



Building the Open Knit machine

by **FabSchool** on November 25, 2014

Table of Contents

Building the Open Knit machine	1
Intro: Building the Open Knit machine	3
Step 1: About building this machine	3
Step 2: Shopping list	4
Step 3: List of tools	5
Step 4: Threading the aluminum profiles	6
Step 5: Prepare the aluminum strips and T-bars	7
Step 6: Assemble the structural bars	7
Step 7: Bend the paperclips	8
Step 8: Prepare the wooden strips	9
Step 9: Assemble the comb	10
Step 10: Preparing the acrylic parts	11
Step 11: Prepare layer (A)2	12
Step 12: Assembling the layers	12
Step 13: Assembling the layers - 2	13
Step 14: Attach the T-shaped bar	14
Step 15: Align '2020nuts' with holes in acrylic	14
Step 16: Fix the acrylic on top of the structural bar	15
Step 17: Placing the 'encoder rack'	15
Step 18: assemble "top_plate_bearings" part	16
Step 19: Prepare the top of the carriage part	17
Step 20: Place the rotary encoder	18
Step 21: Assemble "top_plate_bearings" part with "top_plate" part	19
Step 22: Add the gear	20
Step 23: Prepare a servomotor	21
Step 24: Place the servo on the top plate	22
Step 25: Prepare the main carriage	23
Step 26: Attach the N-mount part	24
Step 27: Add another	24
Step 28: Place "servo_mount_carriage" parts	25
Step 29: Prepare the servo motor	25
Step 30: Make the 'servo beam mount'	25
Step 31: Attach the motor to the carriage	27

Step 32: Assemble the slider part	27
Step 33: Prepare the SLED mechanism	28
Step 34: Attach the motor	29
Step 35: Add arms	29
Step 36: Almost done with the carriage...	30
Step 37: Make the 'legs' of the machine	30
Step 38: Place the 3030 profiles	31
Step 39: Place the short aluminum profiles	32
Step 40: Placing the vertical short bars	33
Step 41: Prepare the yarn carrier	33
Step 42:	34
Step 43:	34
Related Instructables	34
Advertisements	35
Comments	35



Author: FabSchool FabSchool

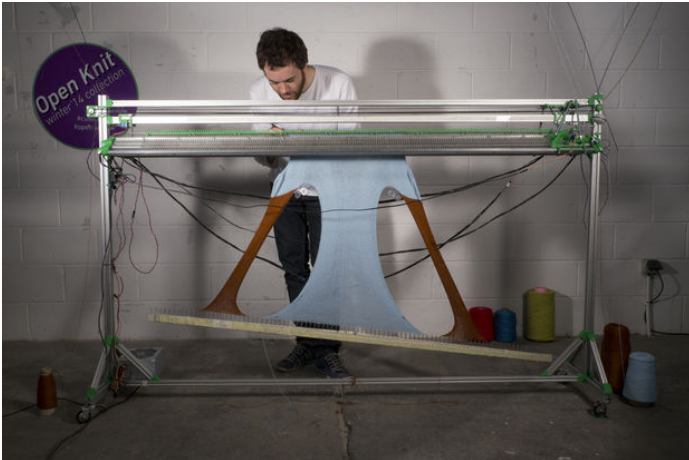
In hands-on workshops at the Fablab, a hightech workspace, we give youngsters the tools they need for tomorrow's society: art, creativity, entrepreneurship and critical reflection. We want to find out how creative design processes and working spaces can play a role in education. FabSchool is a joint project of Waag Society (Amsterdam) and Rotslab (Utrecht).

Intro: Building the Open Knit machine

The Open Knit machine is an open-source, low cost, digital fabrication tool developed by Gerard Rubio. The machine affords the user the opportunity to create his own clothing from digital files. Designing, producing and wearing clothiers can now happen in the very same place, allowing the user to make decisions regarding creativity and responsibility.

This instructable shows you how to build the Open Knit machine step by step. The instructable has been developed for the Open Knit Machine workshop organized by Gerard Rubio, Waag Society and TU/E within the CRISP Smart Textile Services project.

The machine is work-in-progress: anyone is allowed and encouraged to reproduce it and help improve it. So comments and suggestions on both the design and the instructable are very welcome!

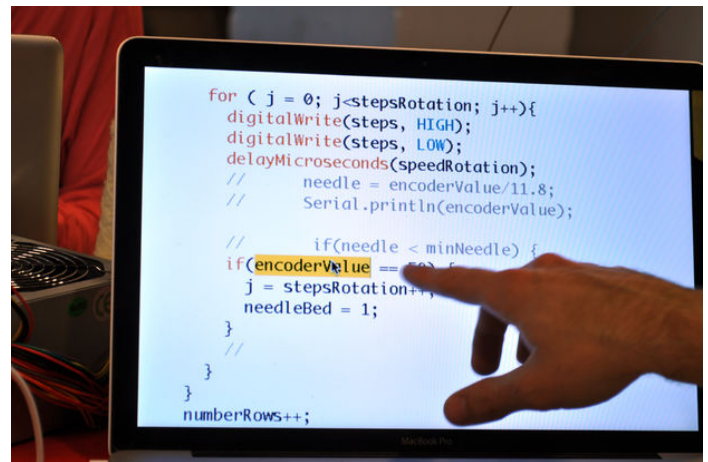
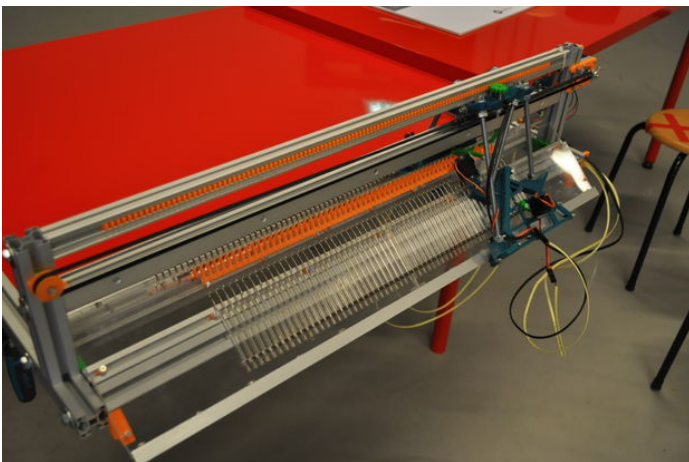


Step 1: About building this machine

The process from start to scarf can be divided in three steps:

- building the machine
- connecting the machine
- using the machine

This instructable shows you all the steps to build the structural part of the machine.





Step 2: Shopping list

updates available at: <https://github.com/g3rard/OpenKnit/tree/master/Wa...>

- 805x604 mm acrylic sheet: <https://github.com/g3rard/OpenKnit/tree/master/Wa...>
- 3D printed parts: <https://github.com/g3rard/OpenKnit/tree/master/Wa...>
- 2 800 x 3 mm aluminum strips
- 2 800x2 mm aluminum strips
- 2 30x30x162 aluminum bars
- 2 30x30x300 aluminum bars
- 2 20x20x800 aluminum bars
- 2 30x30x800 aluminum bars
- 2 15x15x800 aluminum T-profile
- Arduino Leonardo
- 1 microinterruptor
- rotary encoder
- axial bearing
- stepper motor
- timing pulley
- 6 threaded rods, sizes: 2x16 2x17 and 2x22
- 120 needles
- 4 servo motors
- 4 servo motor driver
- timing belt
- 16 v-groove bearings
- block of paraffine
- molex c-grid plastic holders: 4-pin, 3-pin and 2-pin
- molex c-grid female pins
- phone cable
- paperclips 32 mm type N.2
- piano hinge 510 mm
- 2 wooden strips: flat on one side, a hole every 60 mm
- brass rod 1.5 mm
- pin headers, male and female
- terminal block
- switching power supply
- cross shaped bead

<http://www.instructables.com/id/Building-the-Open-Knit-machine/>

Bolts and nuts, in generous amounts

M3 tapered 7 mm

M3 tapered 10 mm

M3 tapered 12 mm

M3 tapered 16 mm

M3 tapered 20 mm

M3 tapered 30 mm

M3 flat head 8 mm

M3 flat head 10 mm

M3 flat head 12 mm

M3 flat head 16 mm

M3 flat head 20 mm

M3 flat head 30 mm

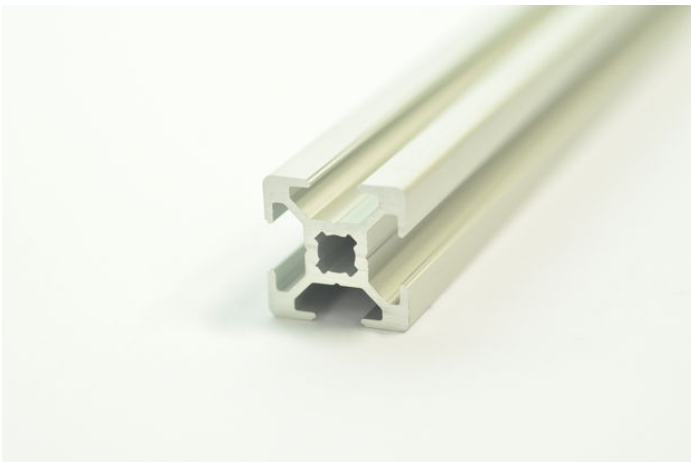
M3 regular nuts

M3 nylock

M3 washers

M8 nuts and bolts (only a few)

