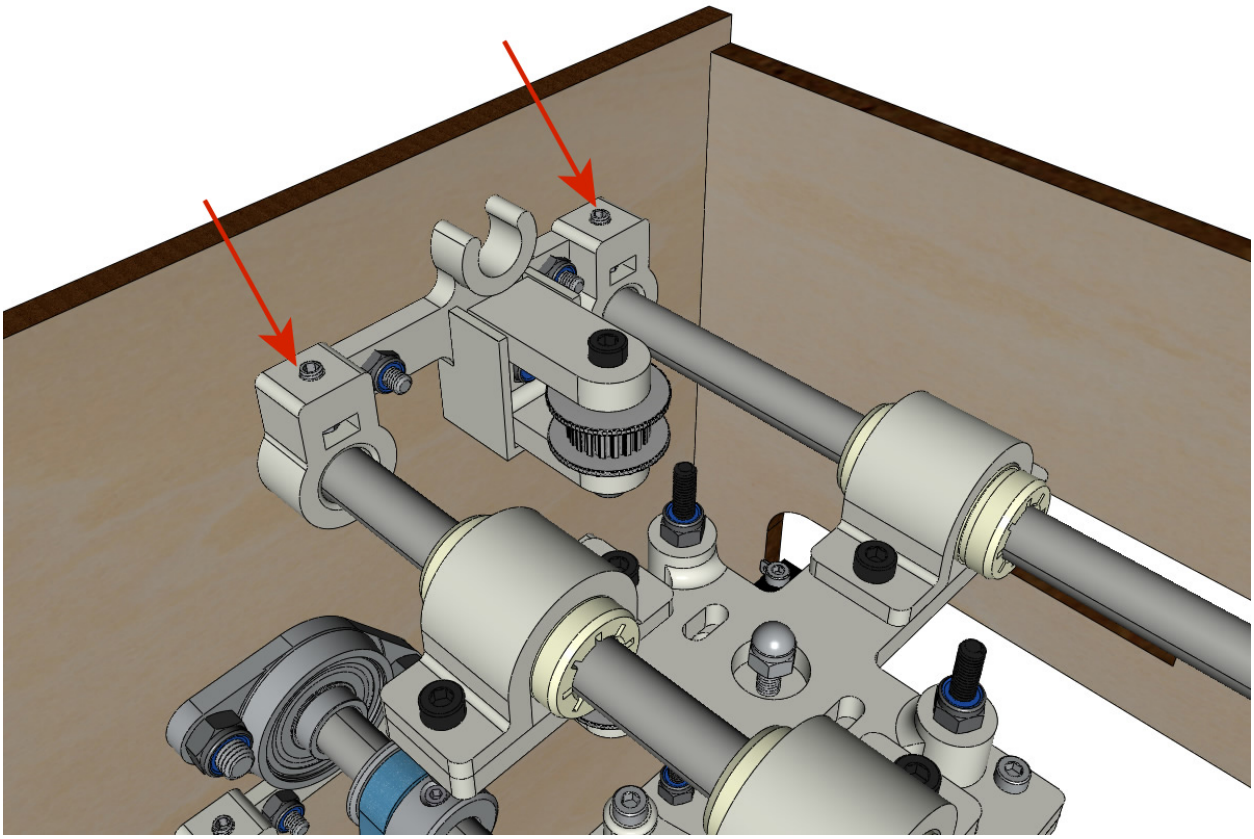
Note: The edge of the wood should remain visible.



- Tighten the axle holder screws on the body on the left and right.



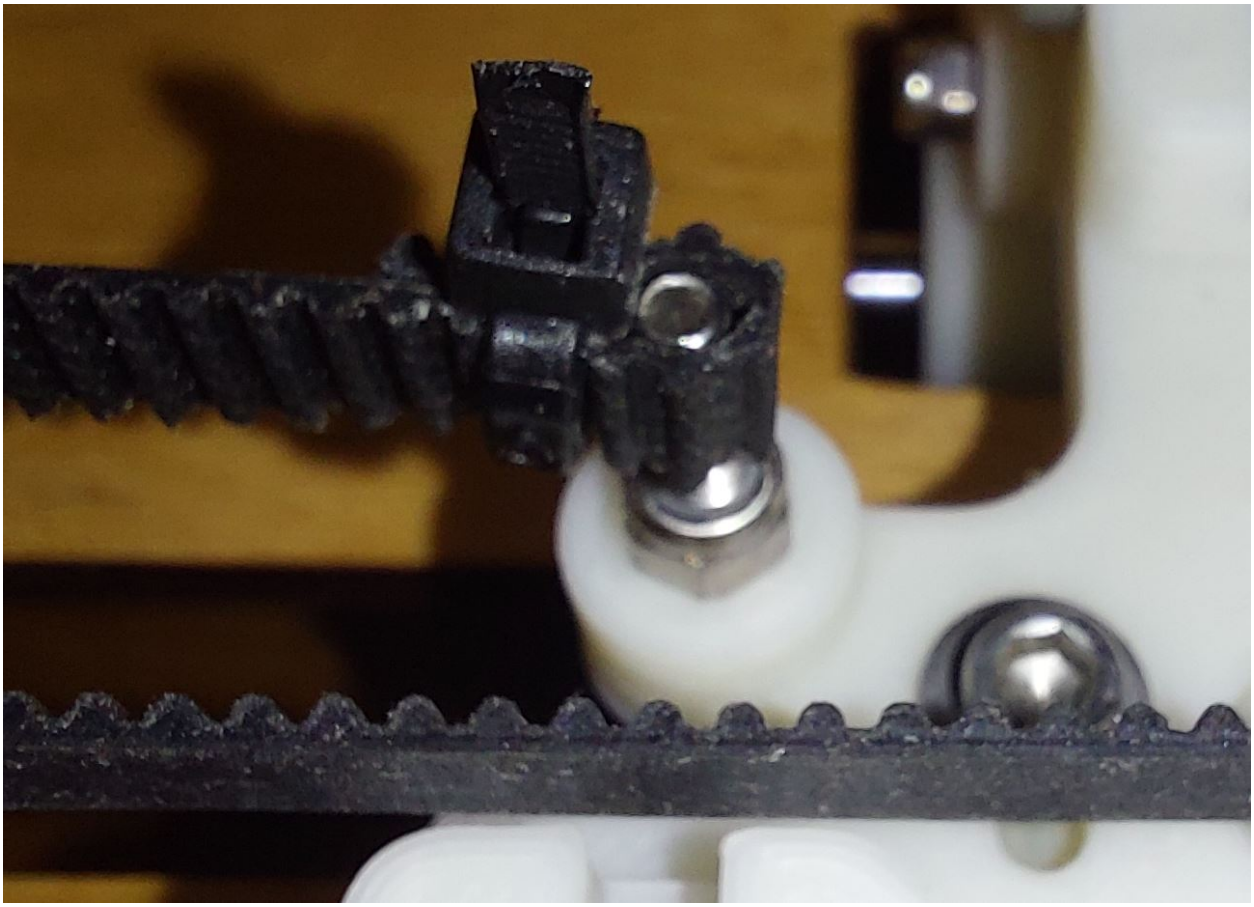
- Screw the grub screws of the axle supports on the left and right.



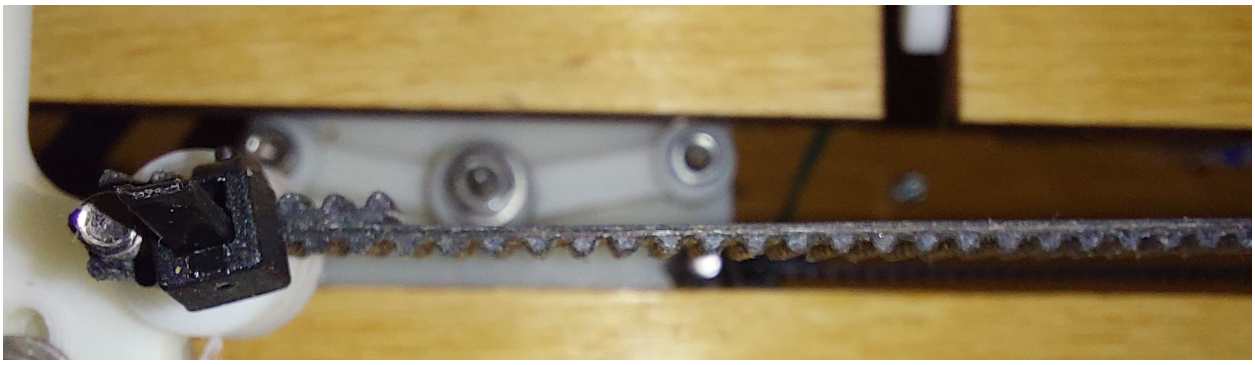
4.34 Laying the trolley strap up

Equipment:

- 1 belt GT2 length ± 620mm
- 2 necklaces
- Using a collar, attach the strap around the carriage screw with the teeth facing out.



- Pass the belt in the free pulley then the pulley of the vertical axis.



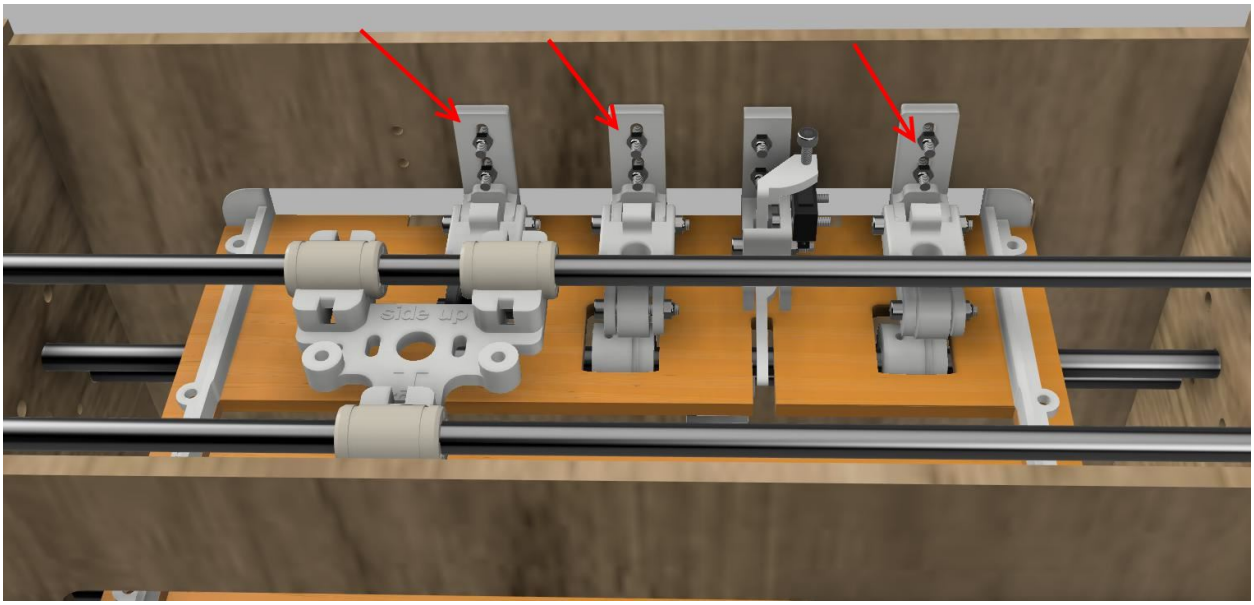
- Tension the belt while holding the carriage and secure the second end of the belt to its screw with a collar.
- Finish stretching the belt with the screw on the outside of the body.

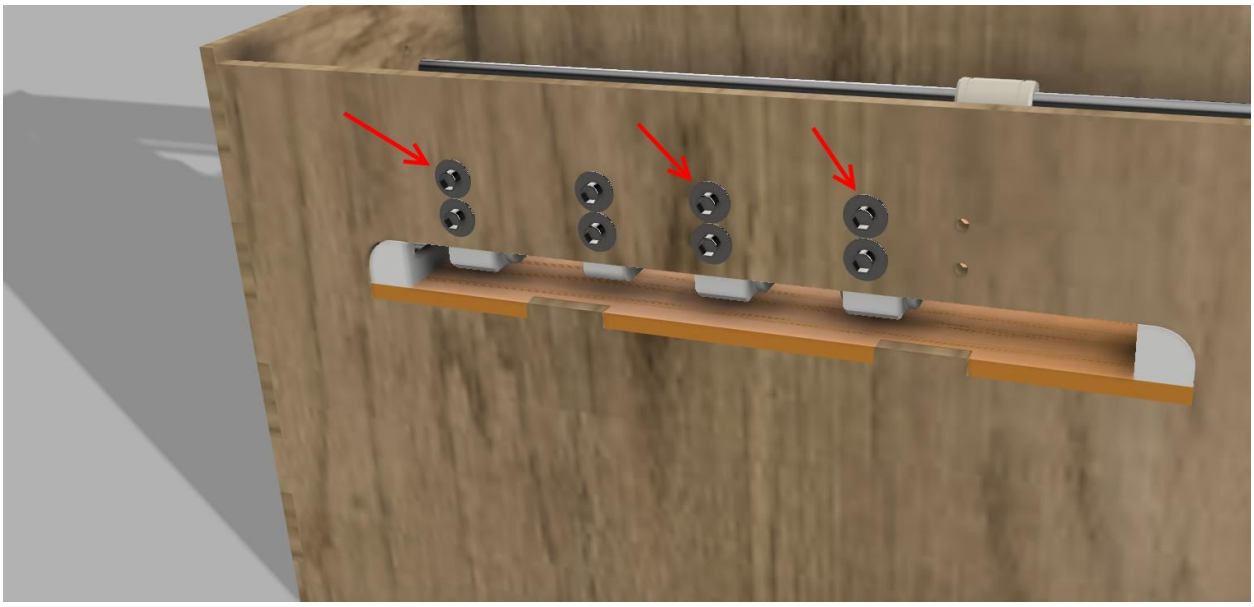
4.35 Assembly of the paperweights (step 2):

Equipment:

- 3 CLIPBOARD mounted in step 1
- 6 screws M3-14
- 6 medium M3 washers
- 6 NYL M3 nuts

Note: The oblong holes in the printed parts adjust the pressure of the CLIPBOARD on the paper.





4.36 Assembly of the Y limit switch

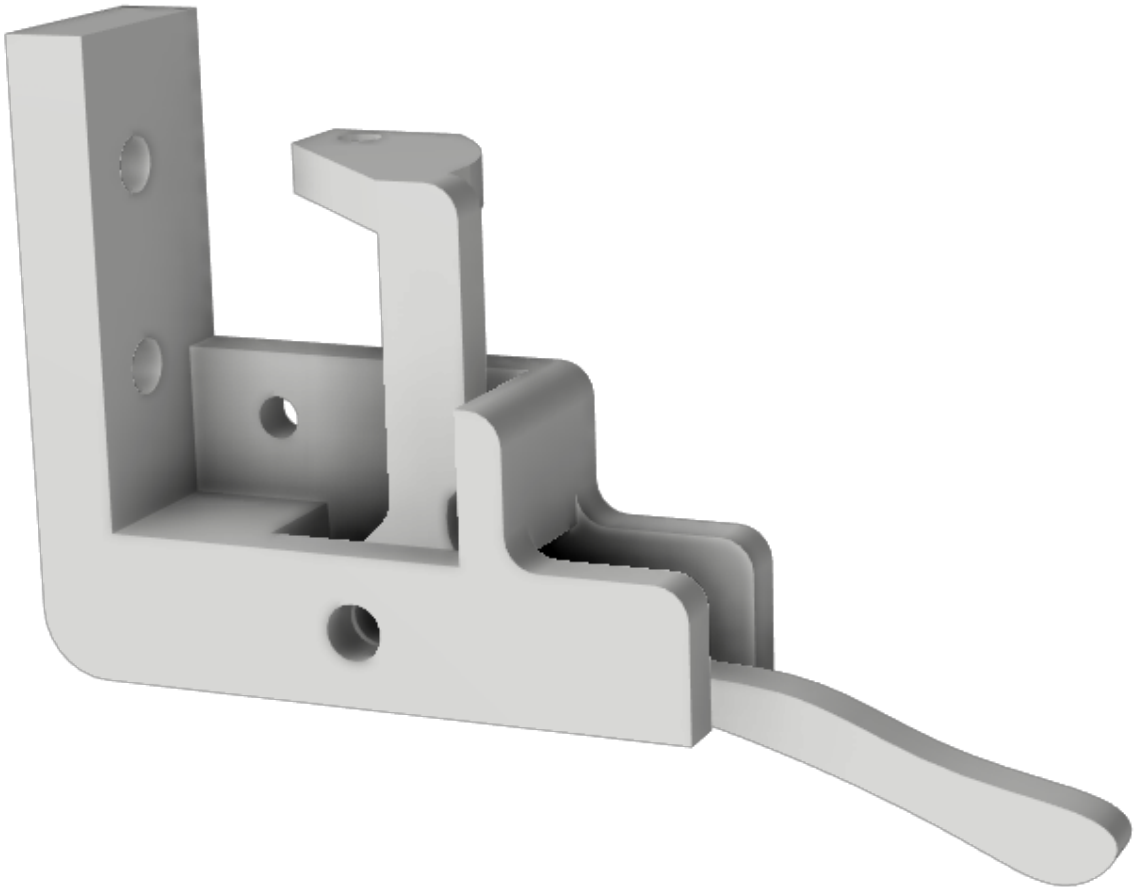
Equipment:

- **3D printed part(s)**: ENDSTOP_Y_support, ENDSTOP_Y_lever
- 2 M3-14 screws
- 1 M3-12 screw
- 1 M3-20 screw
- 2 medium M3 washers
- 3 M3-NYL nuts
- 1 slatted limit switch
- 2 M2.5-14 screw
- 2 nuts M2.5 NYL

Note: The limit switch must be wired before being mounted on its support (not shown).