M8 washers (only a few)



Step 3: List of tools

-flat screwdriver medium size

-phillips screwdriver medium size

-allen key M3

-pliers

-tweezers

-wrench M6 and M8

-small flat file

-small circular file

-hammer

-small zip ties

-grease lubricant

-spray or liquid lubricant



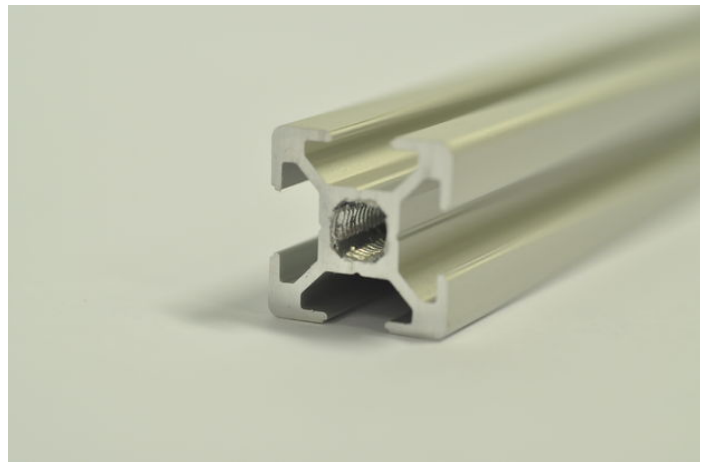
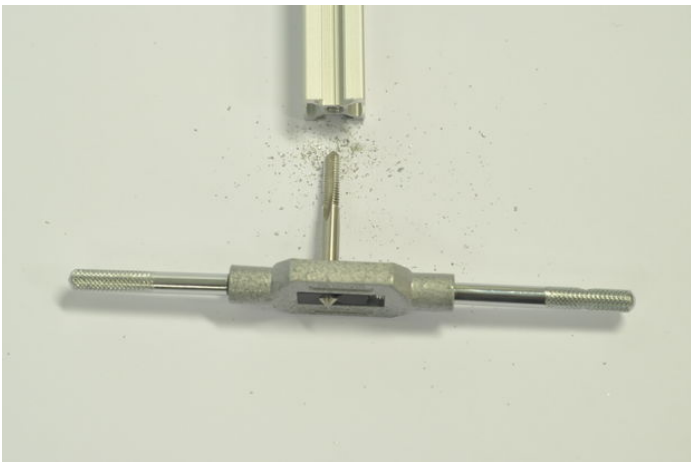
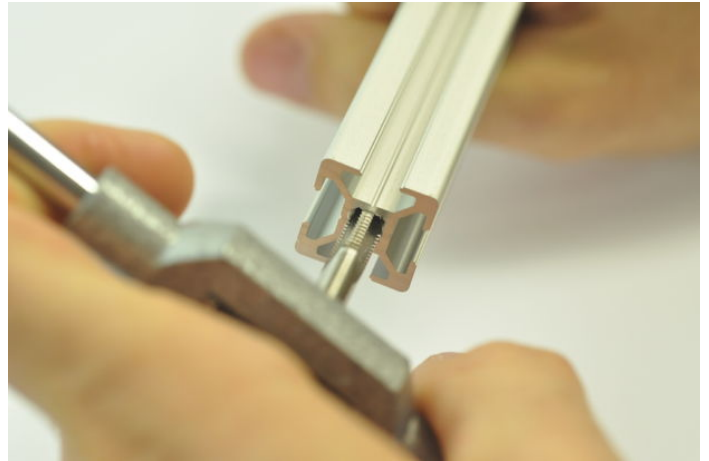
Step 4: Threading the aluminum profiles

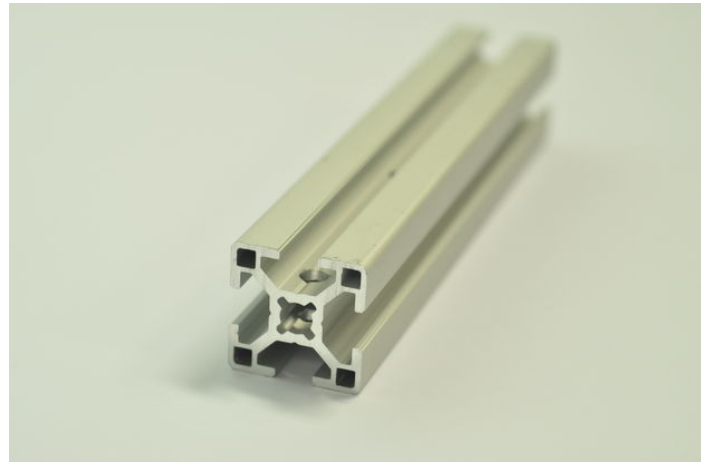
You'll need to thread:

Two 20x20x800mm bars: 6 mm tool on both sides

Two 30x30x800mm: 8 mm tool on both sides

Two 30x30x162mm: 8 mm tool on ONE side, plus one 8 mm hole on the top (see image)





Step 5: Prepare the aluminum strips and T-bars

Make holes, and sink them with a countersink tool so the bolts will not stick out.

Flat strips

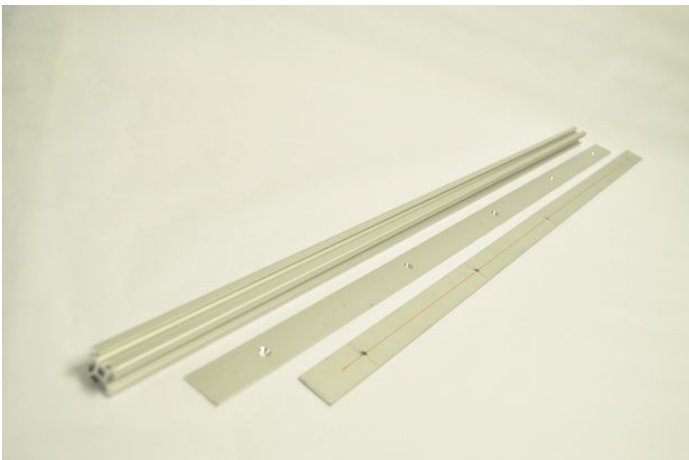
Make a hole at 50, 225, 400, 575, 750mm

(this doesn't have to be very precise)

T-shaped bar:

Make holes at 14, 142, 271, 392, 410, 529, 657, 787 mm

Place profile next to the acrylic to mark the exact place where the holes are going to be, this MUST be precise.



Step 6: Assemble the structural bars

You need

20 x 20 profiles

20 mm aluminum strips

3D printed squares (8x8 mm) : '2020 nuts'

threaded nuts

M3 x 7 bolts

Prepare the 2020 nuts:

You need the 3D printed squares (8x8 mm) and threaded nuts, five per strip. Place the nuts into the 3D printed parts.

Slide the nuts into the profile bar

See picture. Align the nuts with the holes in the aluminum strip.

Close the top of the bar

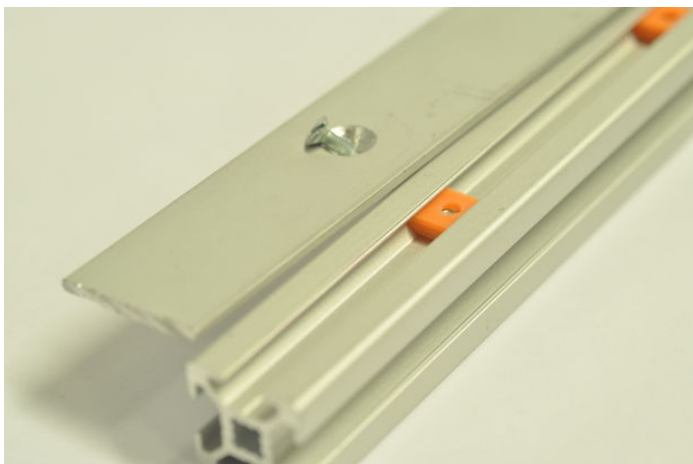
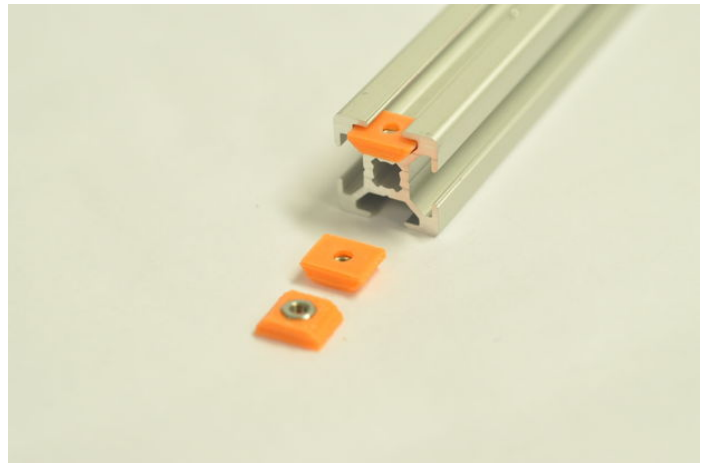
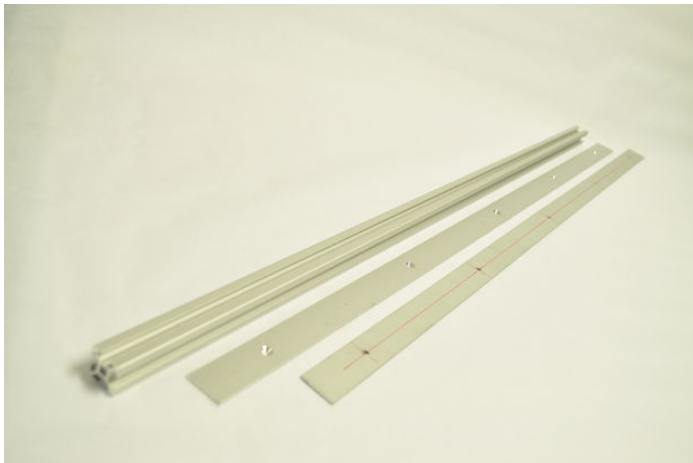
Using the M3 bolts

Repeat on the bottom

<http://www.instructables.com/id/Building-the-Open-Knit-machine/>

Slide in five 2020 nuts, close the assembly with an aluminum strip.

Repeat this procedure with the other 2020 profile bar



Step 7: Bend the paperclips

Bend the paperclips as indicated in the image. The 'hook' on the right is the end result. You'll need 60 of them, have fun bending!



Step 8: Prepare the wooden strips

The wooden strips will be part of the comb. For this part you need:

2 Half rounded wooden strips, a hole every 60 mm and lines every 15 mm

60 paperclips

Long flat hinge

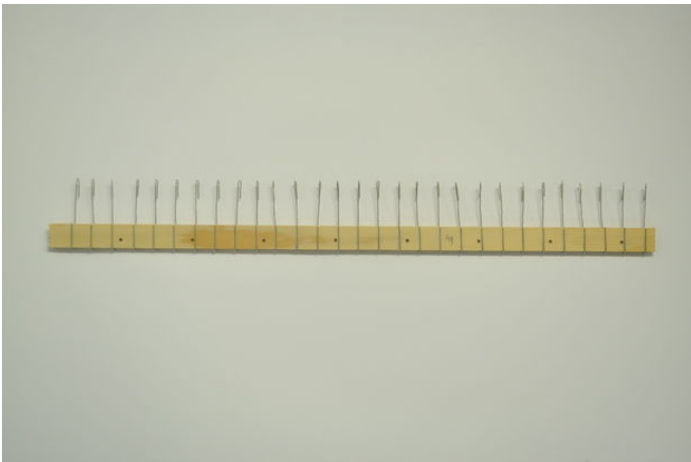
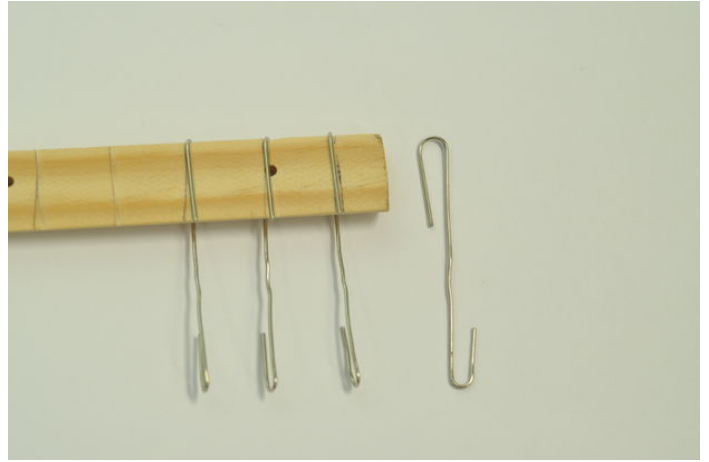
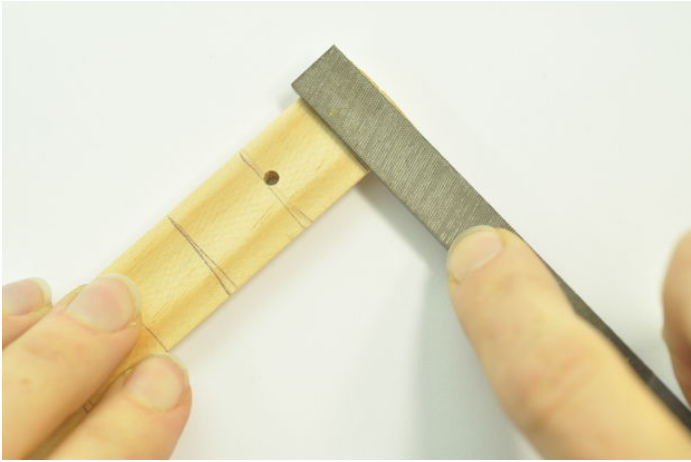
M3 bolts and nuts, 12 mm

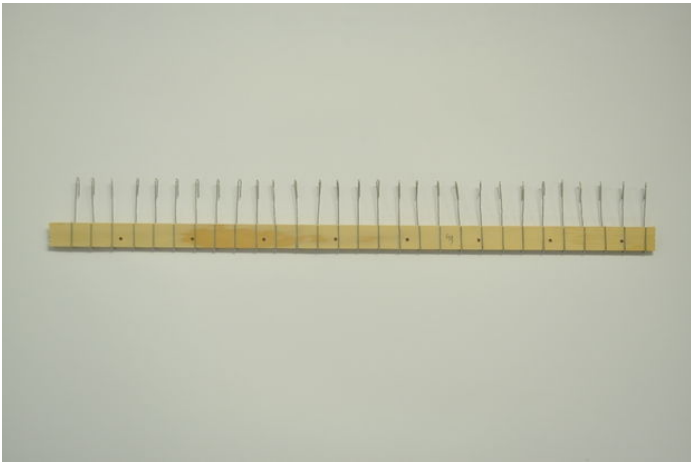
Preparation

File small slide at the indicated lines

Place the clips inside the slits. 30 per bar

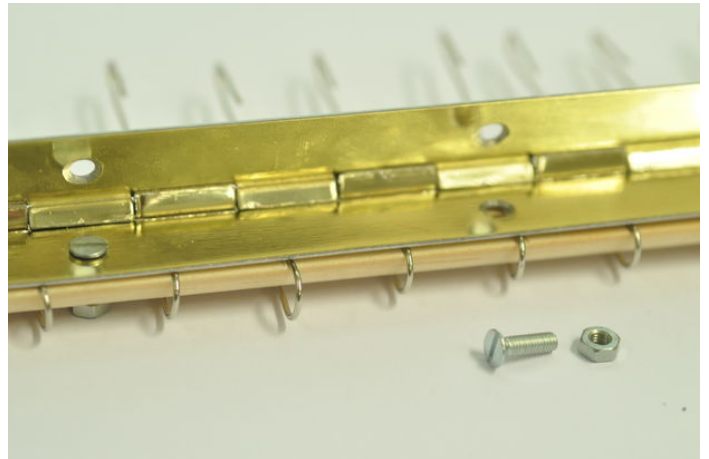
Take a look at the pictures how to position the 'hooks'

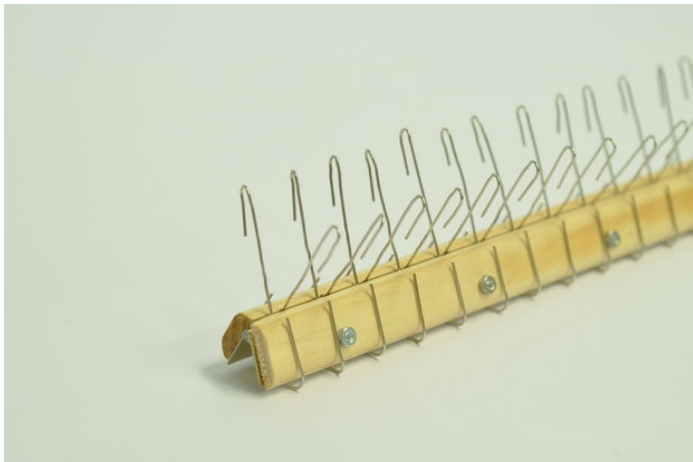
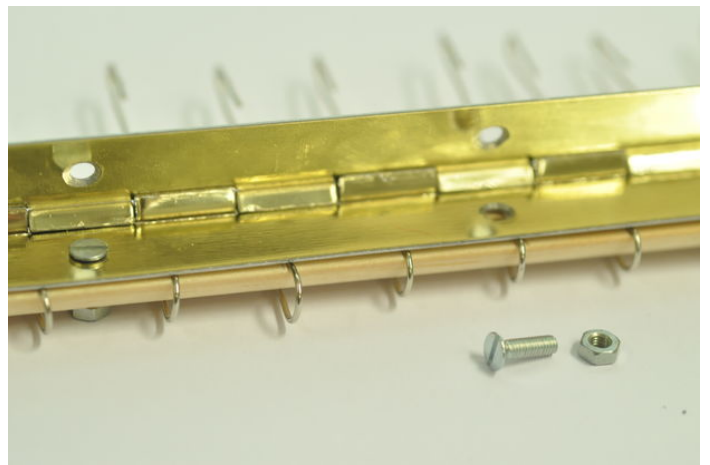




Step 9: Assemble the comb

Attach the hinge to the flat sides of the wooden pieces as indicated in the images. When the hinge opens, the hooks cross each other.