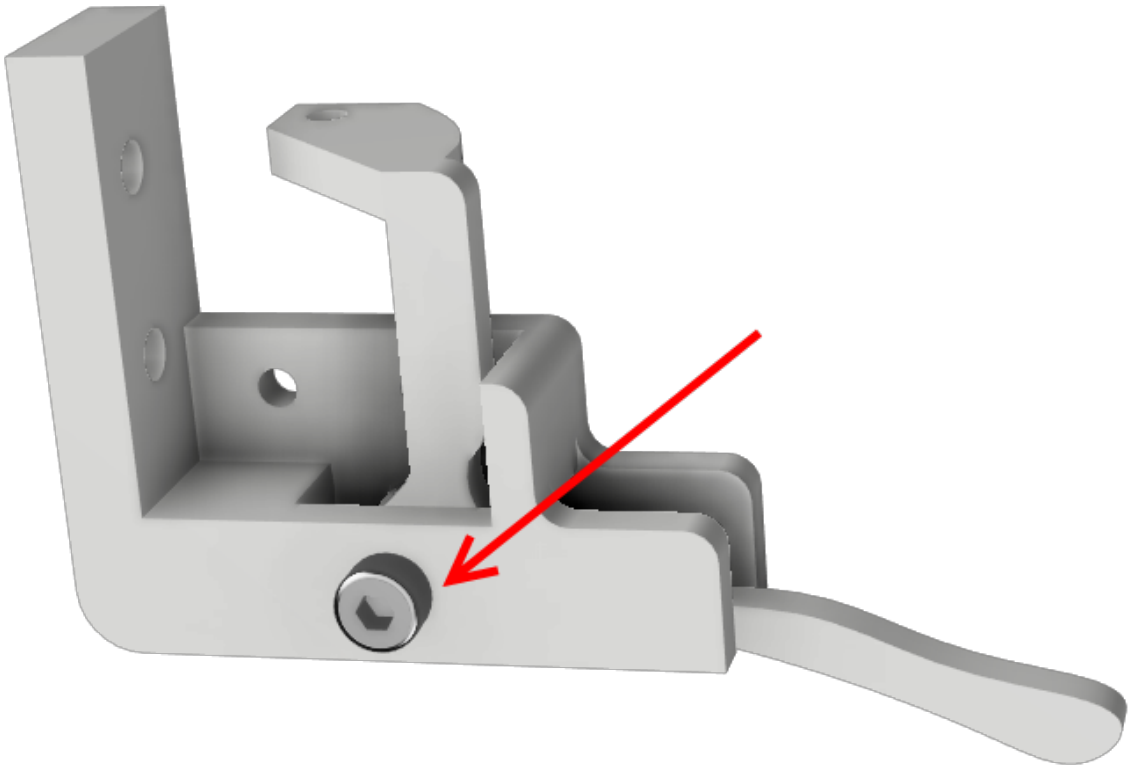
- Tap the adjustment screw support with an M3 tap

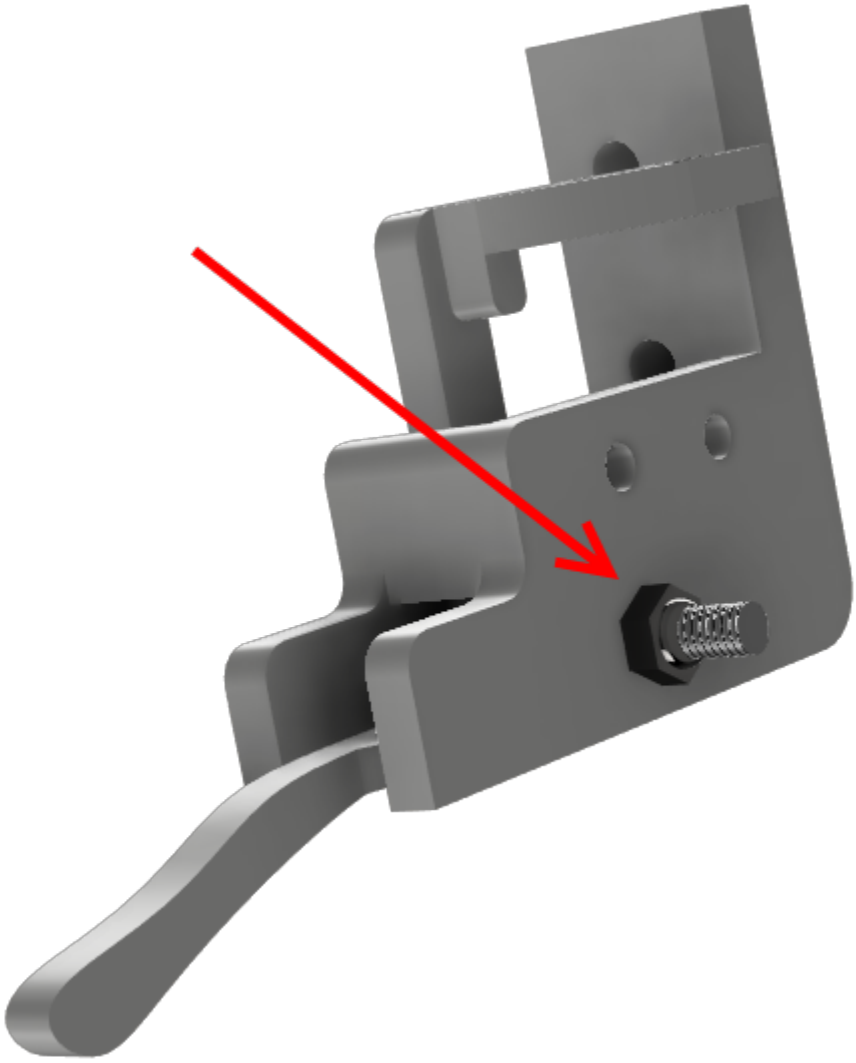
- Position the lever **ENDSTOP_Y_LEVER** in the support**ENDSTOP_Y_support**.



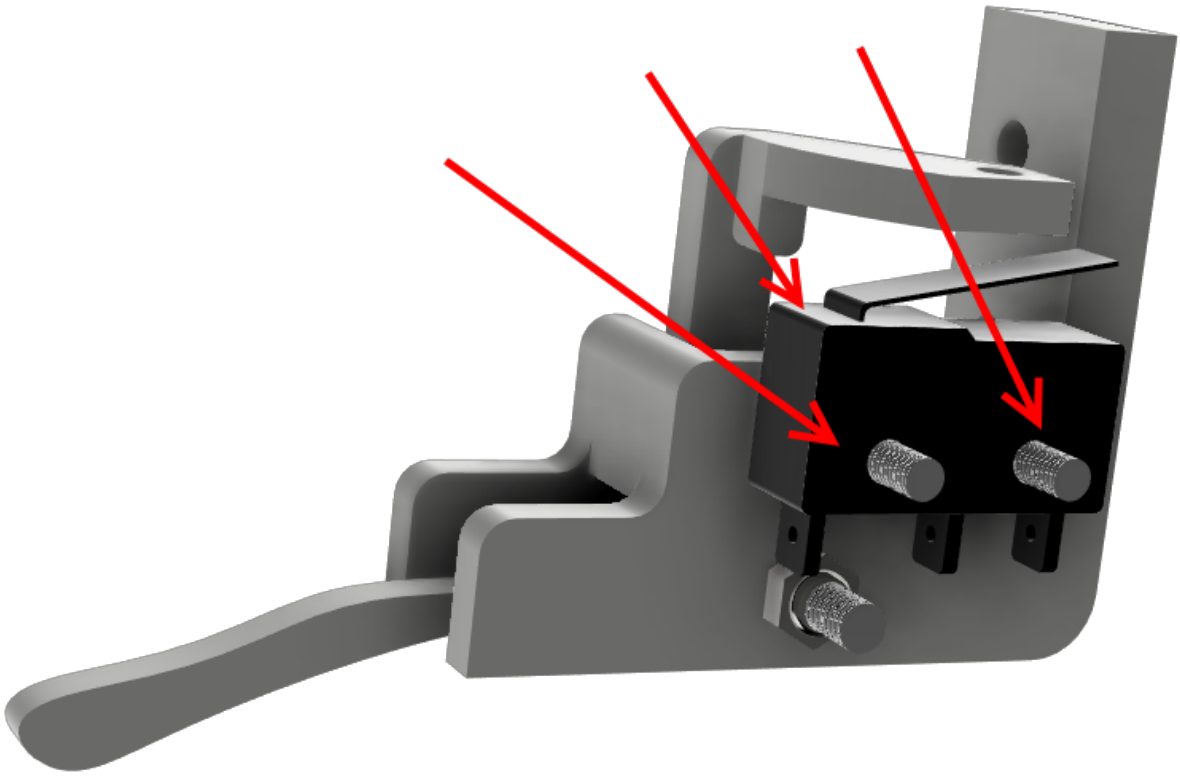
- Fix the lever **ENDSTOP_Y_LEVER** to the support **ENDSTOP_Y_support** with an M3-20 screw and an M3-NYL nut

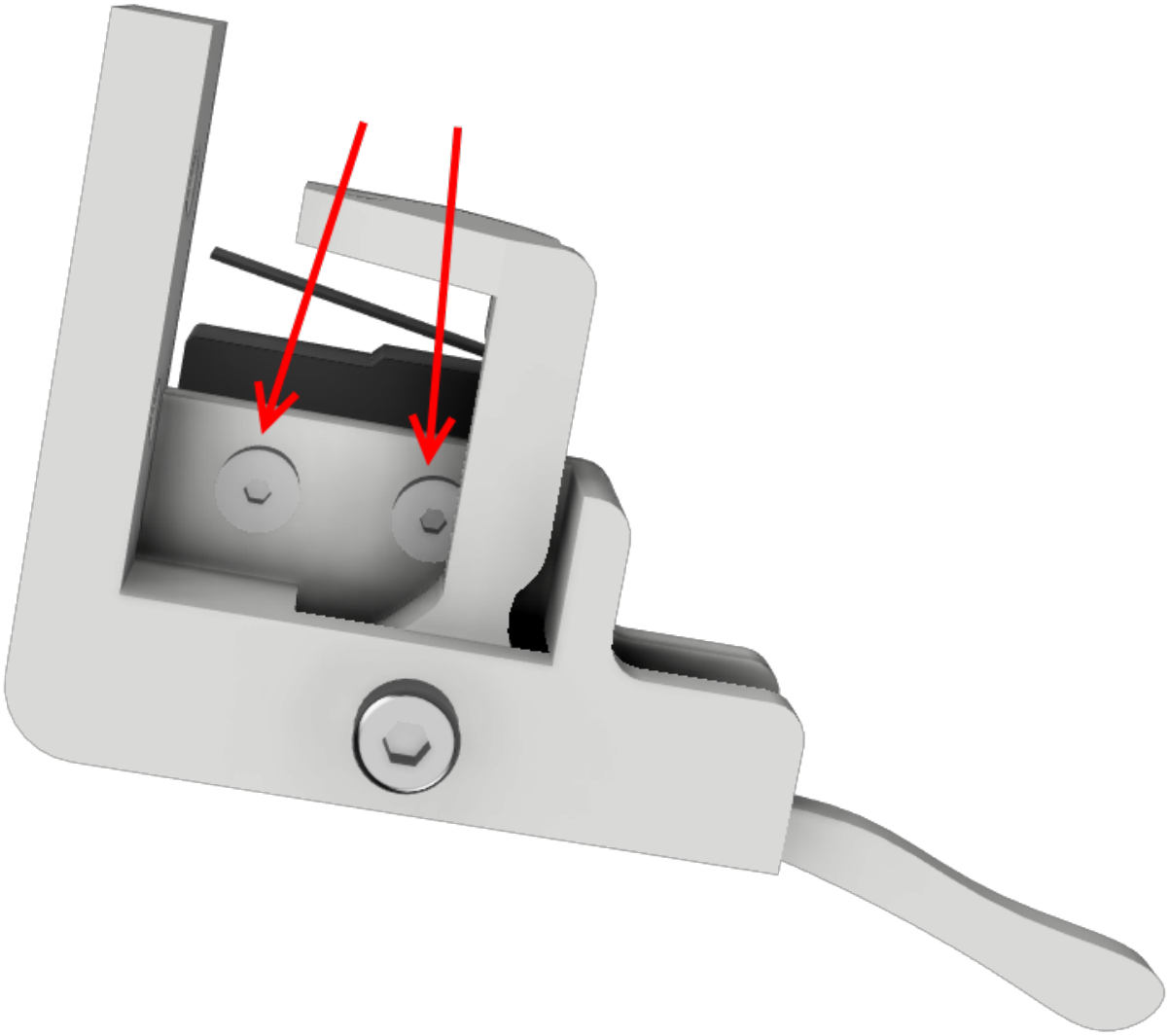
Note: Do not tighten the M3 nut, the lever must be able to rotate freely in his support.



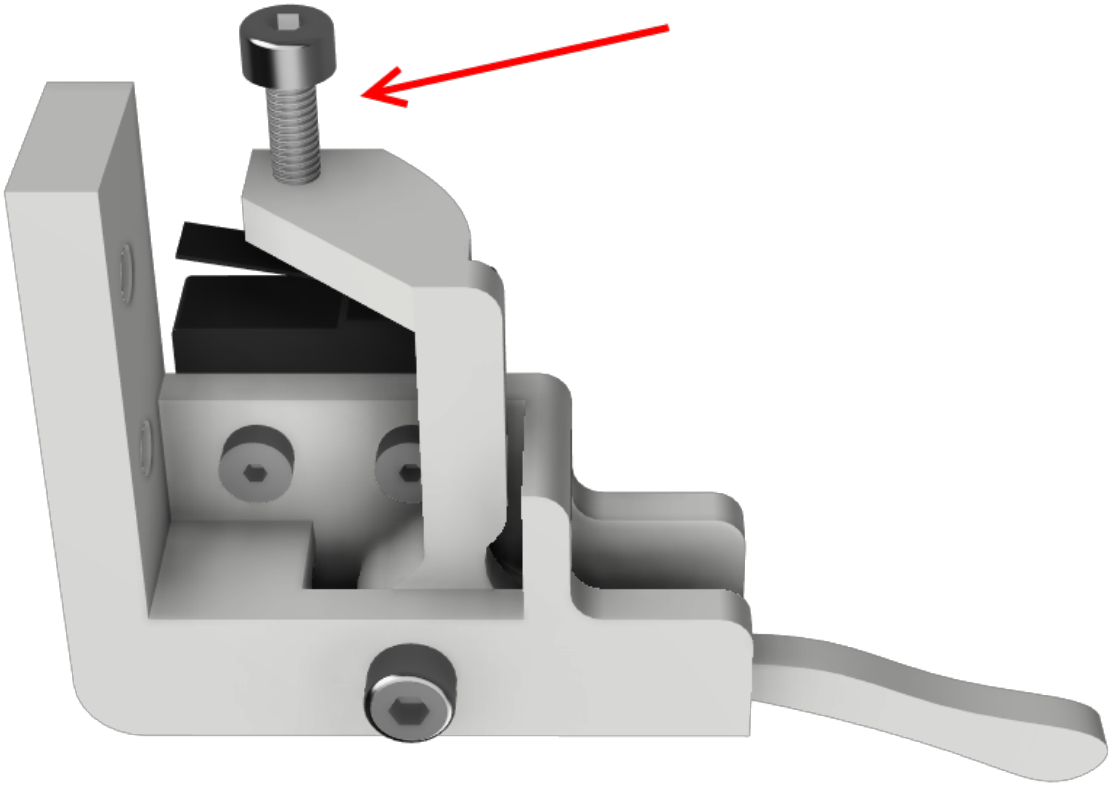


- Assemble the limit switch and the SWITCH_Y_support using M2.5-14 screws and M2.5 NYL nuts.