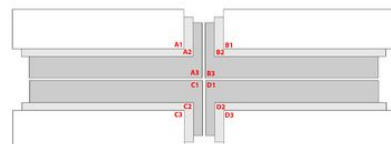


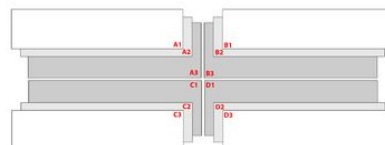
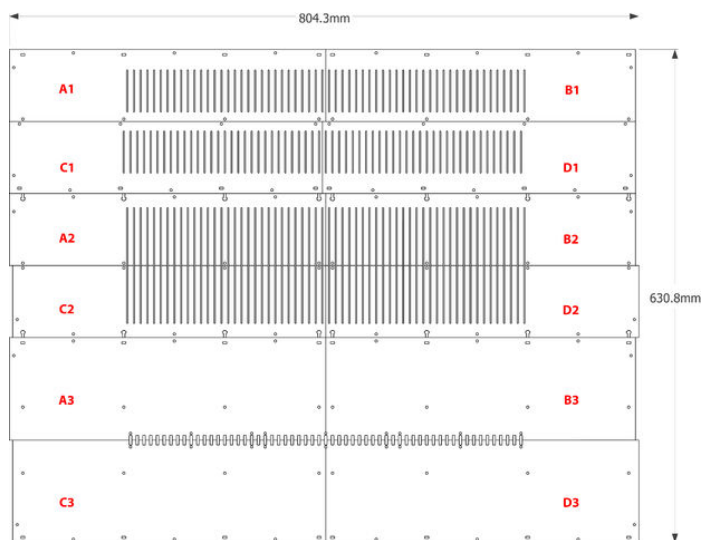


Step 10: Preparing the acrylic parts

Place the acrylic parts in front of you on a table as indicated.

Make four piles of three layers each:

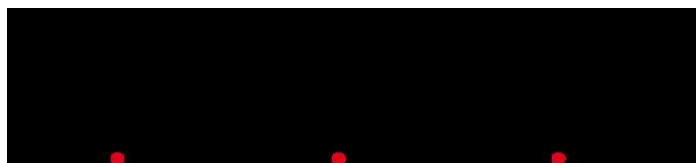




Step 11: Prepare layer (A)2

Start with pile A. Take layer A1 off

In layer A2, sink three holes, indicated in RED. Then later, the bolts will not stick out.

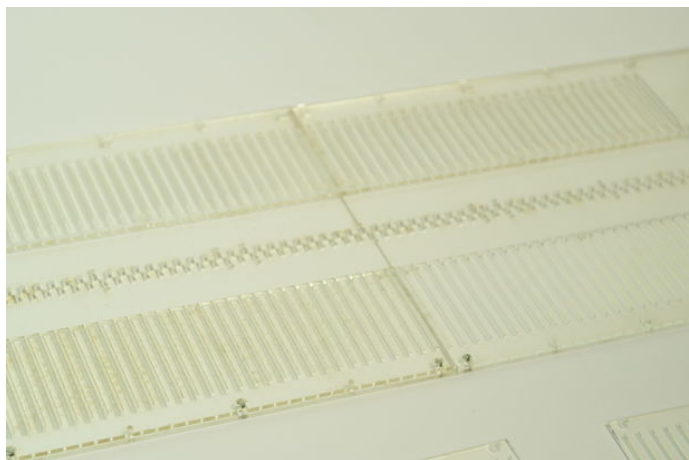
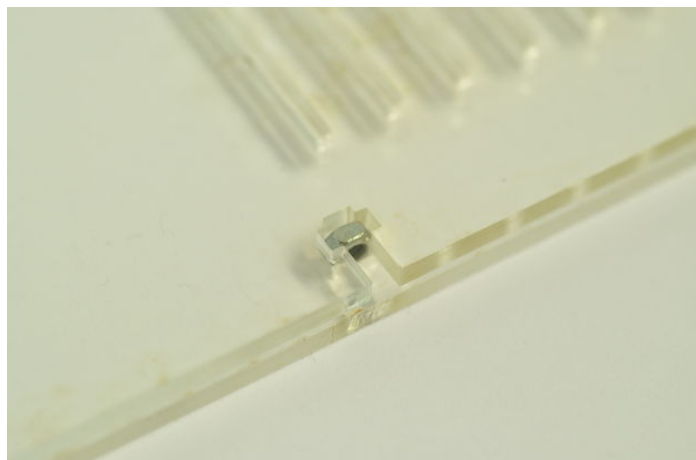


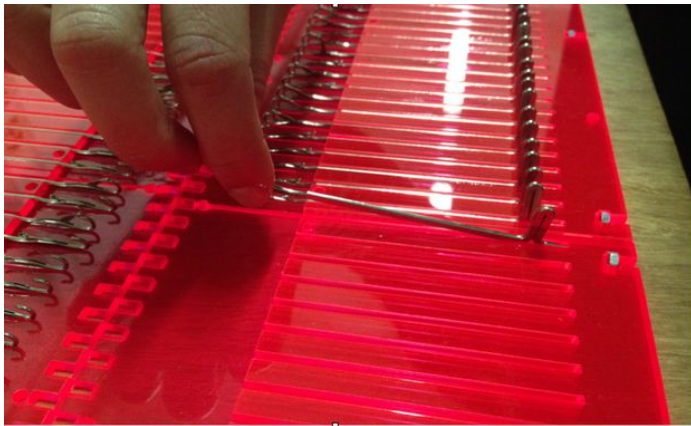
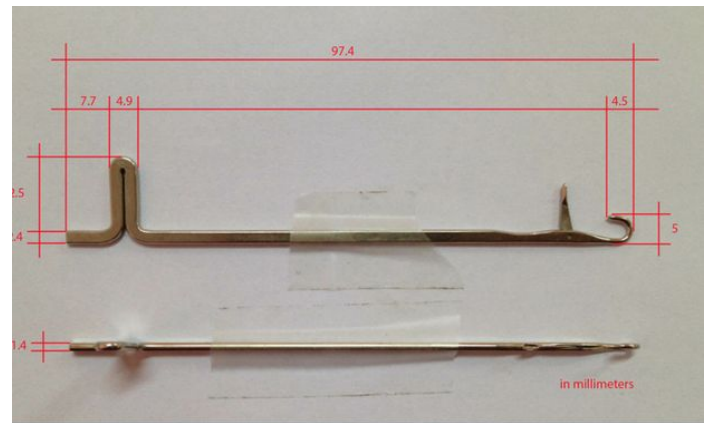
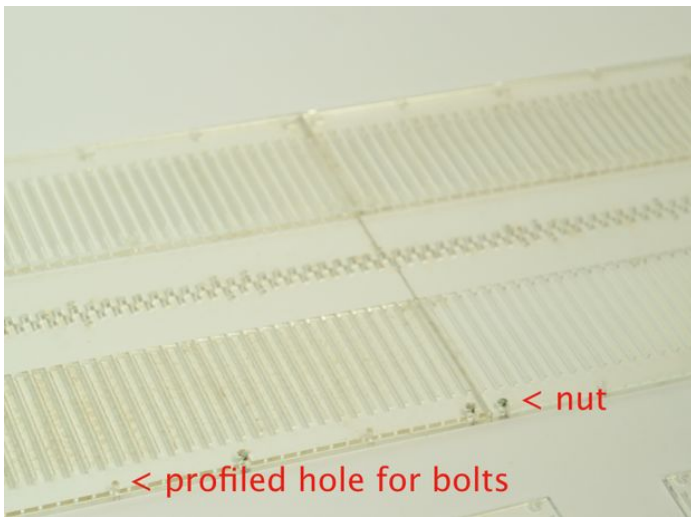
Step 12: Assembling the layers