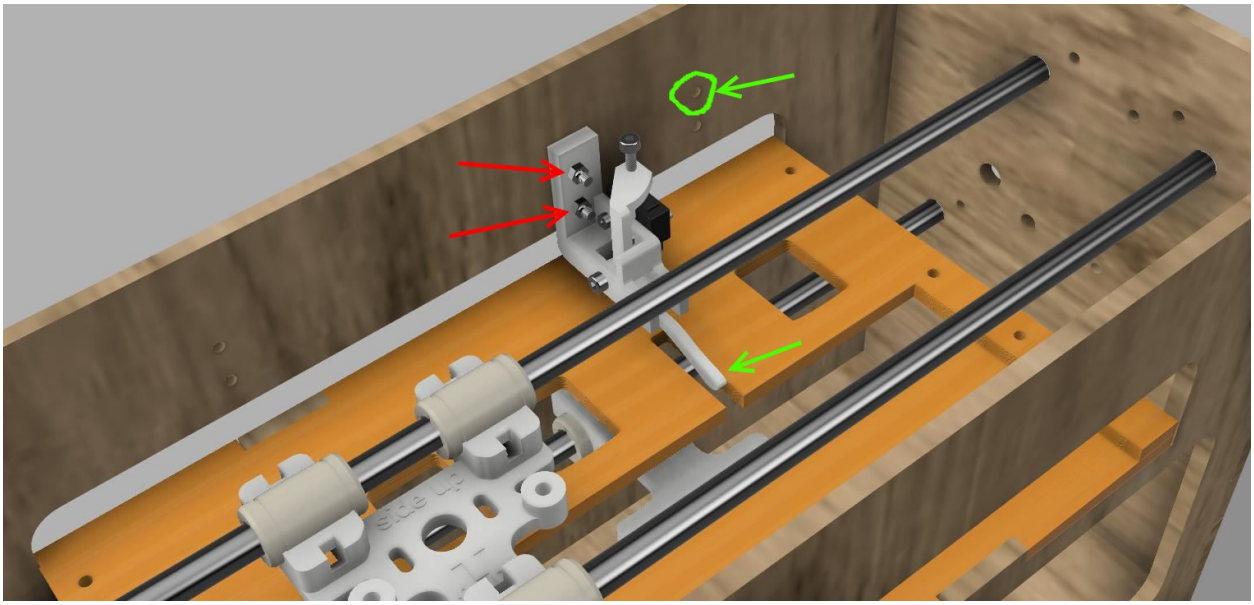


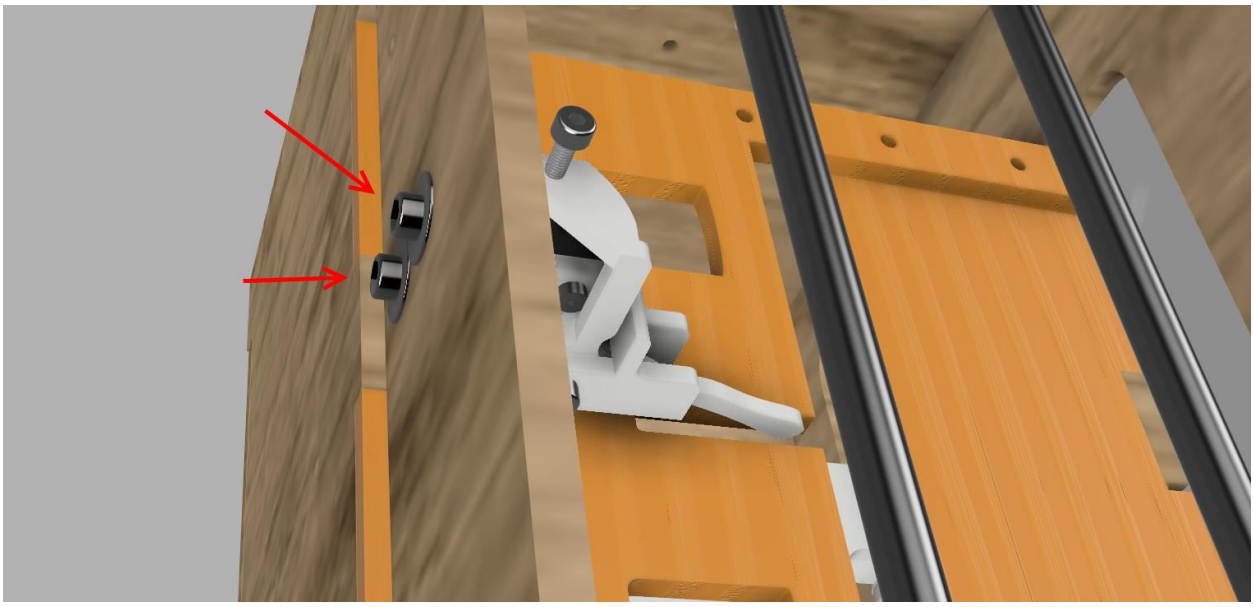


- Position the M3-12 adjustment screw on the lever **ENDSTOP_Y_LEVER**



- Assemble the limit switch assembly and the SWITCH_Y_support to the body using the M3-14 screws, M3 washers and M3 NYL nuts.

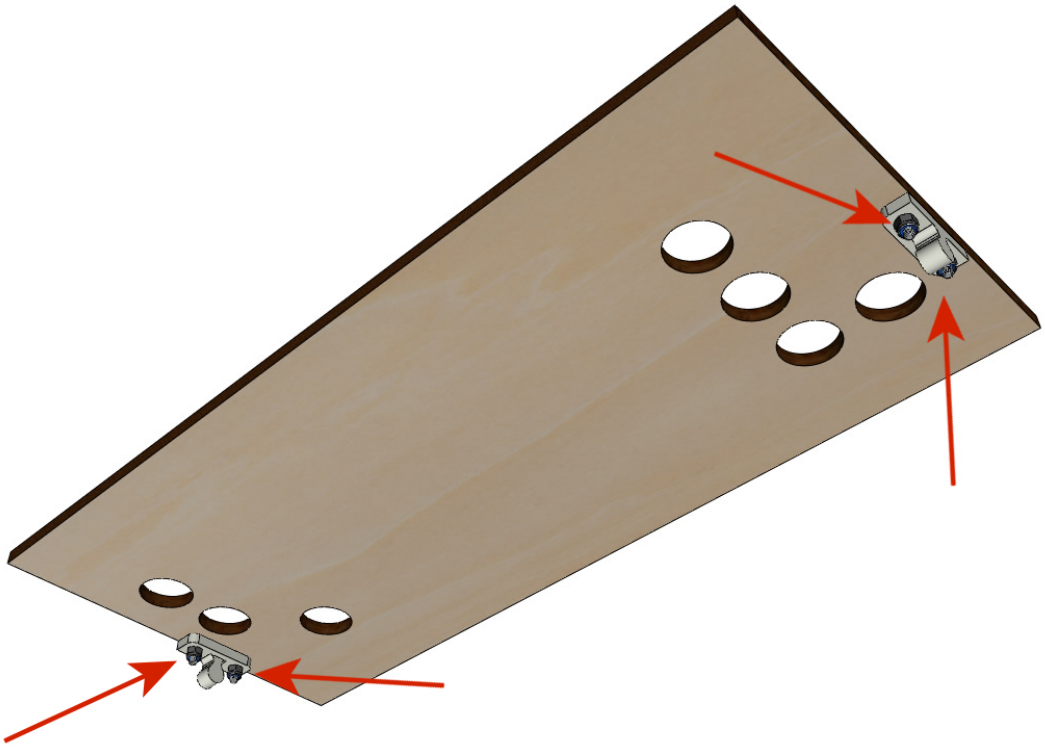


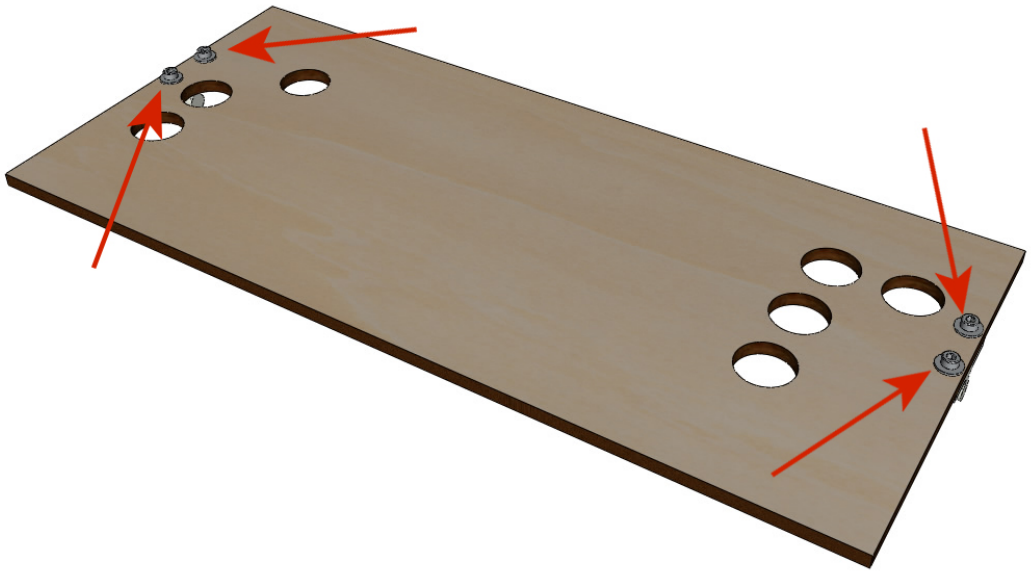


4.37 Fixing the clips on the lid

Equipment:

- **3D printed parts**: 2 LID_LOCK
- 4 M3-14 screws
- 4 NYL M3 nuts
- Assemble the 2 LID_LOCK on the cover using the M3-14 screws, M3 washers and M3 NYL nuts.

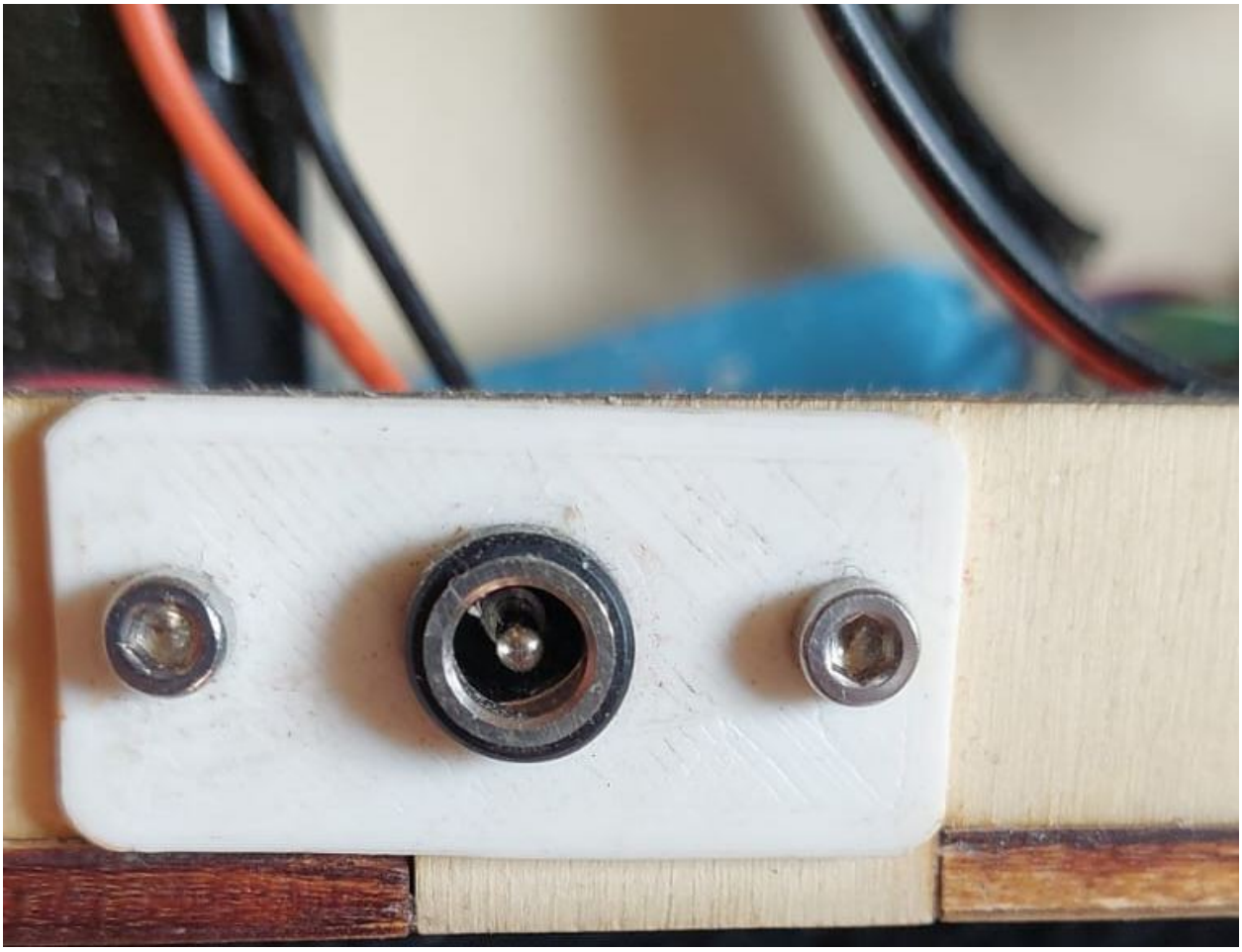




4.38 Fixing the plate for the power supply base

Equipment:

- **3D printed part**: POWER_plate
- 2 M3-14 screws
- 2 M3 NYL nuts



4.39 Electronic board controller mount

Equipment:

- MKS GEN 1.4 card
- 4 spacer M3-12
- 4 medium M3 washers
- 8 screw M3-8
- Assemble the 4 spacers on the card.

Note: To be able to carry out the final adjustments easily, we recommend wiring the card outside the chassis. Once the embosser is functional, you can mount the board in the embosser.

4.40 Electronic board wiring

General diagram:

Motor X : Trolley Motor
Motor Y : Paper advance Motor
ENDSTOP X : Trolley EndStop
ENDSTOP Y : Paper detection EndStop

EndStops are used in normally closed configuration
!!! Please Note Free-Wheel diode orientation !!!

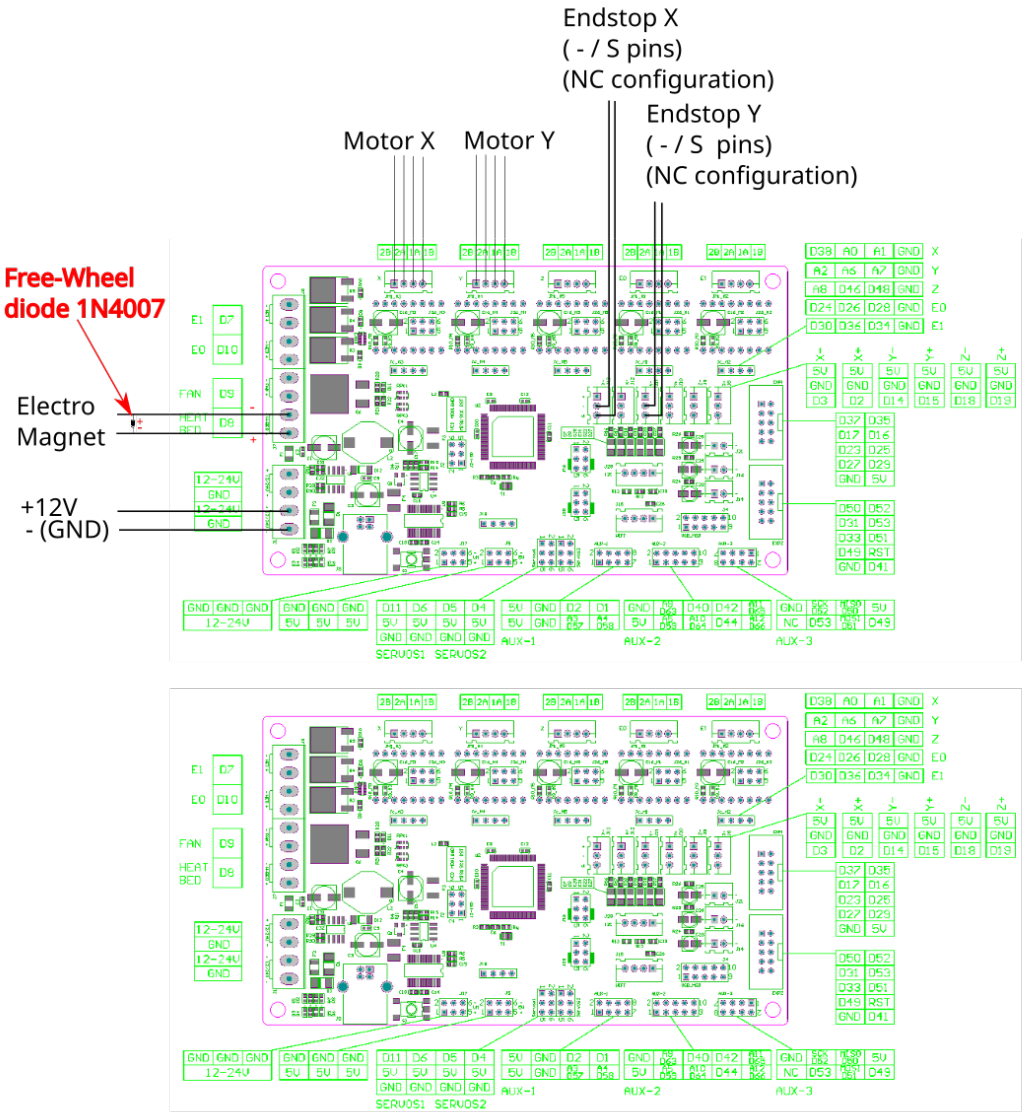
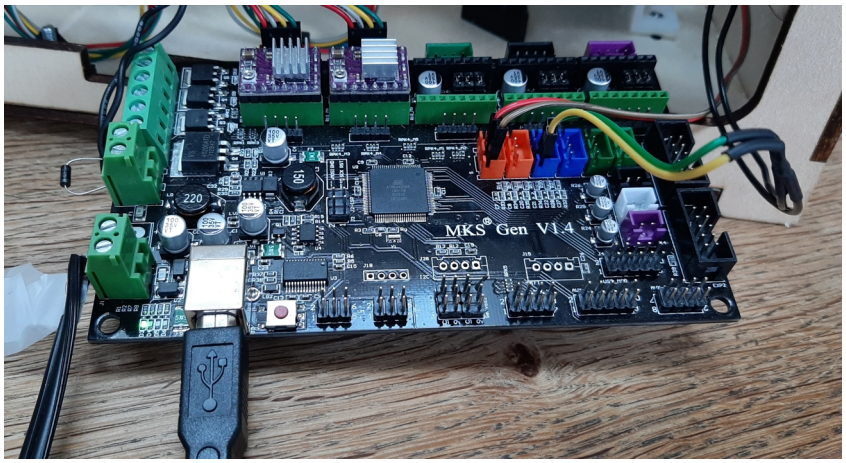


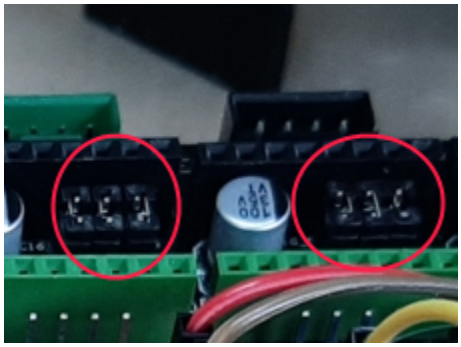
Photo of the assembled board



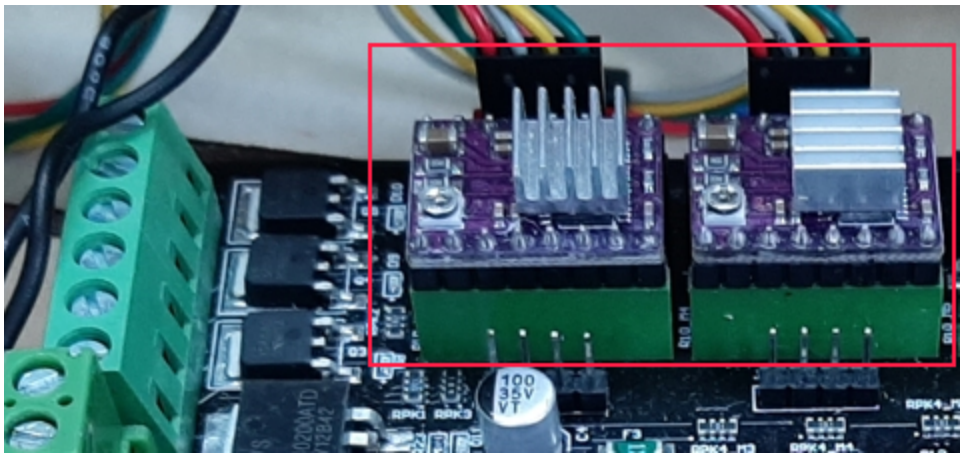
4.41 Laying the drivers on the electronic board

Equipment:

- MKS GEN 1.4 card
- 2 DRV8825 drivers
- 6 jumpers
- If the card is not supplied already equipped with jumpers, put in the places of the drivers of engines X and Y.

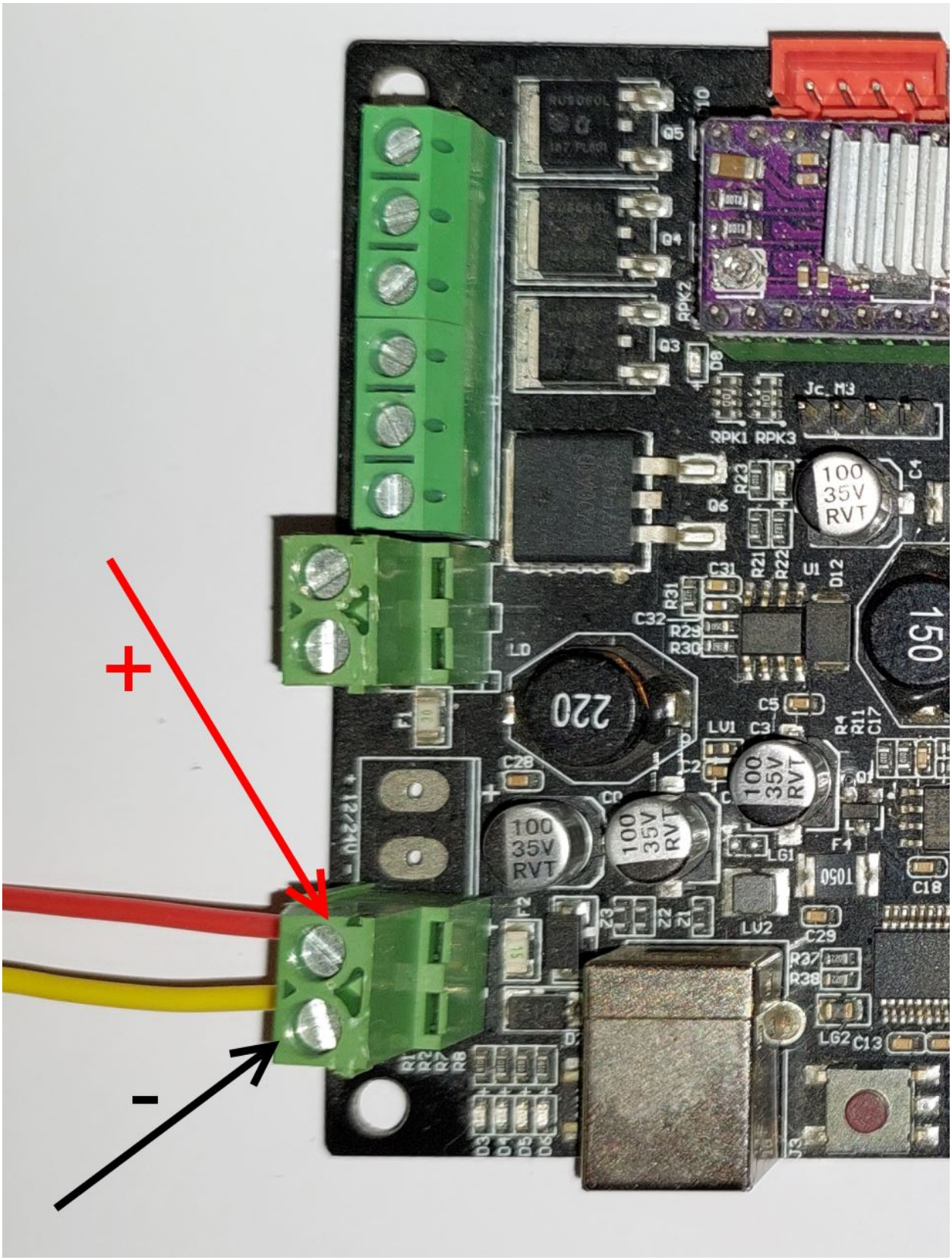


- Push the drivers into X and Y slots.



4.42 12V power wiring

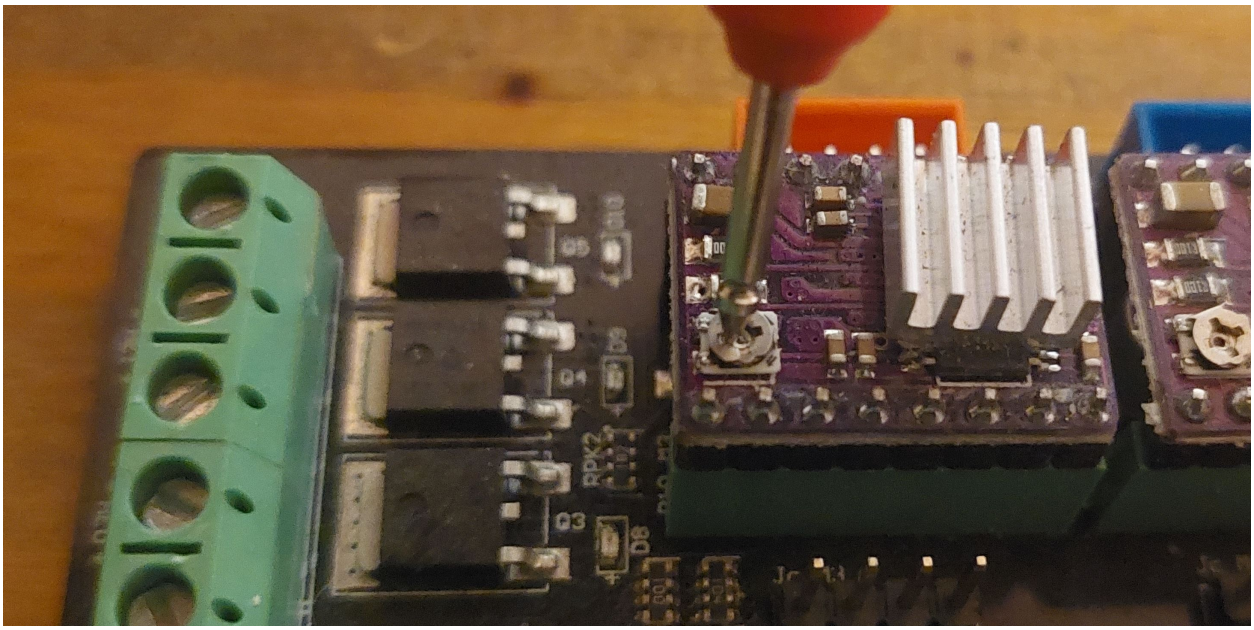
- place the 2 wires coming from the **POWER_plate** socket in the terminal block of the MKS board

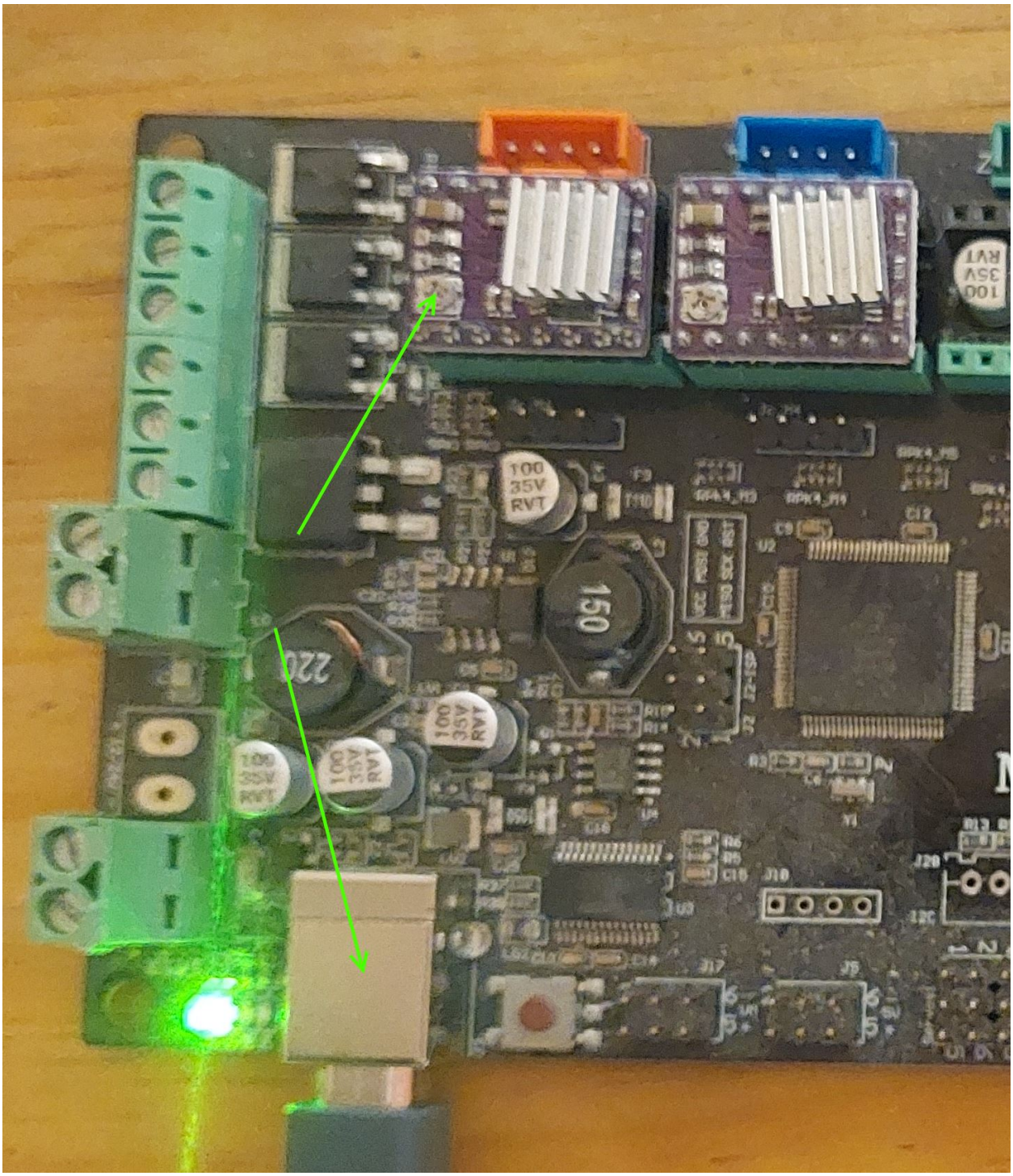

+
-
100
35V
RVT
220
150
Jc_M3
RPK1
RPK3
RPK2
C18
C29
LG2
C13

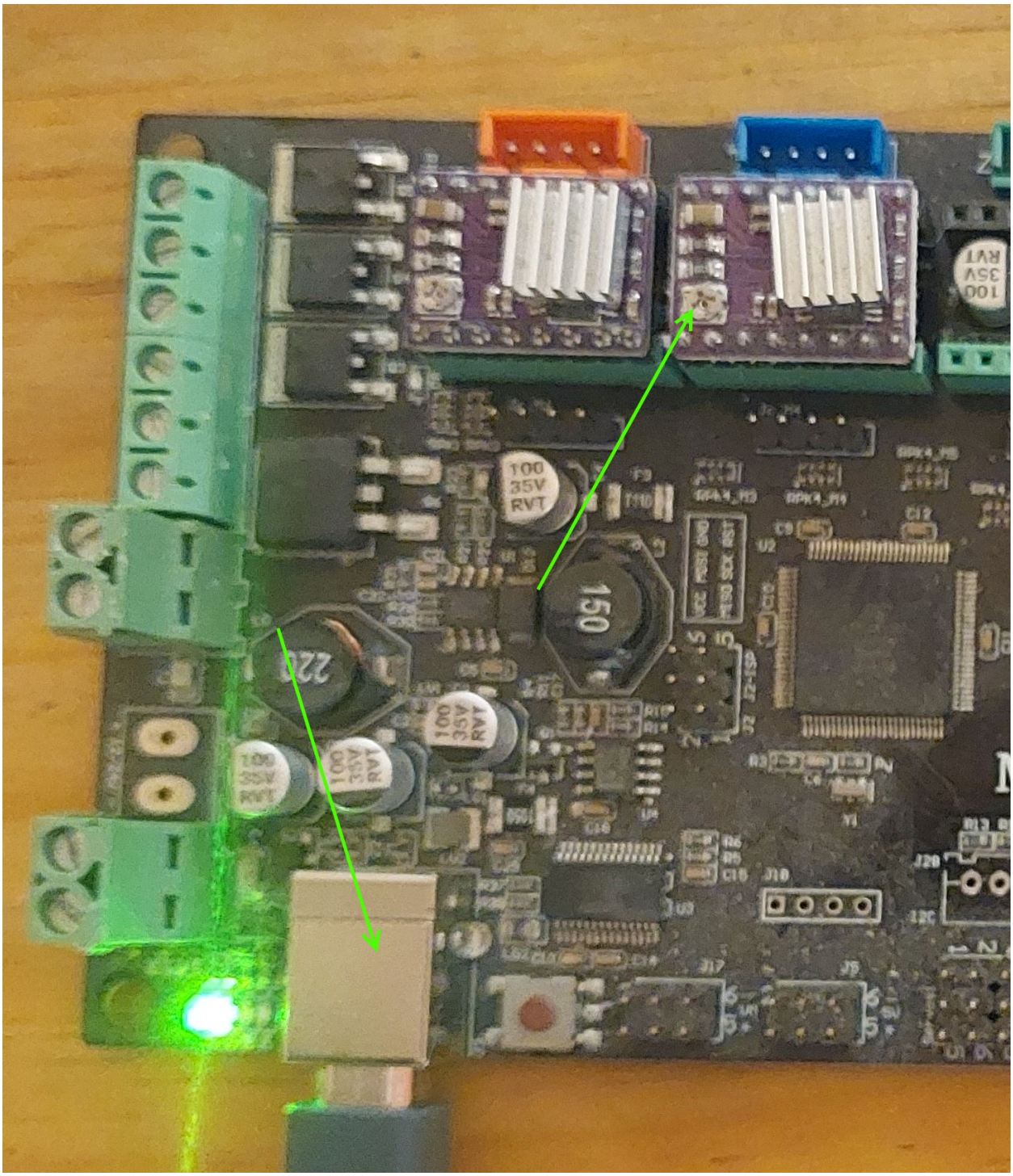
4.43 Adjusting motor drivers

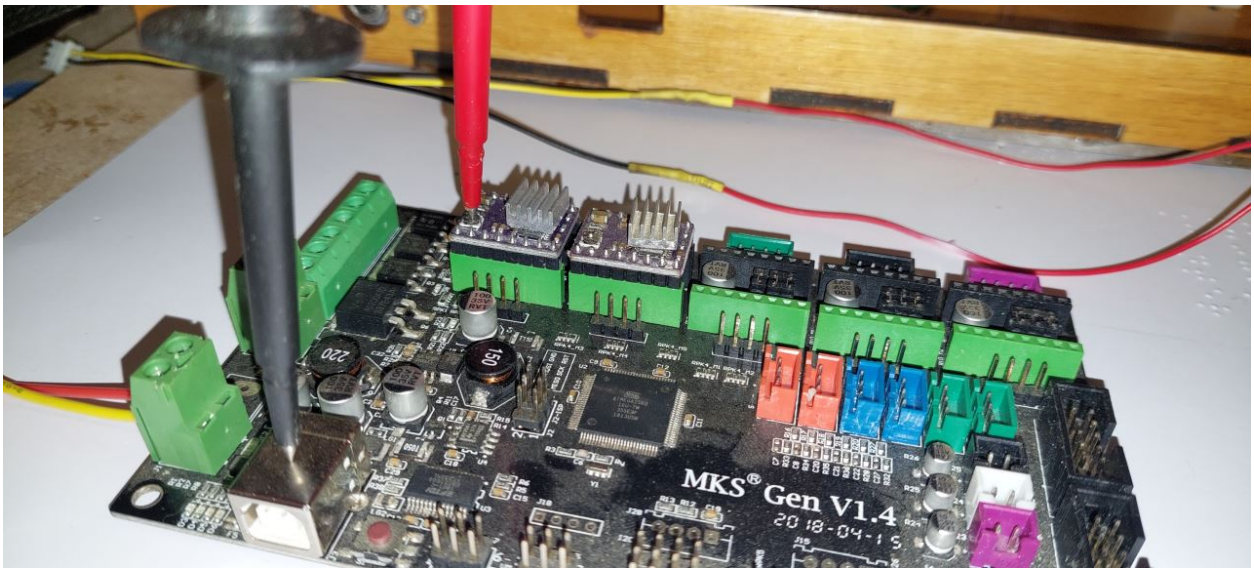
Note: This step must **IMPERATIVELY** be carried out **before** wiringengines.

- Check that you can connect the 12V power supply to the board (a last check to avoid sparks is better :-))
- Connect the 12 V power supply to the board.
- for each driver, measure, with a multimeter, the voltage between the adjustment potentiometer and mass of the USB connection.