Place nuts into the 4 pockets in A2

Place 120 needles in the openings

Repeat for pile B, C and D

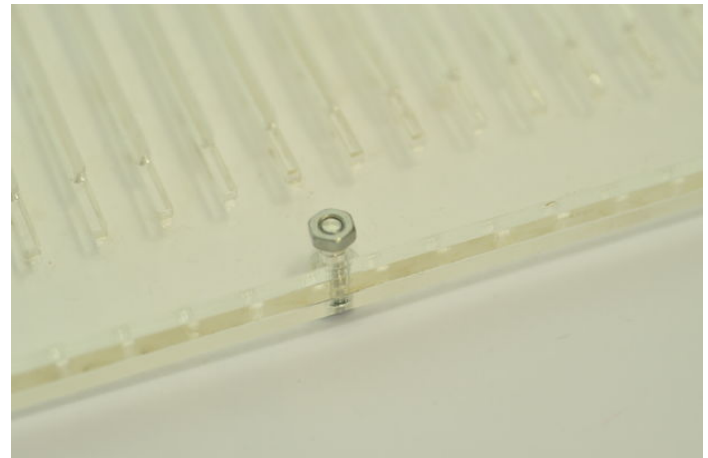
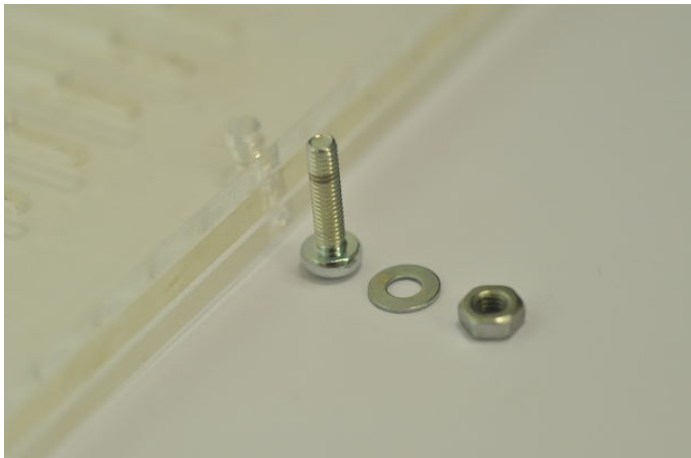




Step 13: Assembling the layers - 2

Place layers (A, B, C, D)1 back on top, get 8 rounded bolts M3 x 12

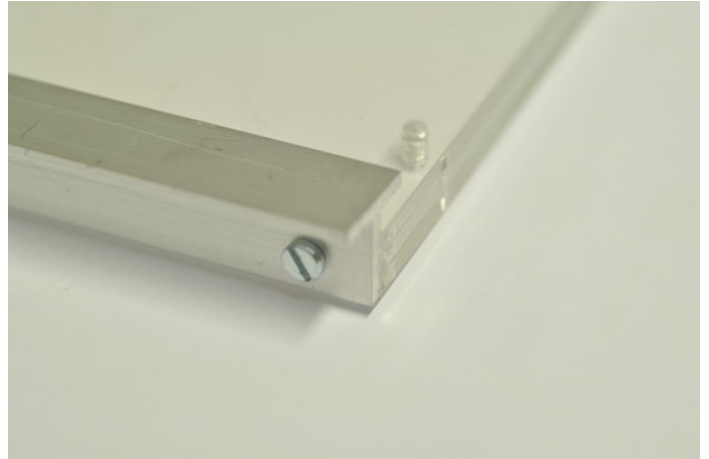
Fix the layers.



Step 14: Attach the T-shaped bar

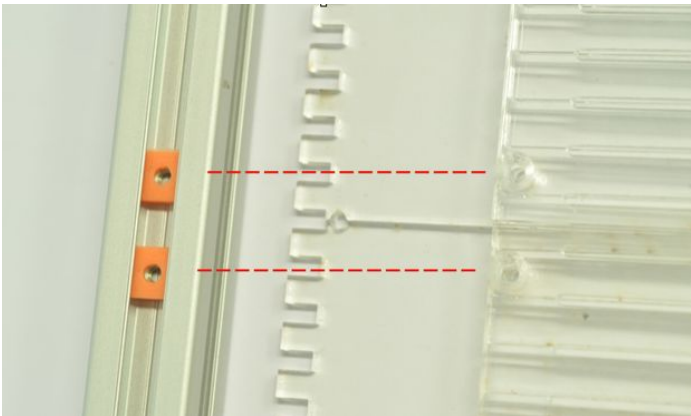
Attach the T-shape profile to the bottoms of A 1-3 and B1-3

First loosely, if it al fits thighten all bolts



Step 15: Align '2020nuts' with holes in acrylic

(in the NON threaded 2020 profiles)

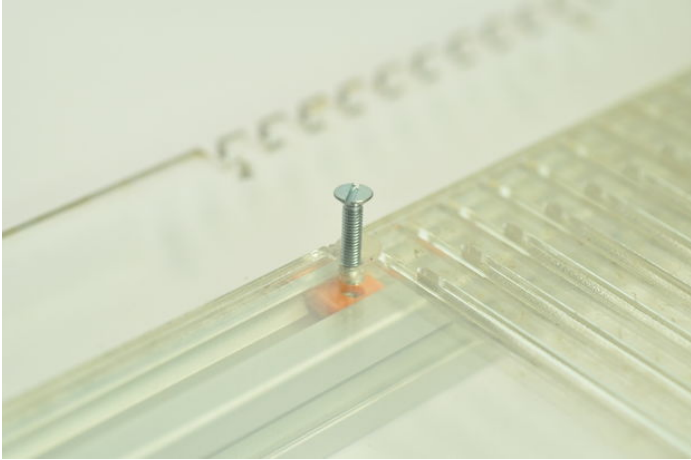


Step 16: Fix the acrylic on top of the structural bar

Sink holes, and place bolts & nuts through acrylic into the nuts

Use 8 x M3x14 countersink bolts

Also fix piles B, C and D to the T shape and structural bar.

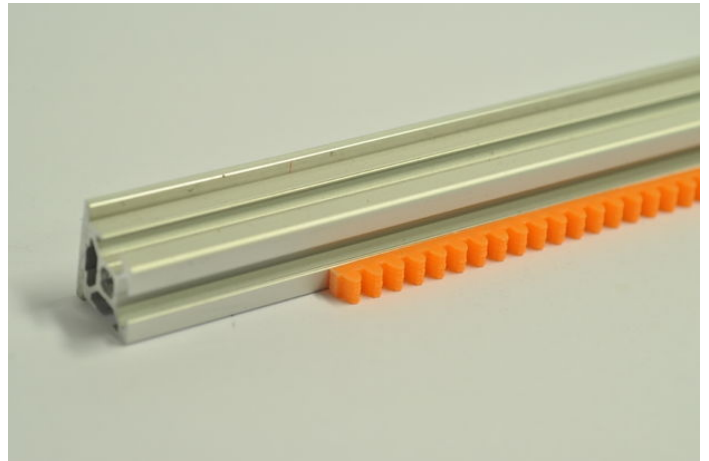
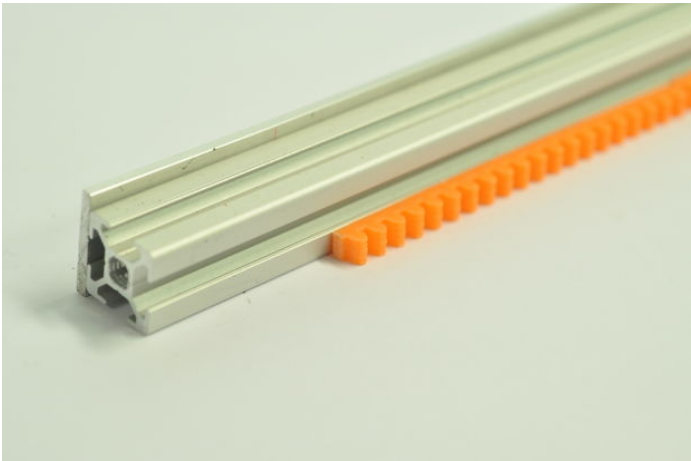


Step 17: Placing the 'encoder rack'

First place 'encoder_rack' pieces along the bar

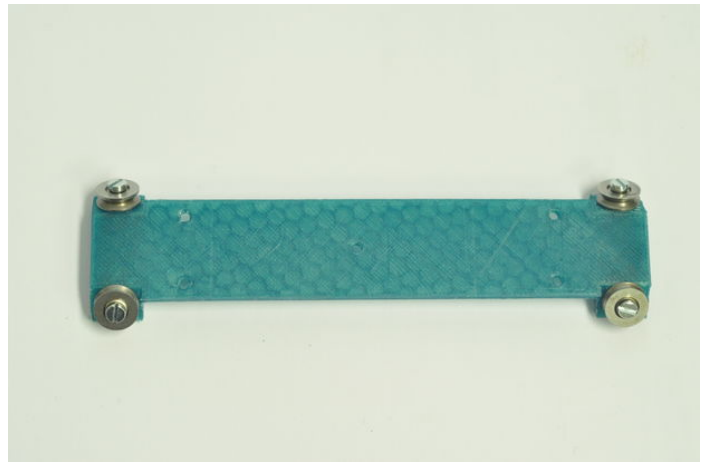
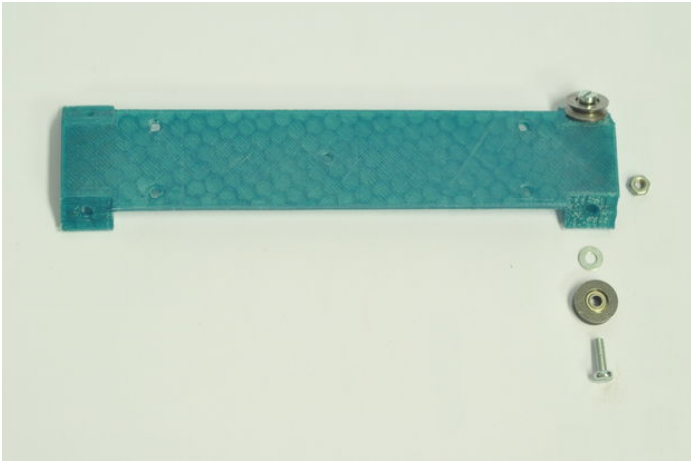
Leave 50 mm on each side