100
35V
RVT
150
220

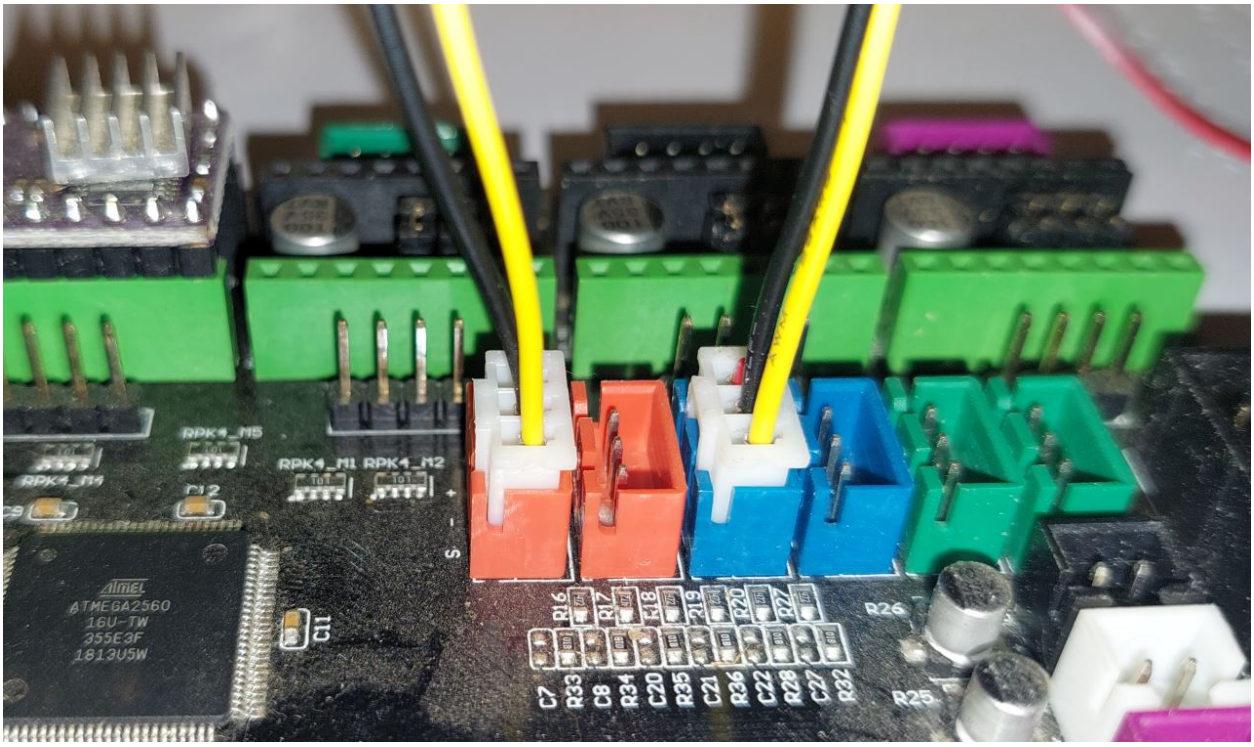

100
35V
RVT
150
220



- The measured voltage should be close to 0.6 V for DRV8825 drivers, ifthis is not the case, use a screwdriver to turn the potentiometer setting and redo the measurement.
- Once the voltage measured on each driver is correct, you can move on

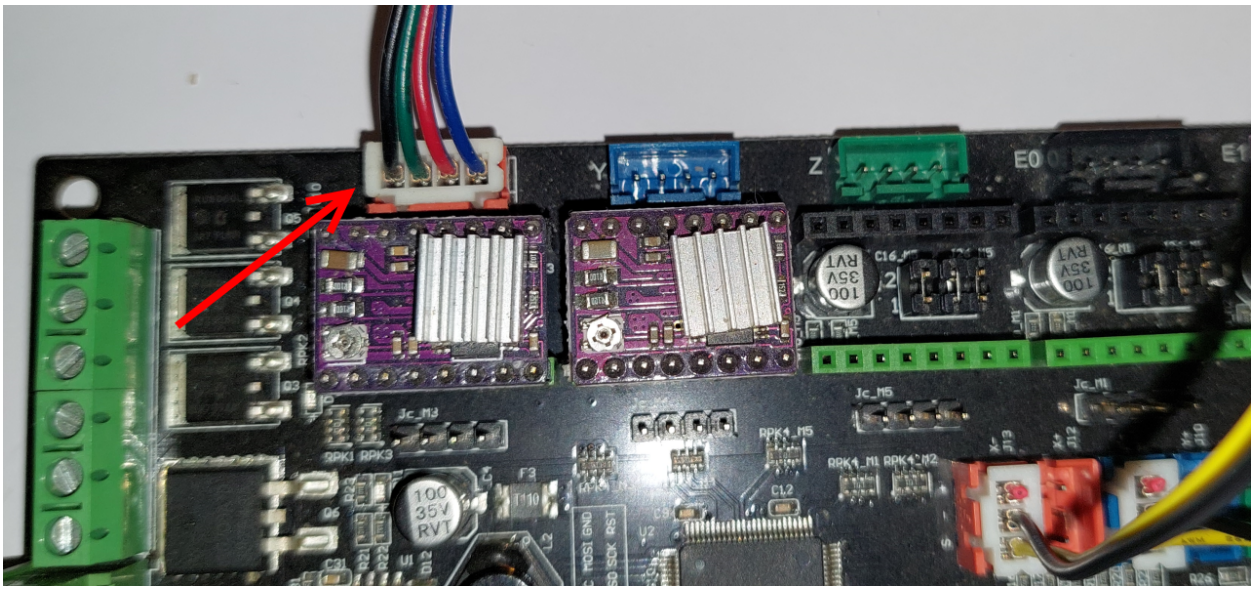
4.44 Wiring of limit switches

- Wire the limit switches on the board.
- The limit switch X (carriage) must be connected to the connector of left (red)
- The Y limit switch (paper detection) must be plugged into the connectorleft (blue)

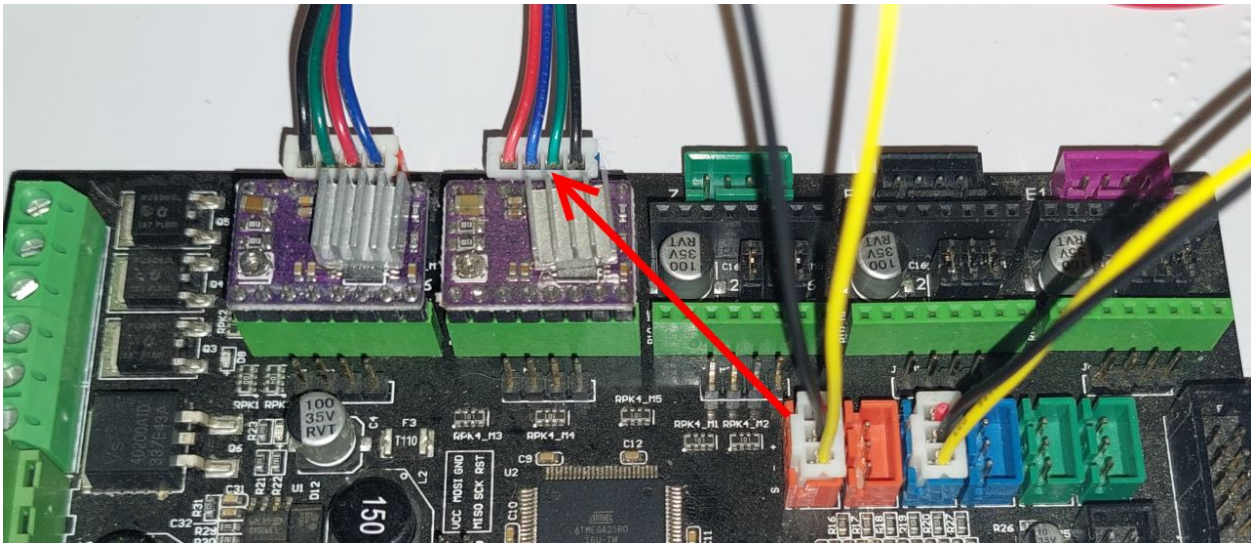


4.45 Connecting the motors to the board

- Connect the motors to the control board with cables.
- Motor X (carriage) must be plugged into the left connector(red)

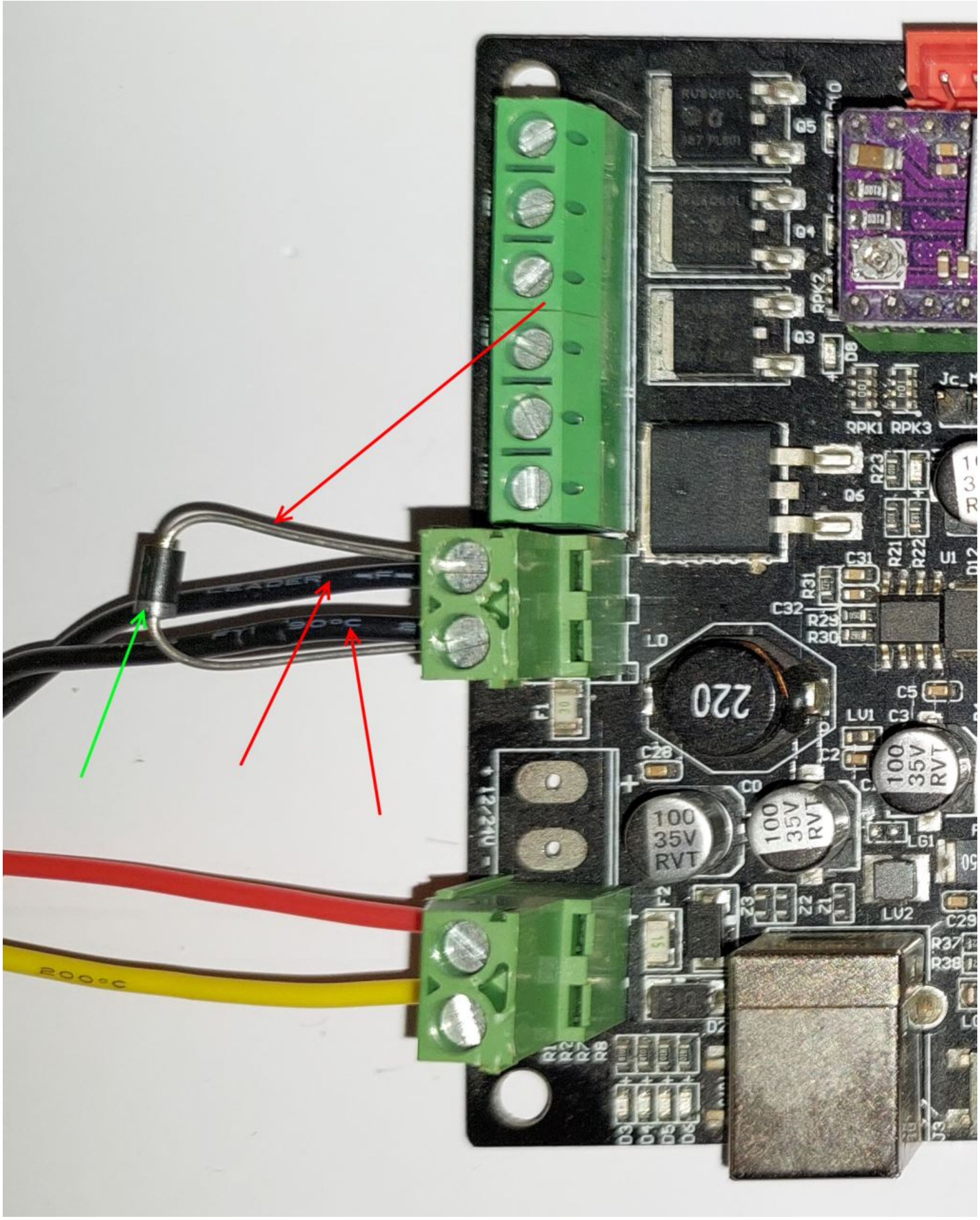


- The Y motor (paper) must be plugged into the right connector (blue)



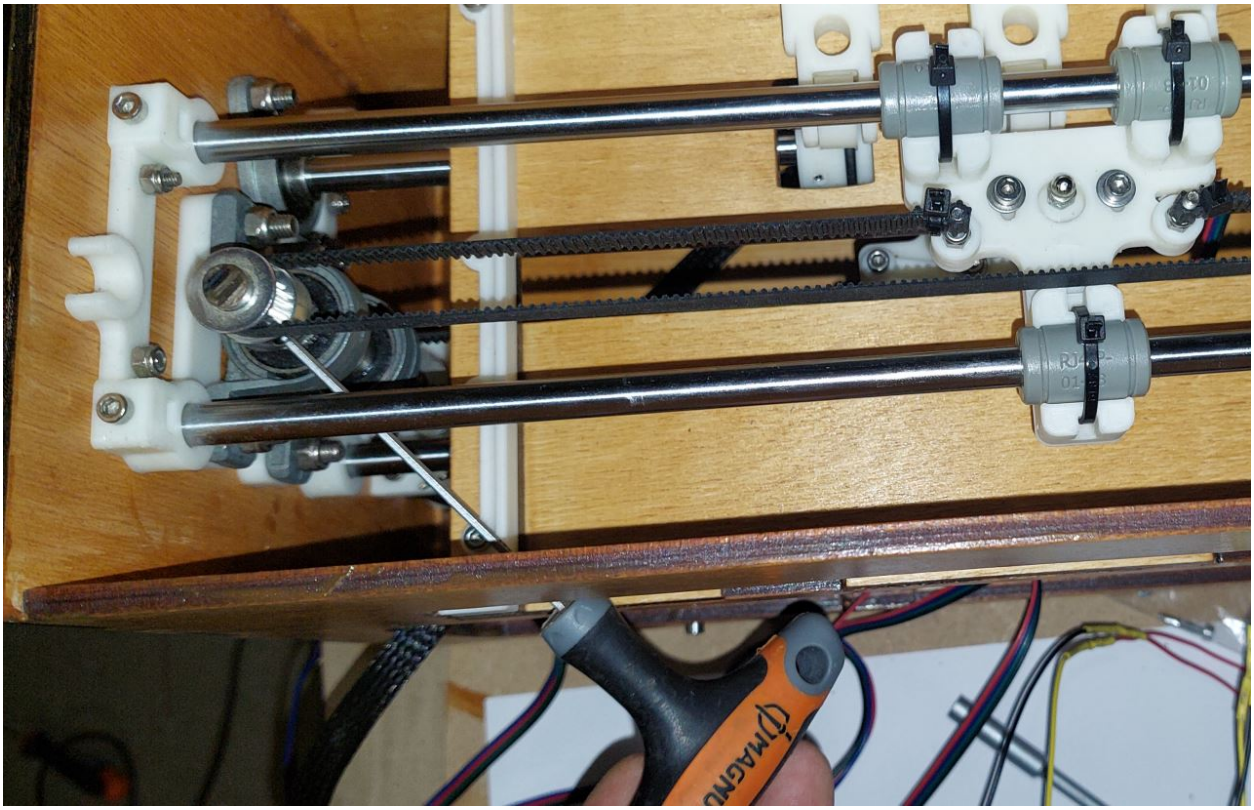
4.46 Wiring of the electromagnet

- place the 2 wires of the electromagnet and the freewheel diode. Caution in the sense of the diode (white line).

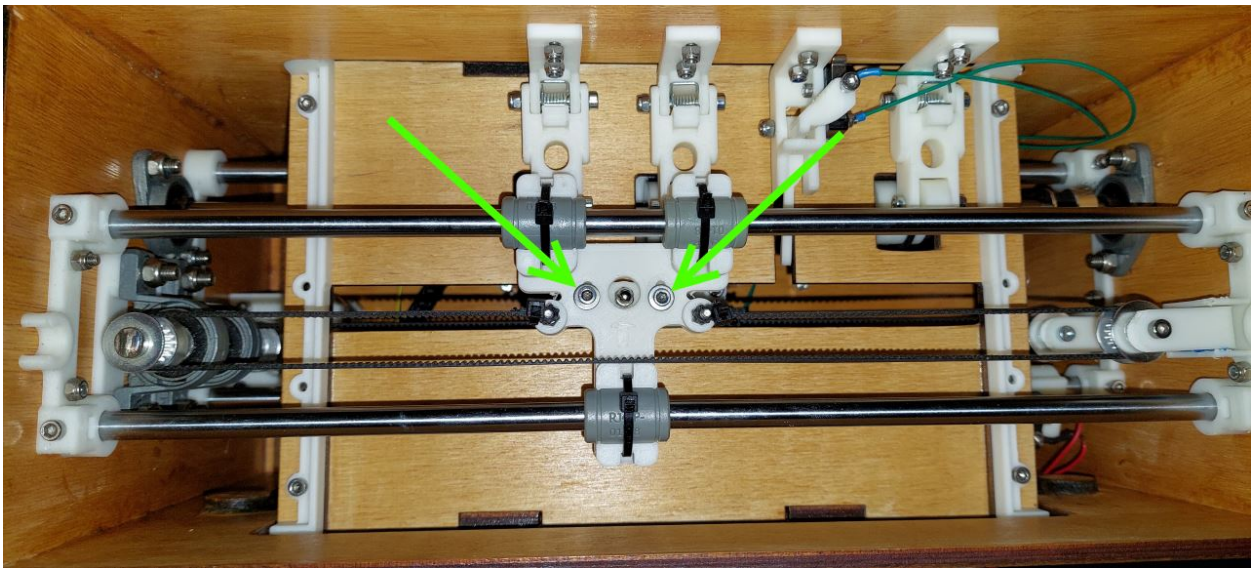

Q5
Q4
Q3
Q6
RPK2
RPK1 RPK3
D8
R23
R21
R22
U1
C31
R31
C32
R29
R30
LD
220
F1
C5
LV1
C3
C2
C28
C0
100
35V
RVT
LG1
F2
Z3
Z2
Z1
LV2
C29
R37
R38
D2
R1 R2 R7 R8
D3 D4 D5 D6
12/24V
LEADER
200°C

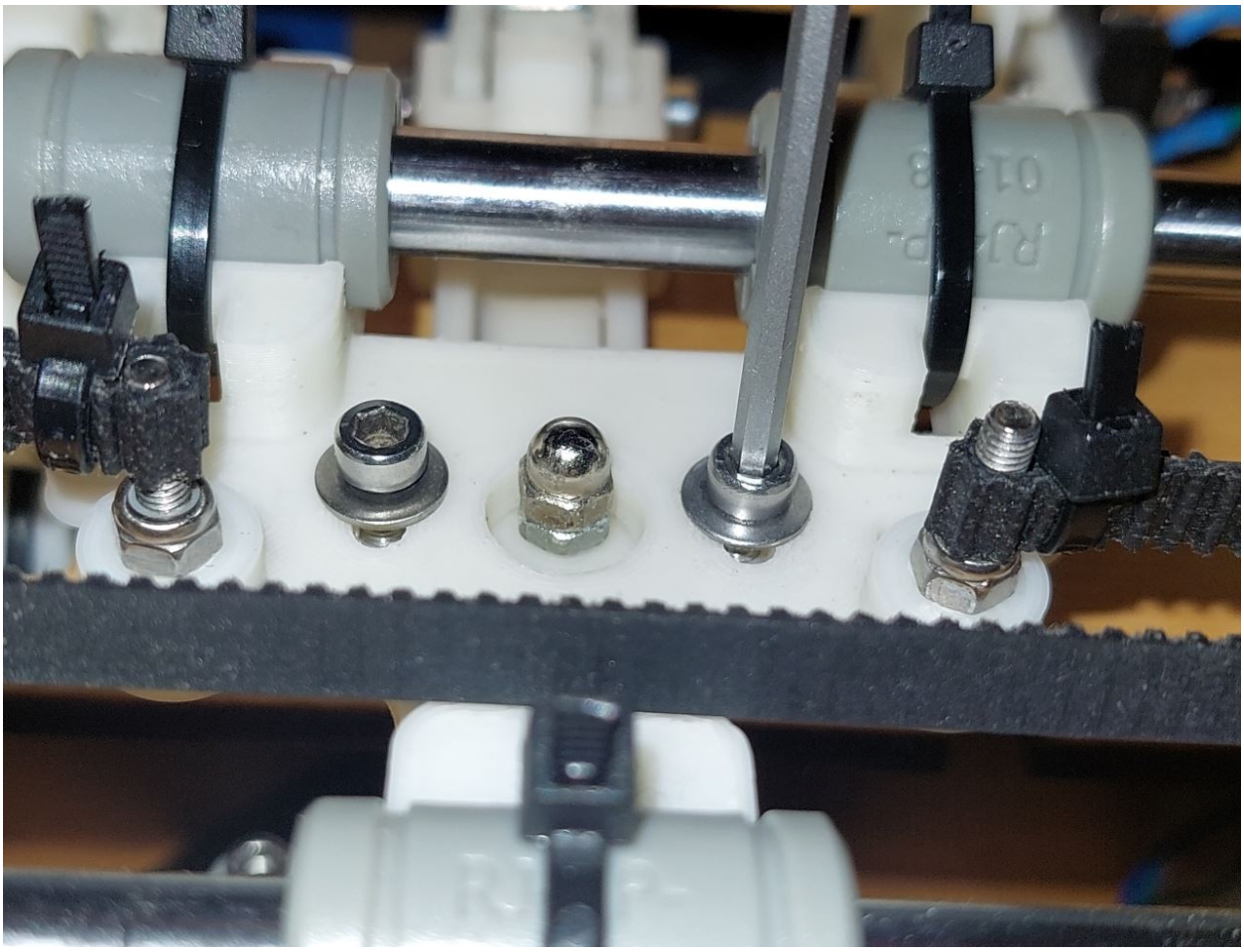
4.47 Horizontal alignment of the top trolley

- Loosen the pulley on the vertical axis to release the upper carriage.



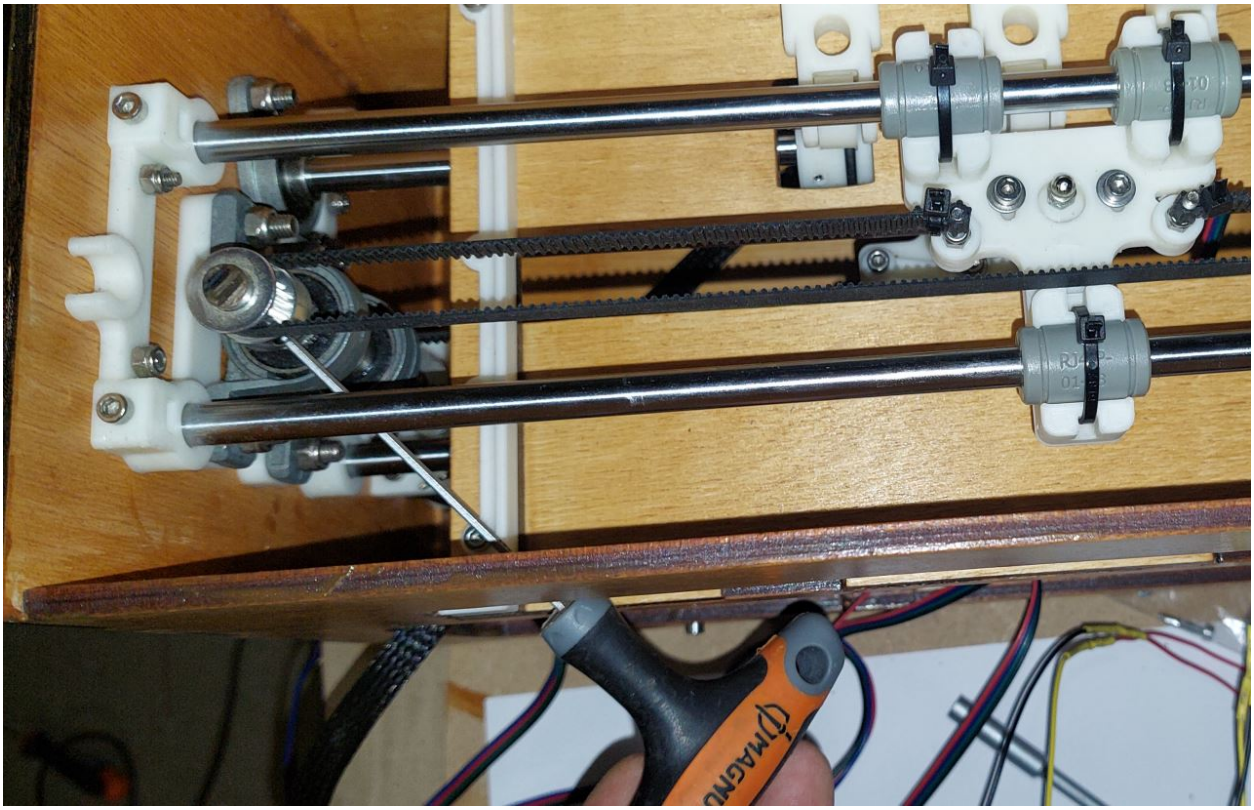
- Vertical alignment of the two trolley
- Move upper carriage to align footprint (**FEMALE_shape**)with the top of the Braille stylus.
- Use the fixing screws of the **FEMALE_shape** to align the imprint with the top of the punch.
- When the alignment is satisfactory, tighten the fixing screws of the **FEMALE_shape**.



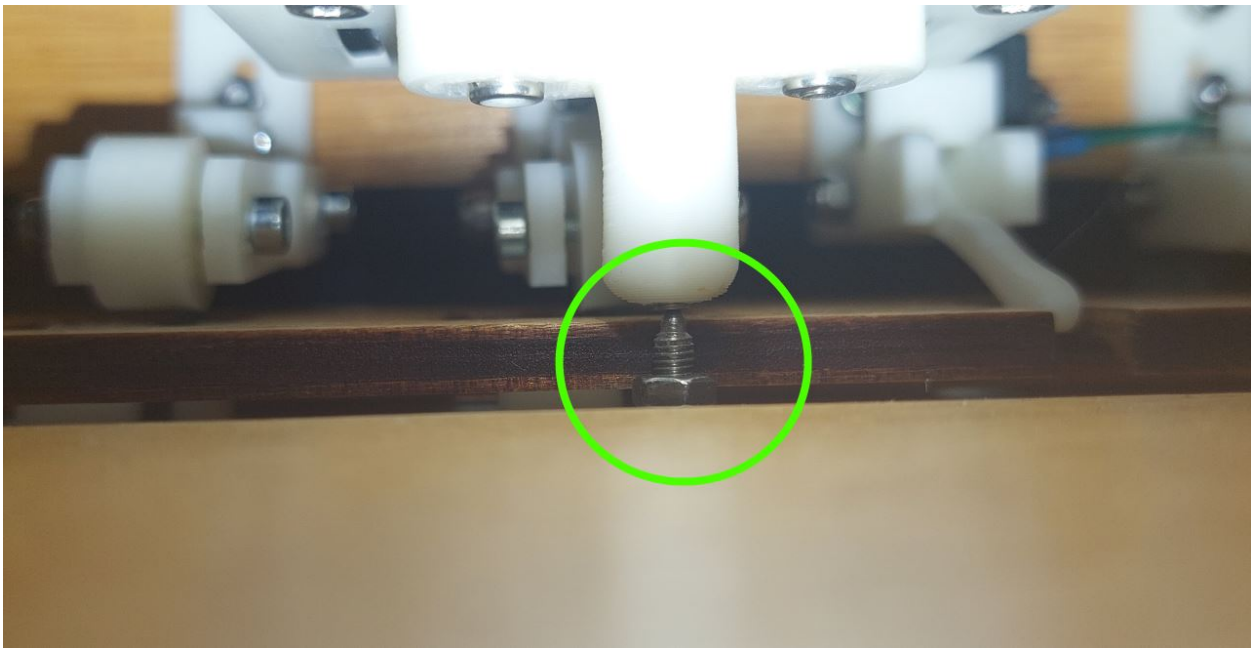


4.48 Vertical alignment of the two carriages

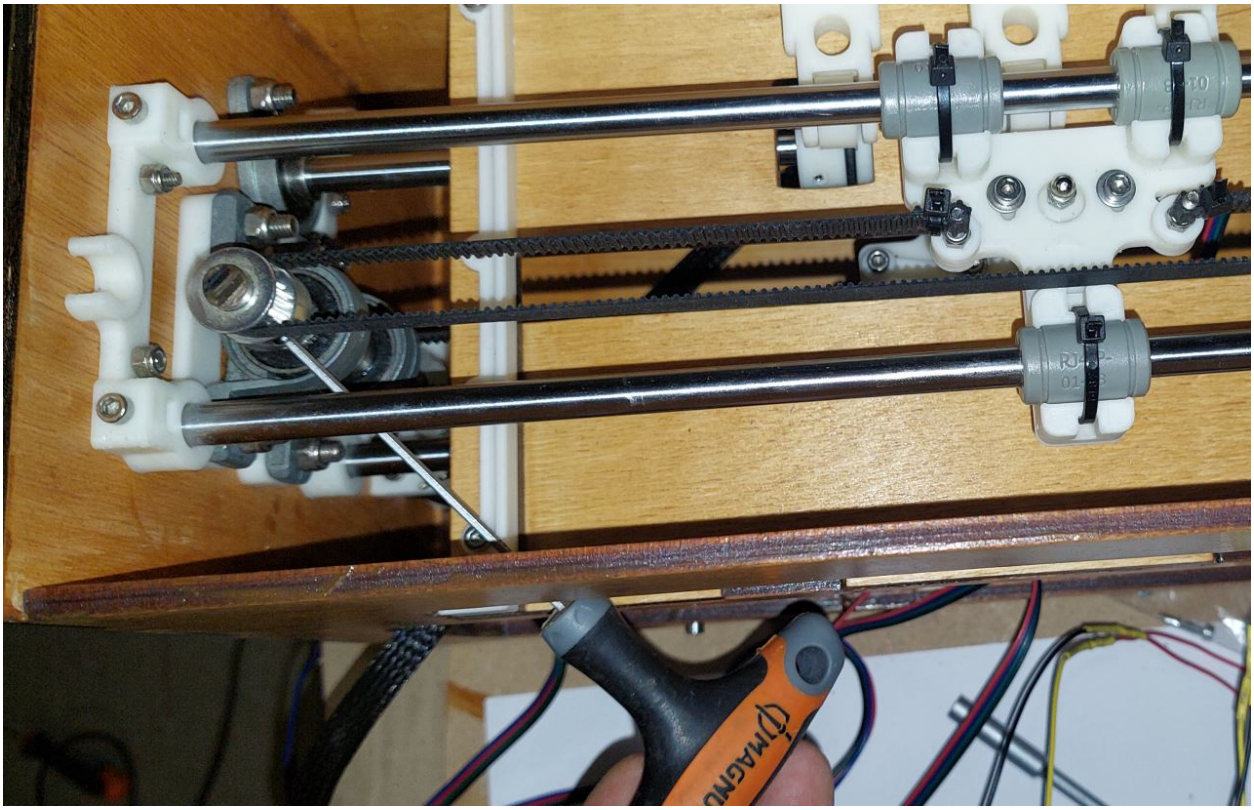
- Loosen the pulley of the upper carriage on the vertical axis to free the top carriage.



- Observing from the rear of the machine, raise the Braille stylus by pressing with the finger under the electromagnet.
- Move upper carriage to align footprint (**FEMALE_shape**)with the top of the Braille stylus.
- Logically the Braille stylus must enter slightly into the grub screw of the **FEMALE_shape**.

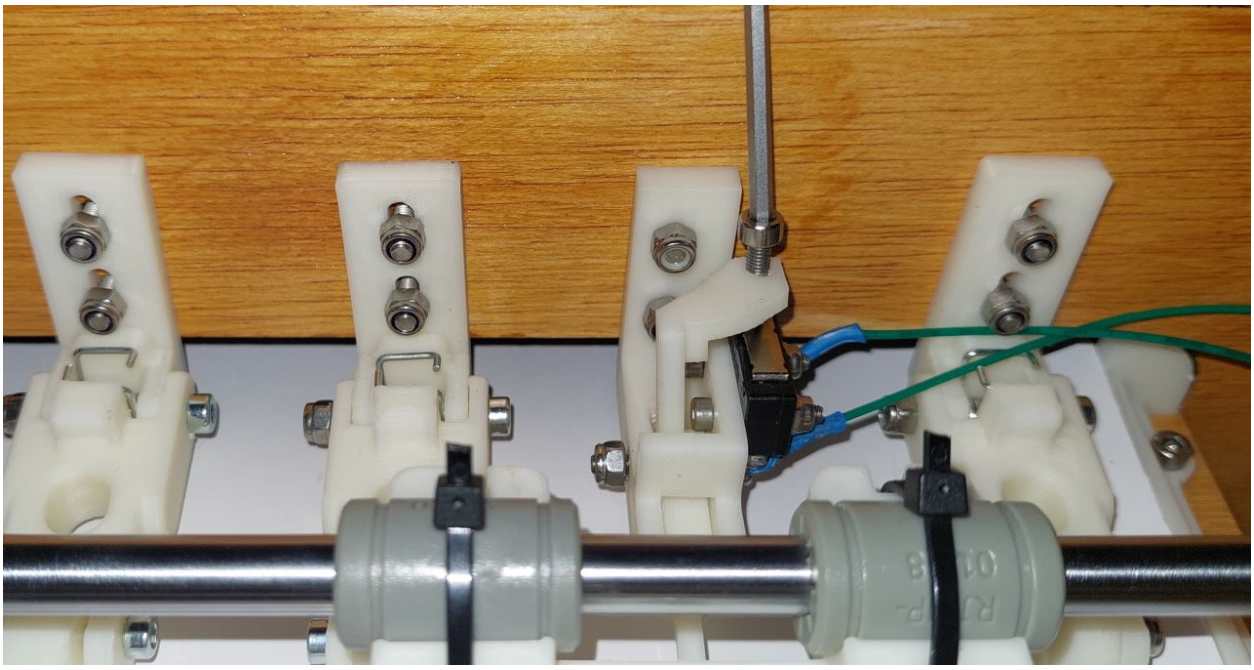


- When the alignment is satisfactory, lock the upper pulley onto the vertical axis.