Press the piece into the bar



Step 18: assemble “top_plate_bearings” part

Take the “top_plate_bearings” part + 4 bearings and attach them as indicated



Step 19: Prepare the top of the carriage part

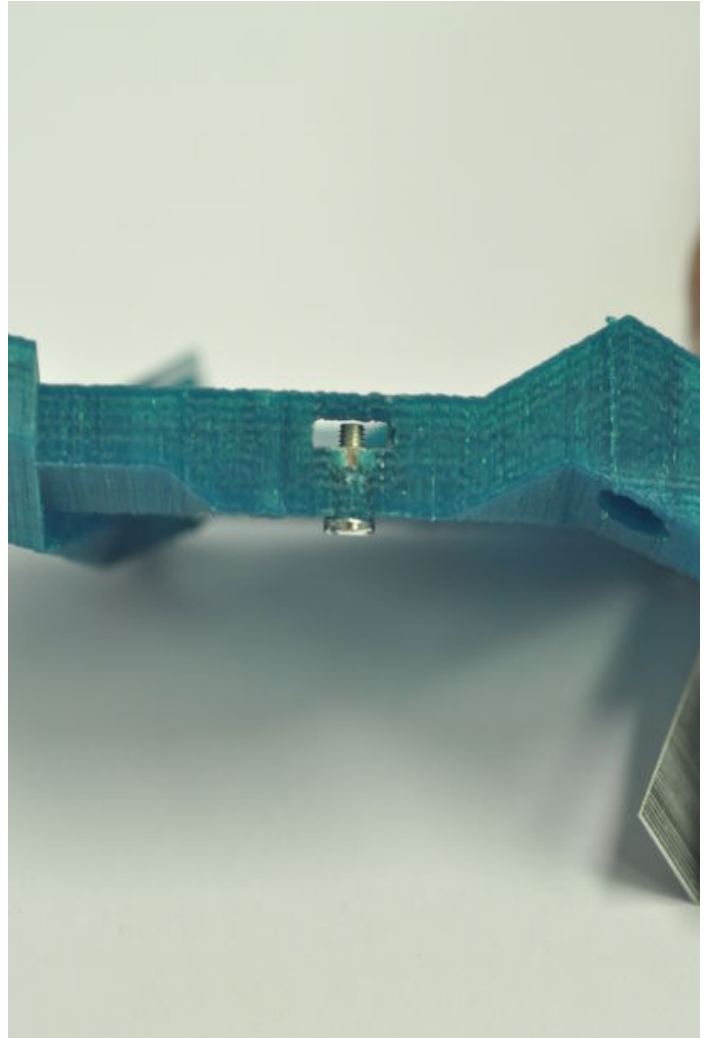
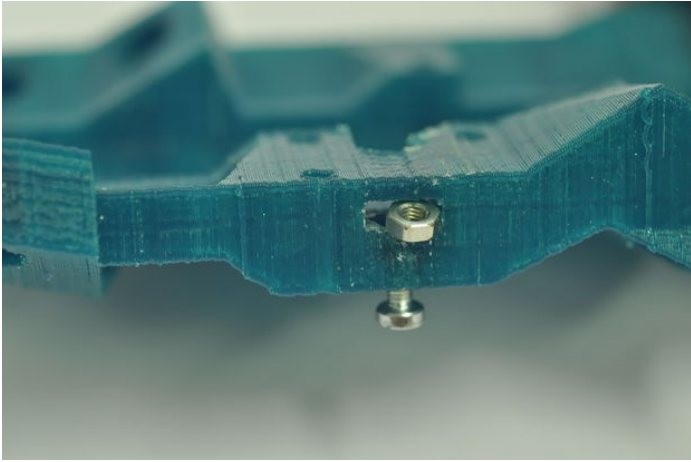
Take the "top_plate" part

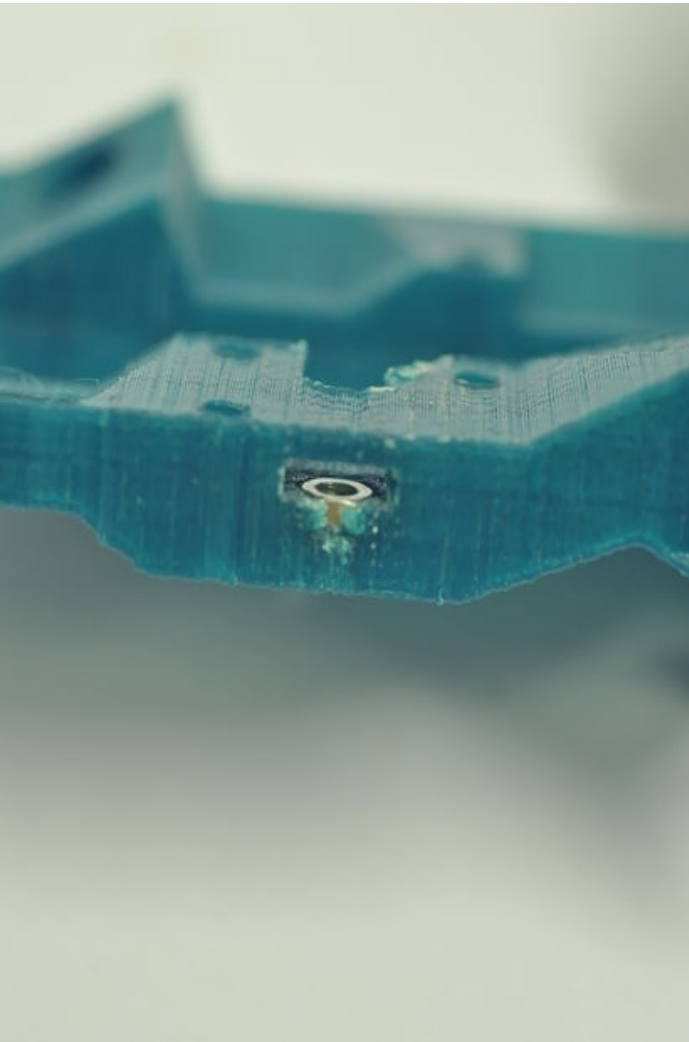
Place a nut into the hole

Catch the nut with the screw

Pull the nut down, take screw out.

Now the nut is 'seeded'