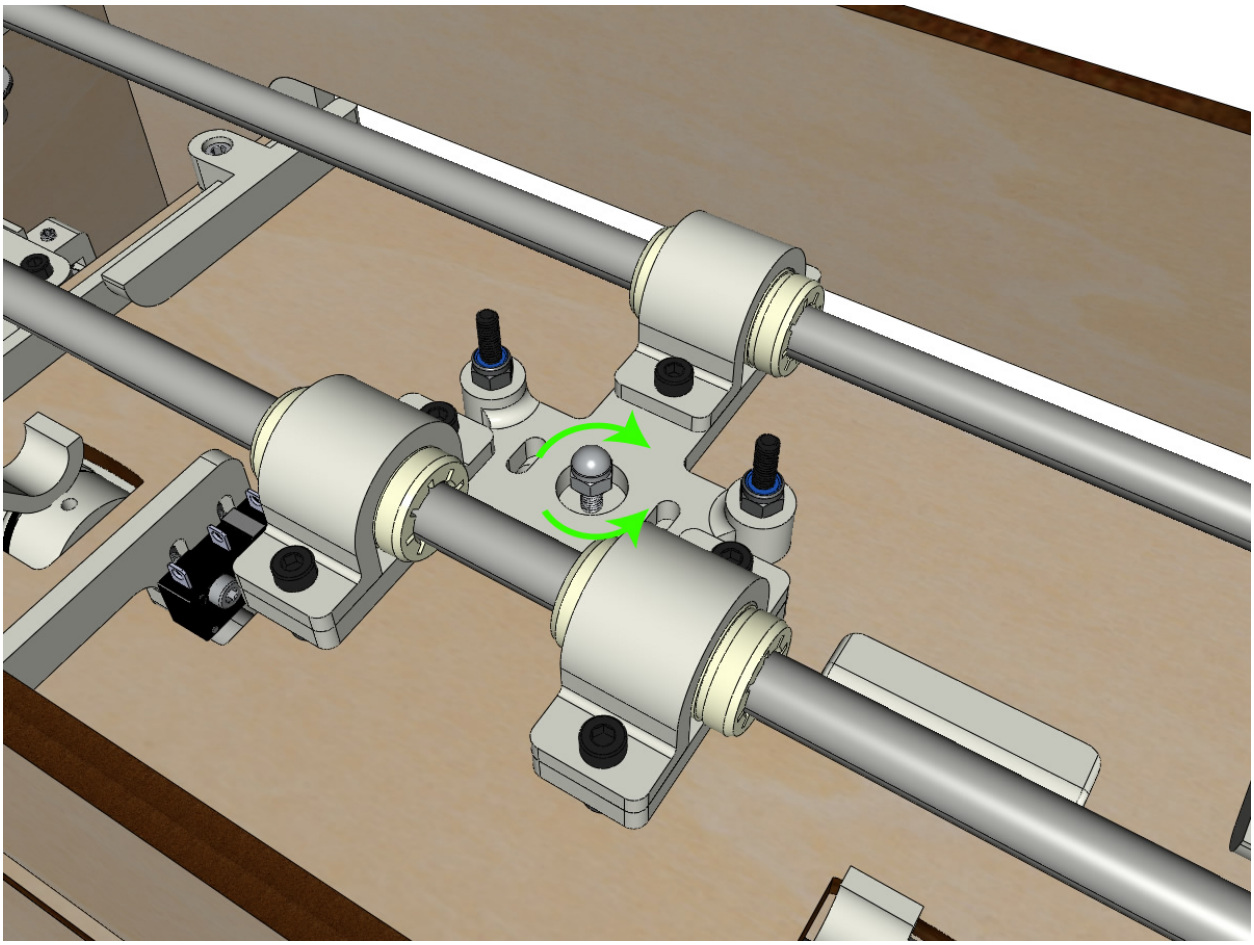
4.49 Carriage Adjustment and paper limit sensors (X and Y)

- Adjust the position of the limit switch X. The sensor should activate before the low carriage belt attachment meets the vertical axis pulley.
- With a sheet of paper, adjust the Y limit switch so that the sensor is activated when a sheet is present under the lever of the sensor. And deactivates if the sheet of paper has not yet moved the lever.



4.50 Adjusting the Braille point depth

- Depending on the material you will use (paper, plastic, aluminum bobbin), you will need to adjust the height of the borrows of the high carriage using the blind nut



CHAPTER

FIVE

WINDOWS USB DRIVERS FOR MKS 1.4 OR MKS GEN L 2.1

5.1 For MakerBase MKS 1.4

Download the FTDI driver (Virtual COM Port Drivers) from here: https://ftdichip.com/drivers/vcp-drivers/

Install the driver

5.2 For MakerBase MKS GEN L 2.1

Download the CH340 driver (CH341SER.EXE) from here : https://www.wch.cn/download/CH341SER_ZIP.html

Install the driver

CHAPTER

SIX

RAMPS OR COMPATIBLE BOARDS MARLIN FIRMWARE

Note: Marlin firmware is used for braille embosser controlWe use the CNC configuration to control the elctromagnet with M3 and M4 GCODE commands

Note: The Marlin firmware in **MarlinBraille** directoryhttps://github.com/braillerap/BrailleRap/tree/master/MarlinBraille is already configured for BrailleRAP. If you have not performed a modifications from the documentation, you can use itdirectly without worrying about the Marlin configuration

6.1 Marlin configuration

in configuration.h

Motherboard configuration

```
#ifndef MOTHERBOARD
  //#define MOTHERBOARD BOARD_RAMPS_14_EFB
  #define MOTHERBOARD BOARD_RAMPS_14_SF
#endif
```

Spindle / laser / pen configuration

```
// BRAILLE RAP CONFIG
#define SPINDLE_LASER_ENABLE
#define SPINDLE_LASER_ENABLE_PIN  RAMPS_D8_PIN      // !!! for BED MOSFET
#define SPINDLE_LASER_PWM_PIN     RAMPS_D10_PIN     // !!! for E0 MOSFET
#define SPINDLE_DIR_PIN           5                 // pin servo
```

Endstop configuration

```
// Mechanical endstop with COM to ground and NC to Signal uses "false" here (most common␣
↪setup).
#define X_MIN_ENDSTOP_INVERTING false // set to true to invert the logic of the endstop.
#define Y_MIN_ENDSTOP_INVERTING false // set to true to invert the logic of the endstop.
#define Z_MIN_ENDSTOP_INVERTING false // set to true to invert the logic of the endstop.
#define X_MAX_ENDSTOP_INVERTING false // set to true to invert the logic of the endstop.
#define Y_MAX_ENDSTOP_INVERTING false // set to true to invert the logic of the endstop.
#define Z_MAX_ENDSTOP_INVERTING false // set to true to invert the logic of the endstop.
```

(continues on next page)

(continued from previous page)

```
#define Z_MIN_PROBE_ENDSTOP_INVERTING false // set to true to invert the logic of the␣
↪probe.
```

Motor step / mm

```
#define DEFAULT_AXIS_STEPS_PER_UNIT   { 80, 46, 4000, 500 }
```

Max feedrate

```
#define DEFAULT_MAX_FEEDRATE          { 300, 300, 5, 25 }
```

Acceleration

```
#define DEFAULT_MAX_ACCELERATION      { 1500, 1500, 100, 10000 }

#define DEFAULT_ACCELERATION          1500    // X, Y, Z and E acceleration for printing␣
↪moves
#define DEFAULT_RETRACT_ACCELERATION  1500    // E acceleration for retracts
#define DEFAULT_TRAVEL_ACCELERATION   1500    // X, Y, Z acceleration for travel (non␣
↪printing) moves
```

Jerk

```
#define DEFAULT_XJERK                 5.0
#define DEFAULT_YJERK                 5.0
#define DEFAULT_ZJERK                 0.3
#define DEFAULT_EJERK                 5.0
```

Note: In the current release on BrailleRap github, other files have been modified to handle the paper sheet position with the Y end-stop.

CHAPTER

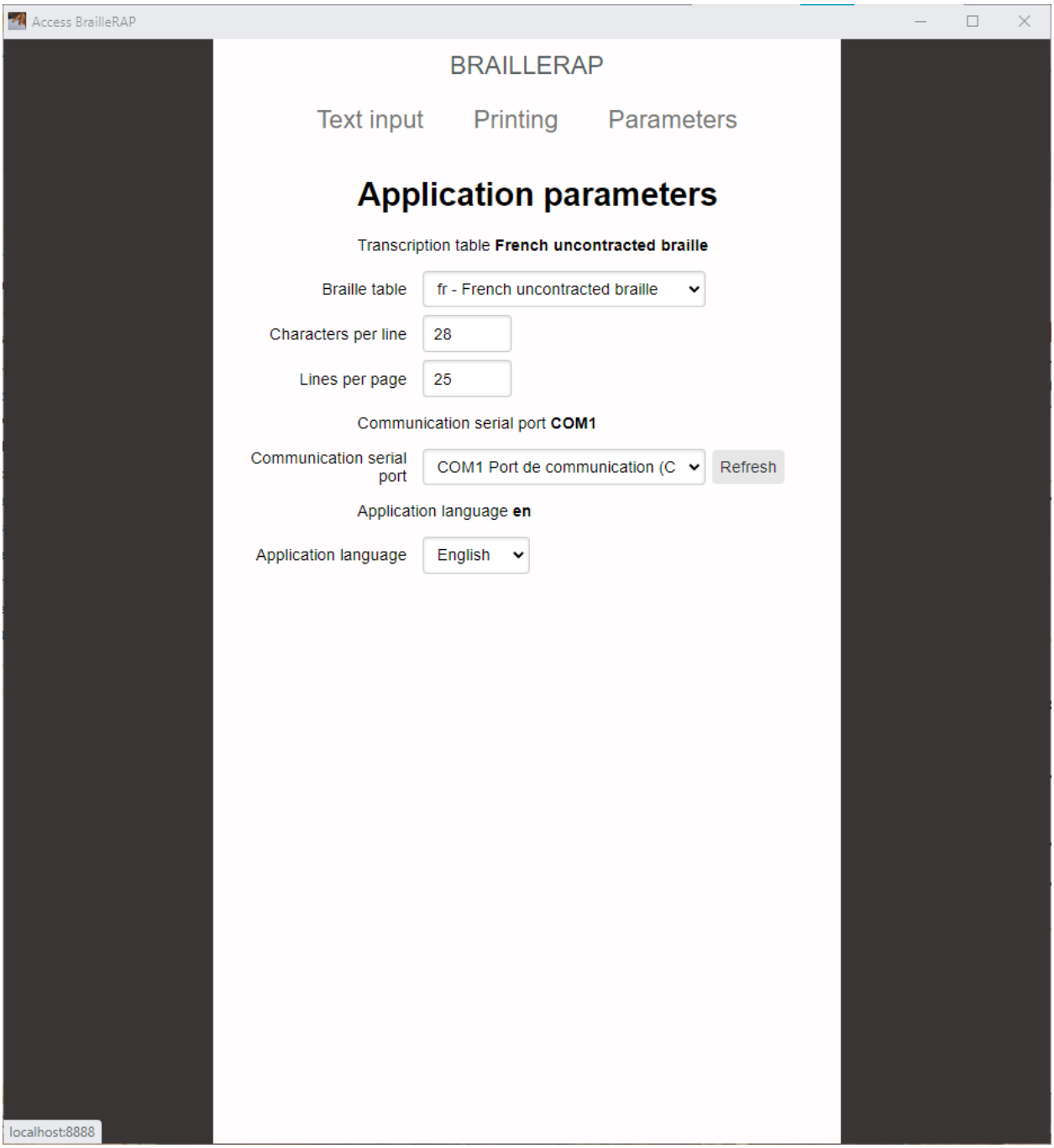
SEVEN

EMBOSS YOUR FIRST BRAILLE TEXT

BrailleRap is a G-CODE controlled device, to emboss Braille you must first translate the text into Braille and Braille into GCODE. There are 3 solutions for translating Braille: The AccessBrailleRap applicationhttps://github.com/braillerap/AccessBrailleRAP/releases The applicationBrailleRap online https://crocsg.github.io/BrailleRap/ The applicationNatBraille http://natbraille.free.fr

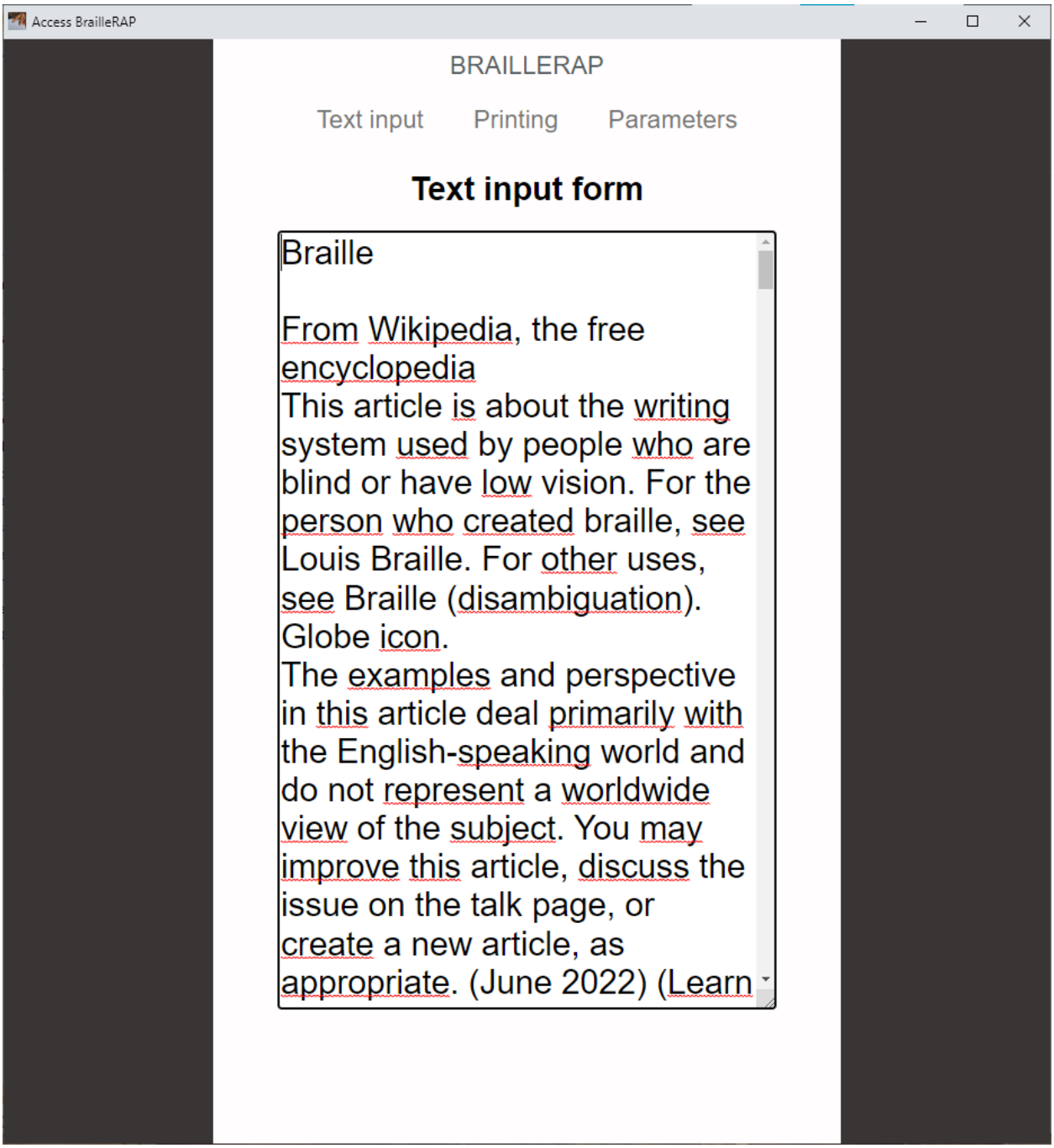
7.1 Utilisation de l'application AccessBrailleRap

Use the "Parameters" button to access the settings screen

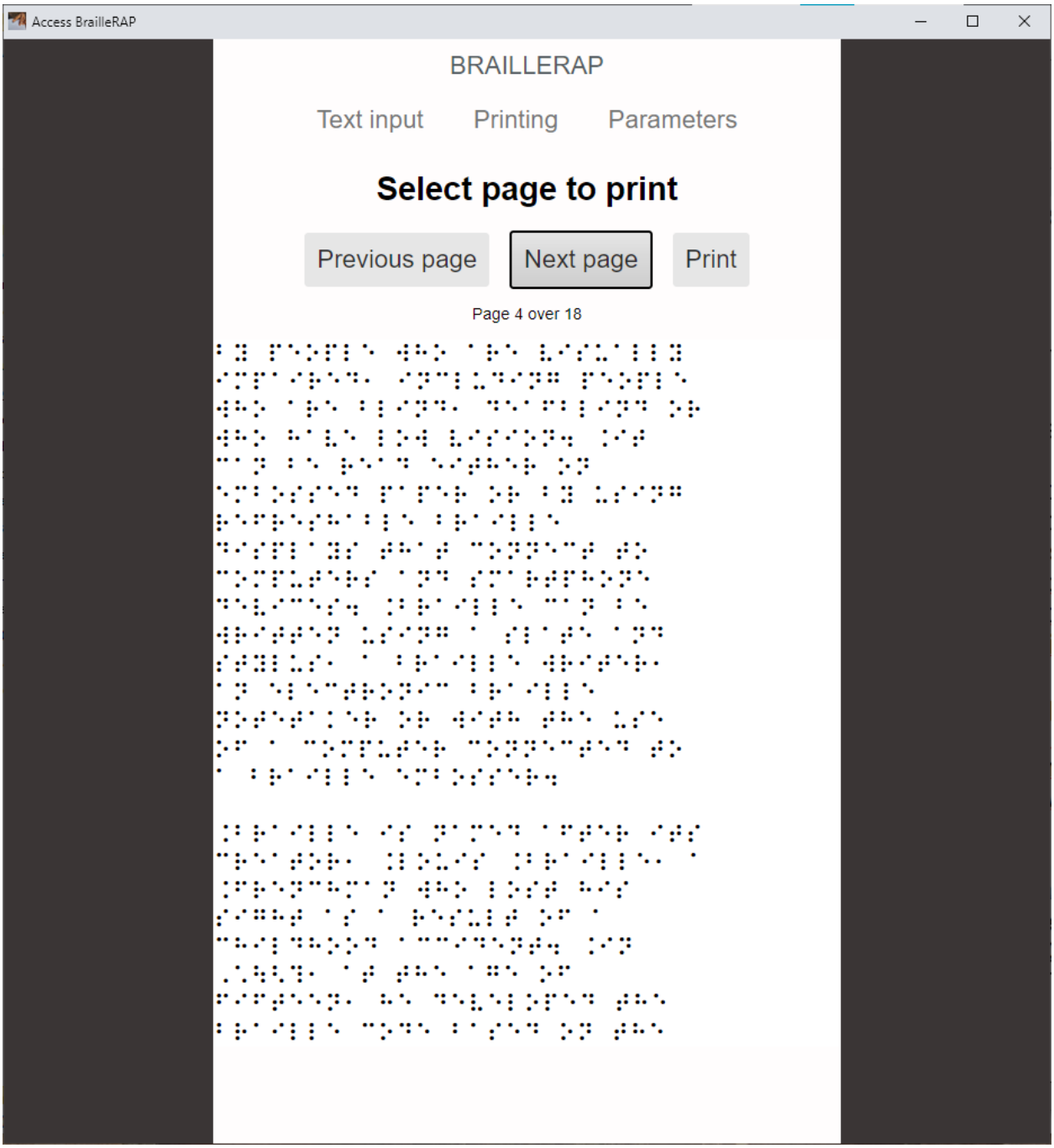


Choose the Braille table of your choice, the communication port fordrive BrailleRAP, and the language of the application

Use the “Text input” button to access the text input screen Enter the text of your choice, you can use copy pasteto use an existing text (web page, word document…)

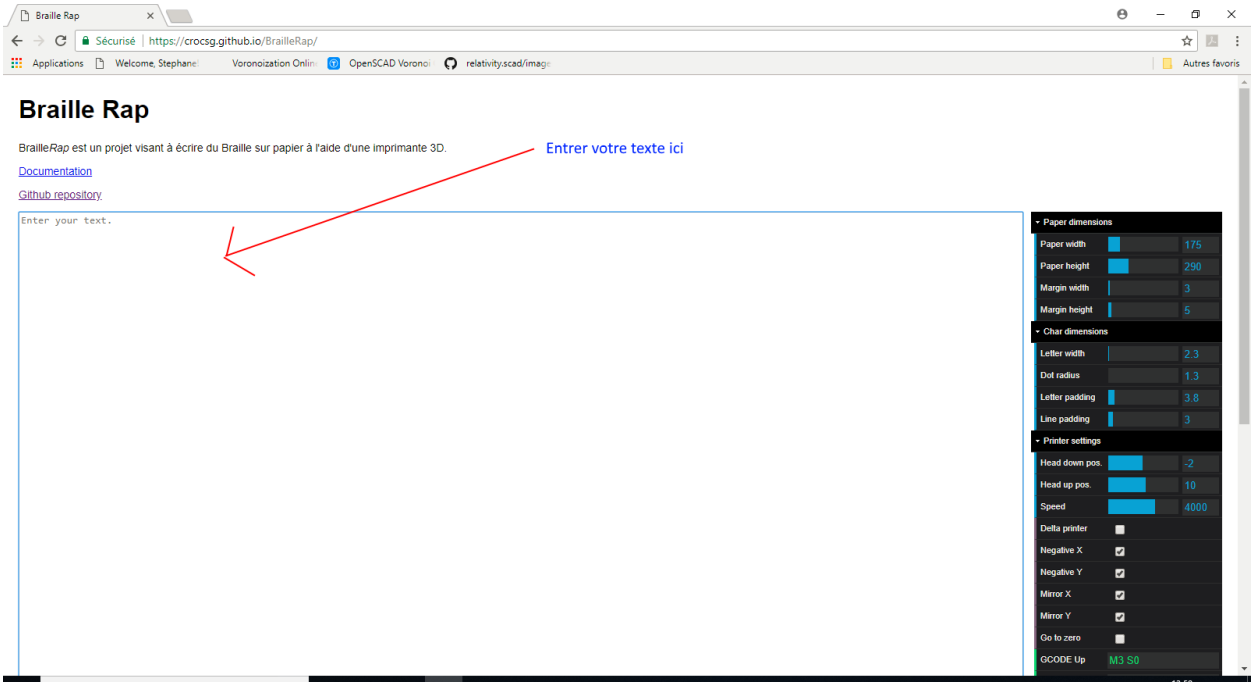


Use the “Print” button to access the print screenSelect the page you want to emboss with the “Page ” buttonprevious” and “next page”. To emboss text, install a sheet of paper in BrailleRAP and use the “Print” button

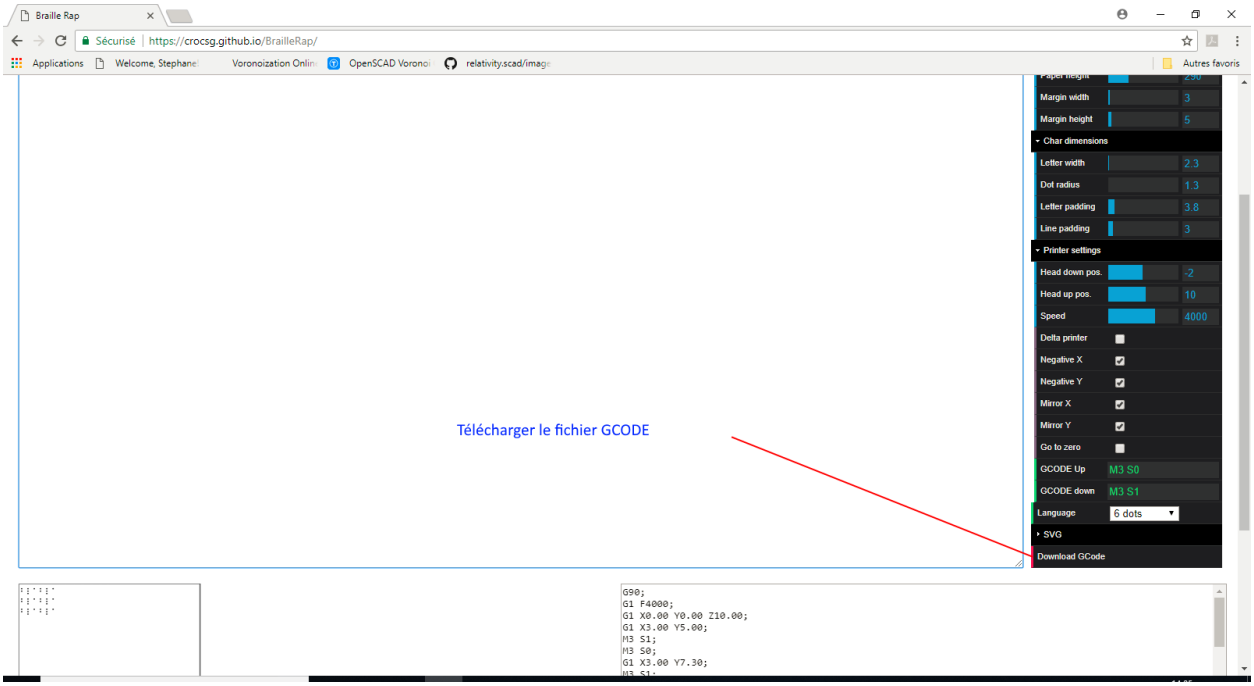

Access BrailleRAP
BRAILLERAP
Text input
Printing
Parameters
Select page to print
Previous page
Next page
Print
Page 4 over 18

7.2 Using BrailleRap App

go to https://crocsg.github.io/BrailleRap/



Enter your text and download the GCODE file for the embosser

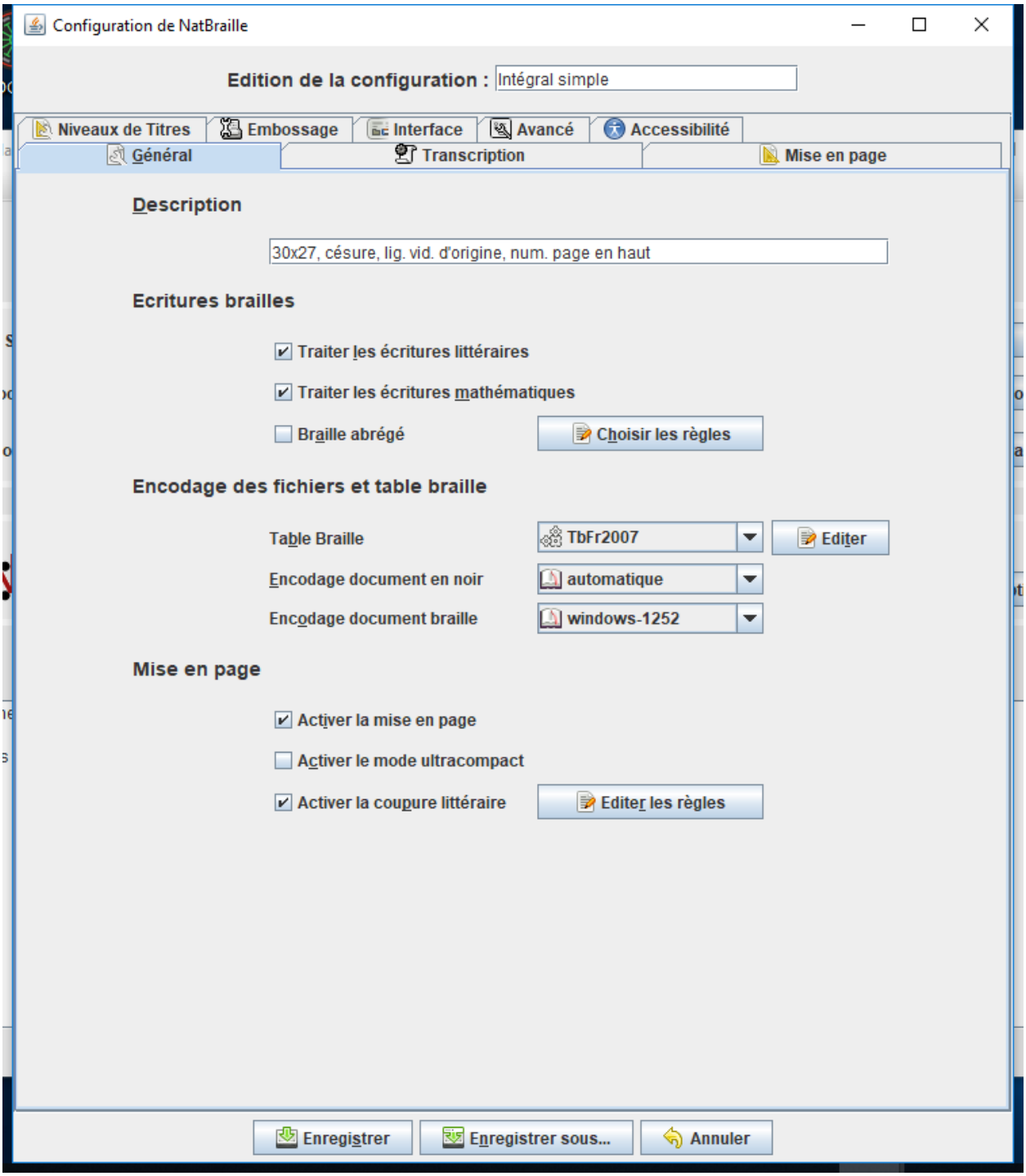


To send the GCODE file to the embosser you can use software like **cura** or **pronterface**

7.3 NatBraille configuration

Build software in the NatBrailleTools project directory

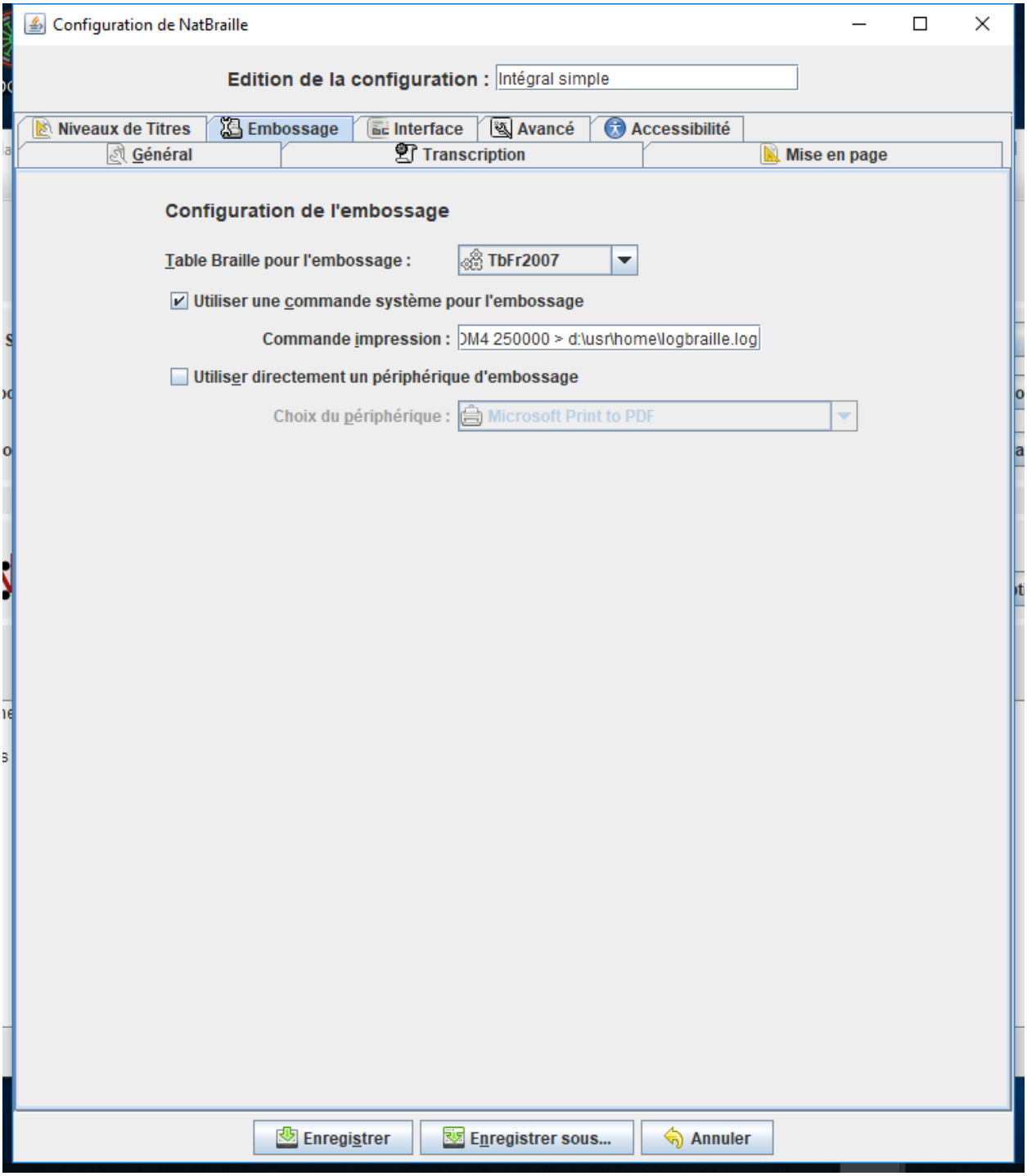
In NatBraille general options, use **TbFr2007** for Braille table, Black document encoding **Automated**, Braille document encoding **Windows1252**



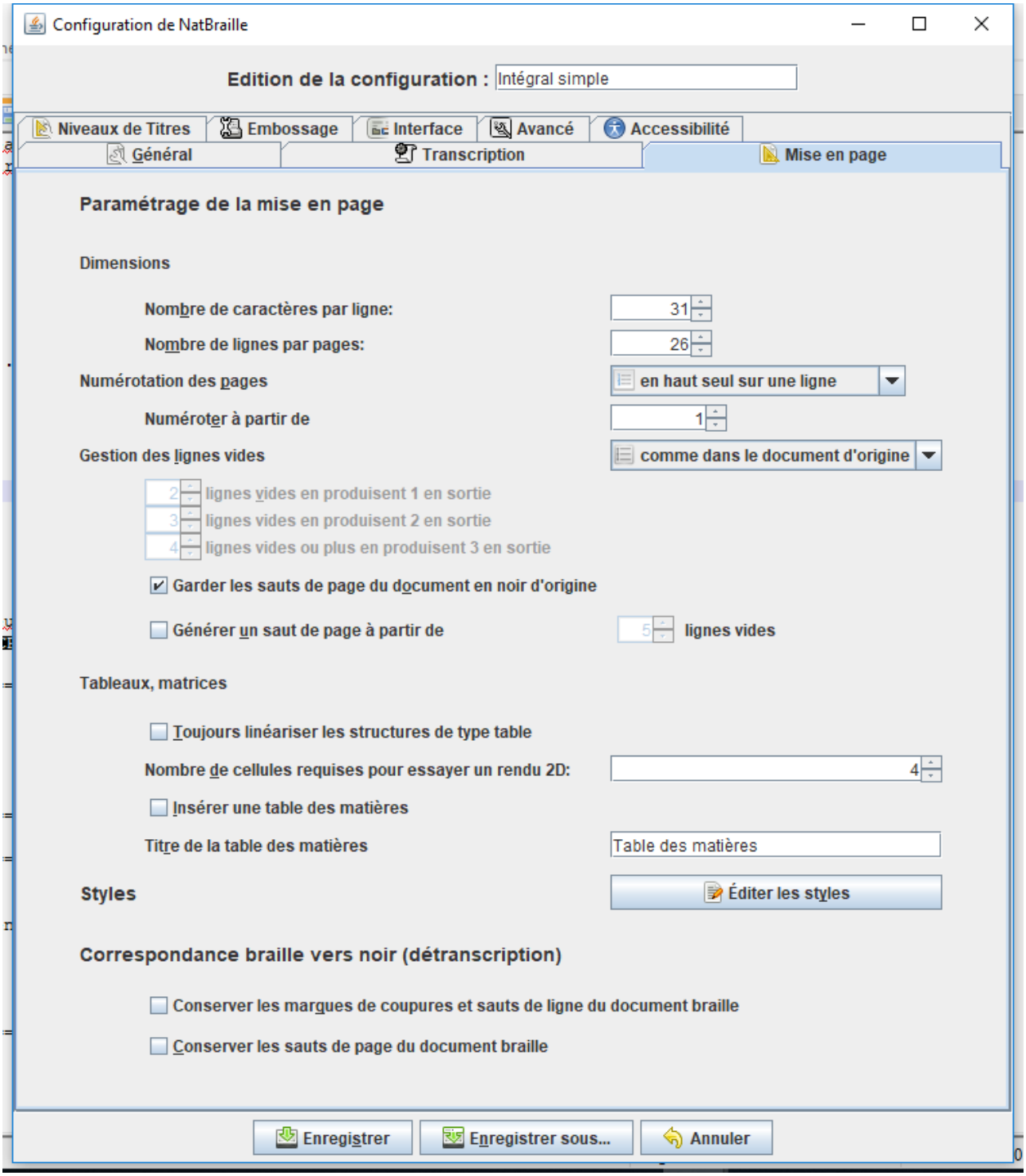
In embossing options, use **TbFr2007** for braille table for embossing

Enable option **use a system command for embossing**

use the parameter **java -jar d:\usr\home\logger\BrailleLogger.jar $f | java -jar d:\usr\home\logger\gcodestreamer.jar COM4 250000** for printer command. You need to modify the executable directory and the COM port reference



In page settings enter 31 and 26 as caracter per line and line per page



Mise à jour: Aug 15, 2023

INDEX