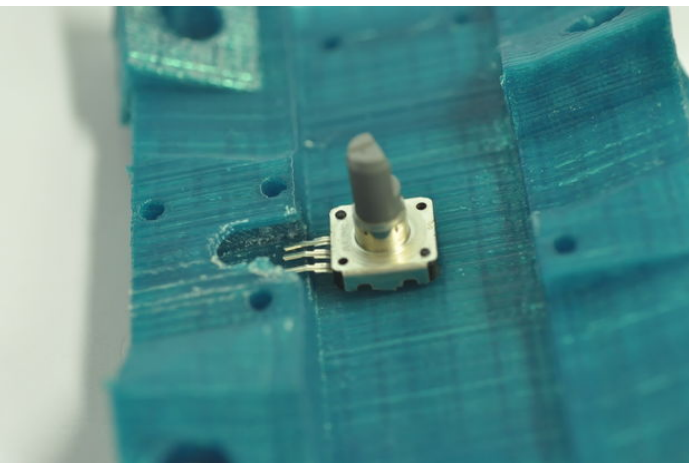


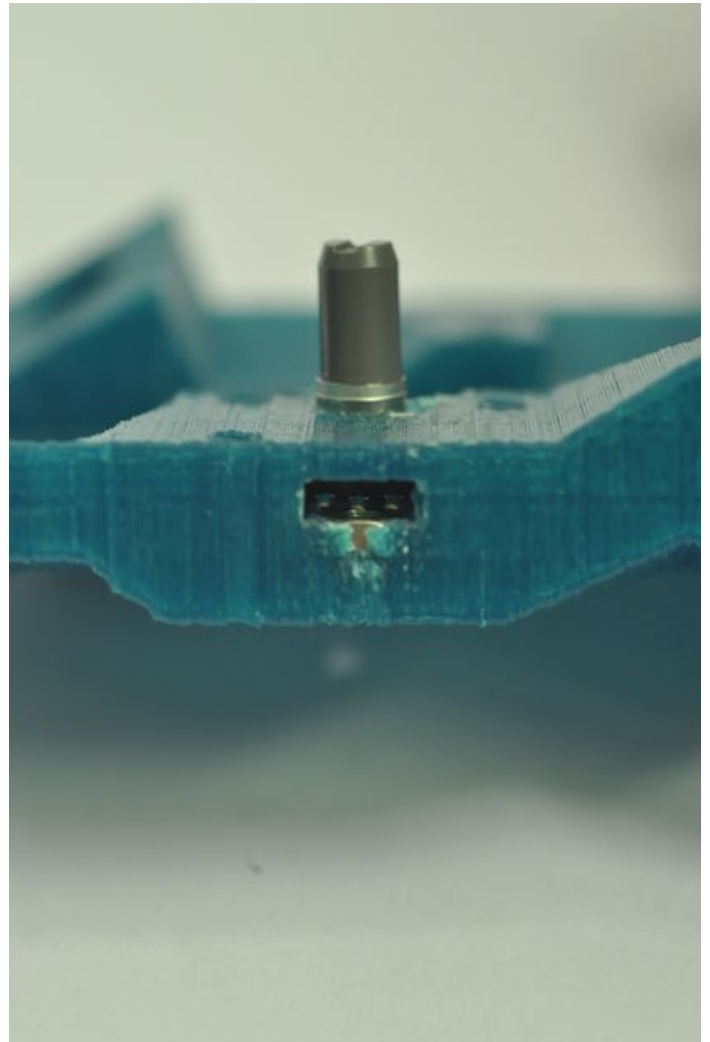
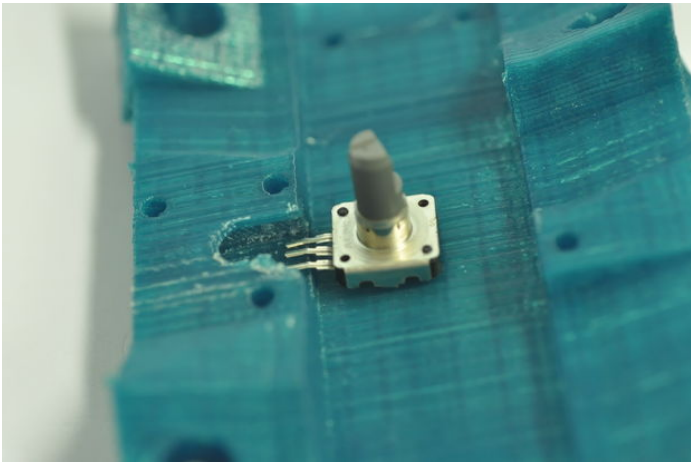


Step 20: Place the rotary encoder

Place the rotary encoder with the pins straight, cut the legs

Slide it in, careful with the pins

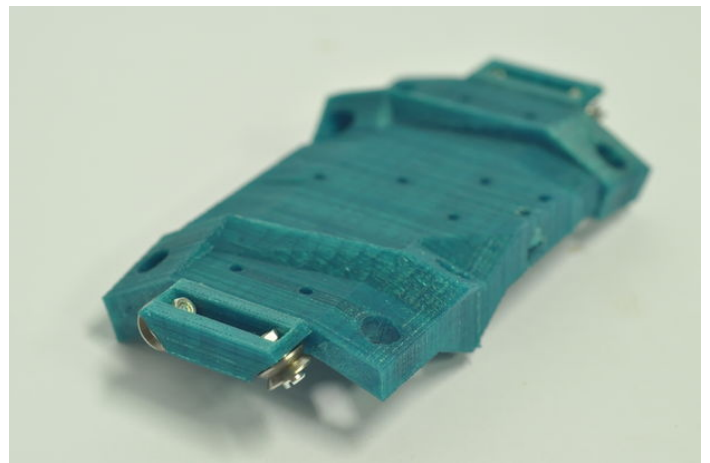
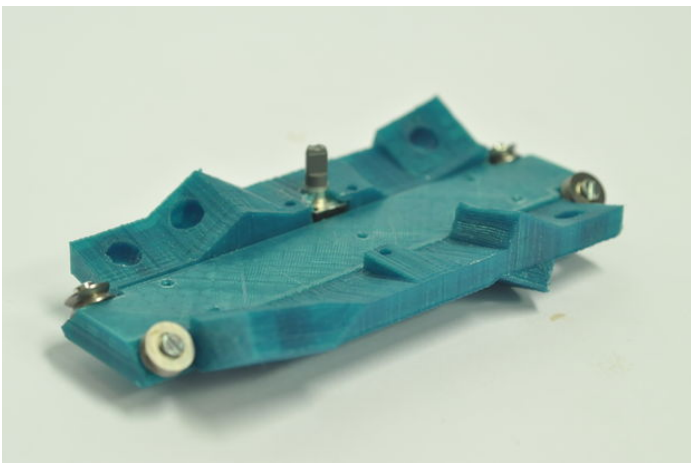


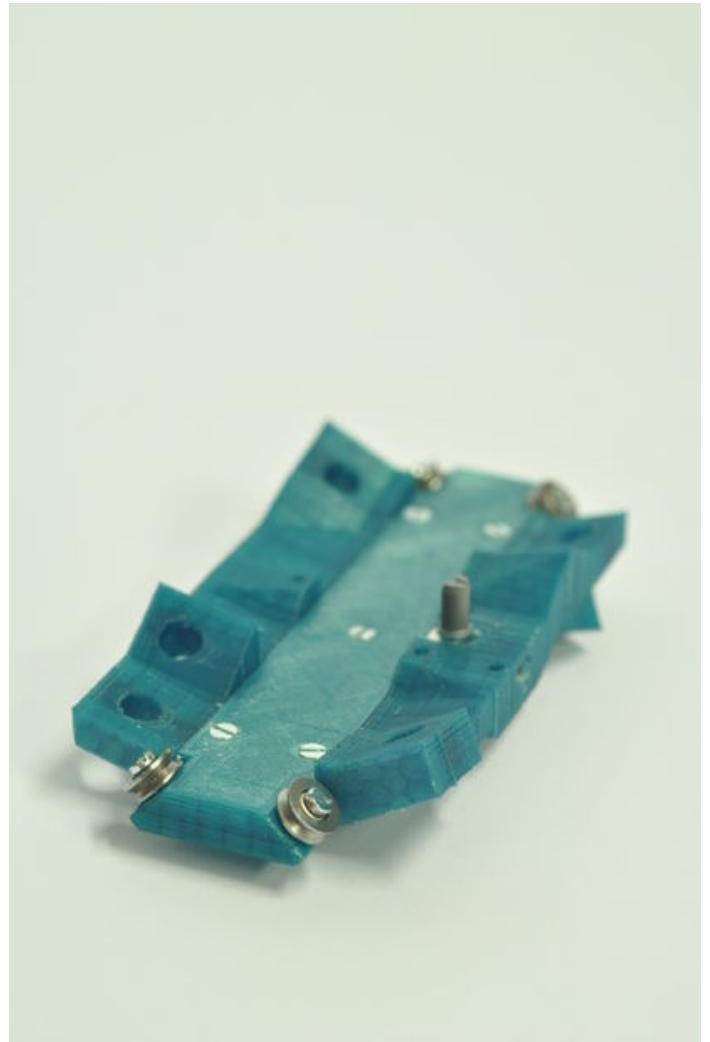
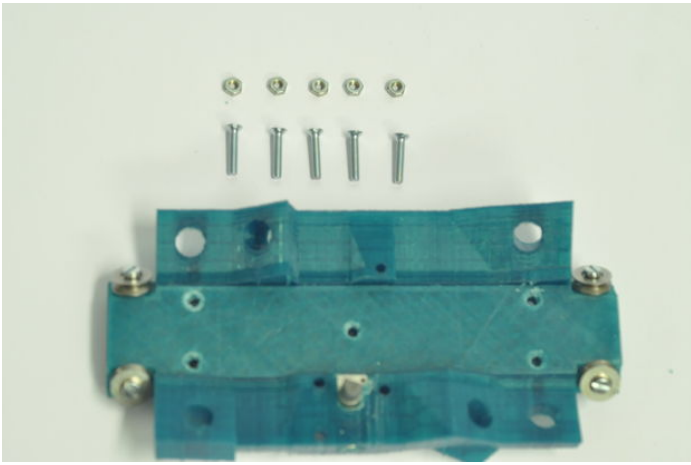


Step 21: Assemble “top_plate_bearings” part with “top_plate” part

Take five long M3x12 countersink bolts

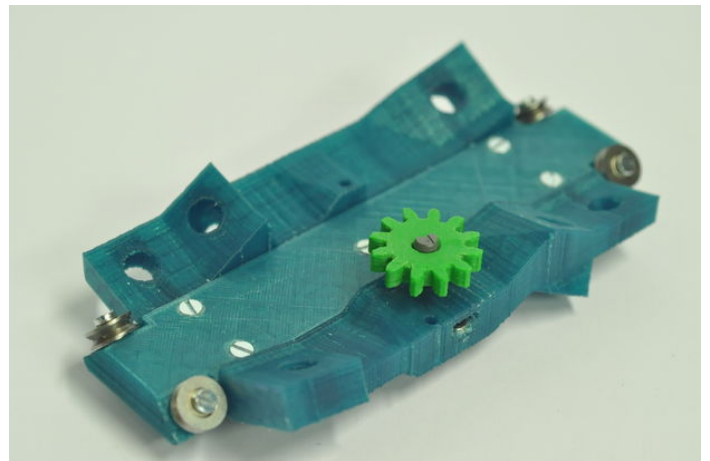
Attach the two parts firmly

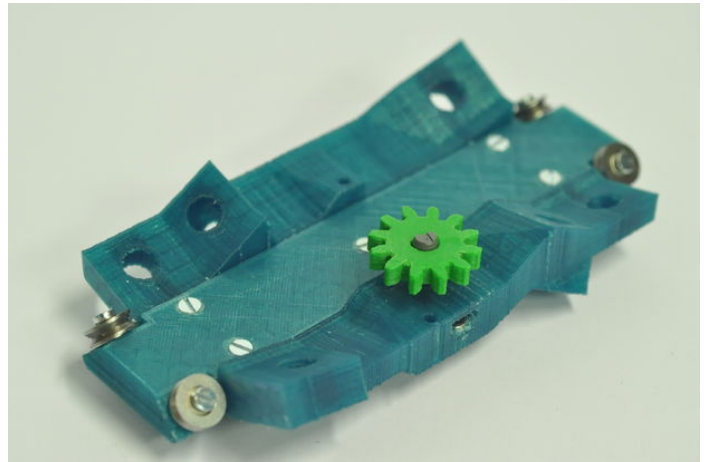
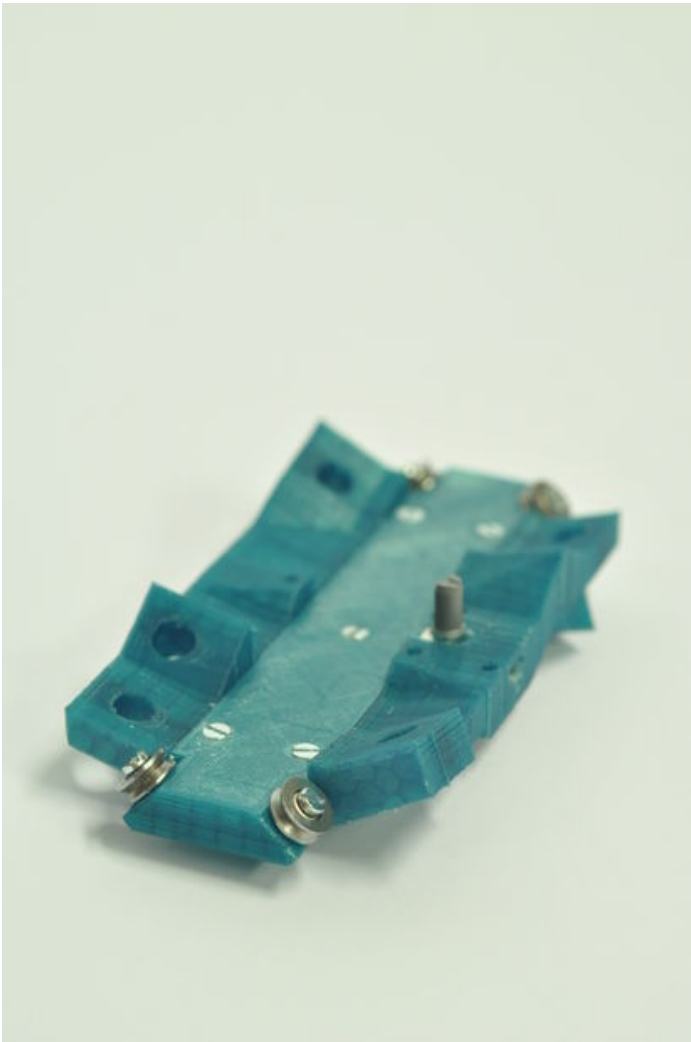




Step 22: Add the gear

Once the screws are all attached, place the “encoder_pinion” on the rotary encoder.





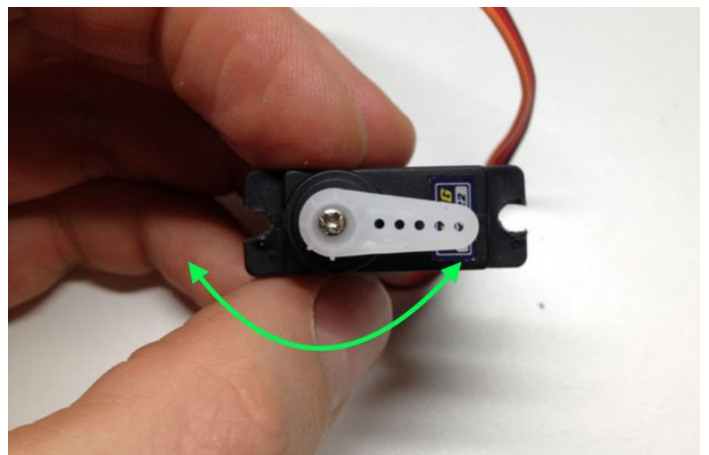
Step 23: Prepare a servomotor

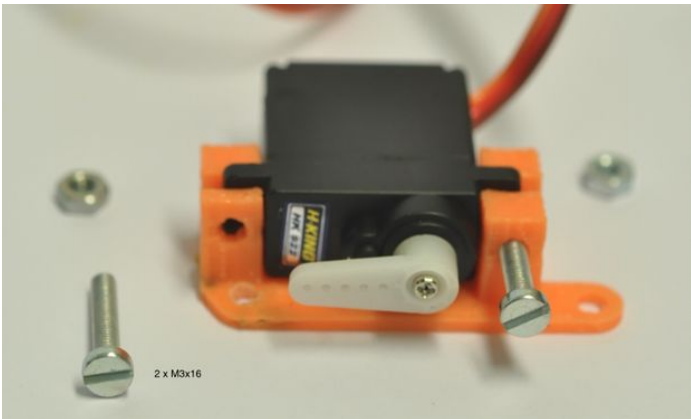
Use the "top_plate_servo_mount", place the servo in - be careful not to loose the tiny servo bolt that comes with the motor

Make sure the arm does the movement indicated in green

Attach the tiny screw

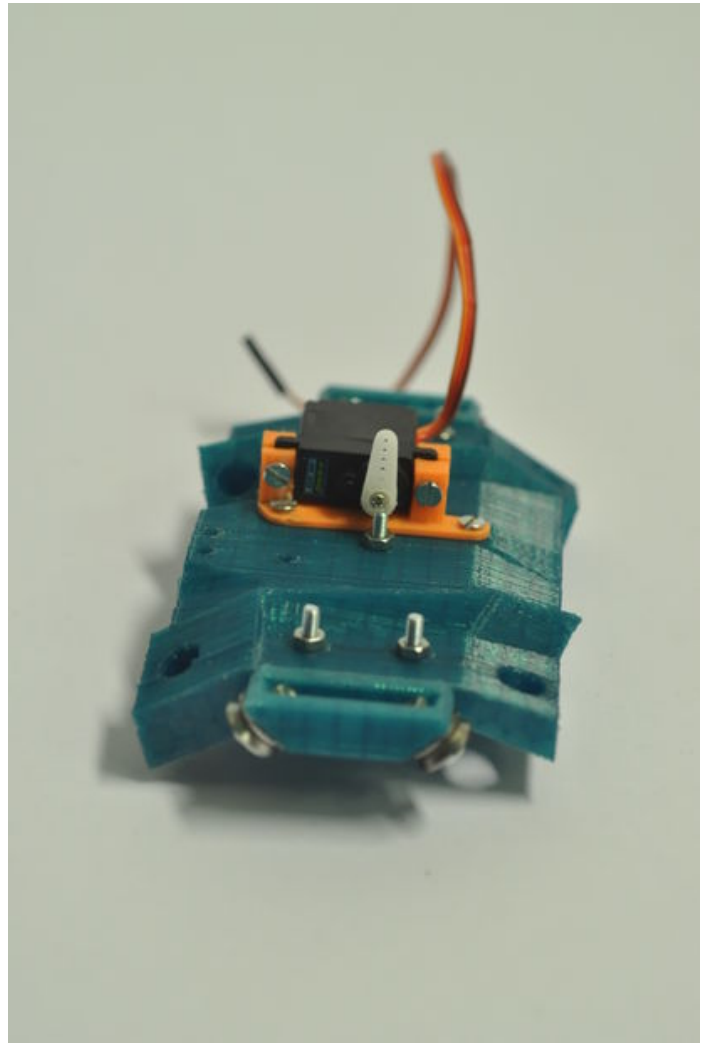
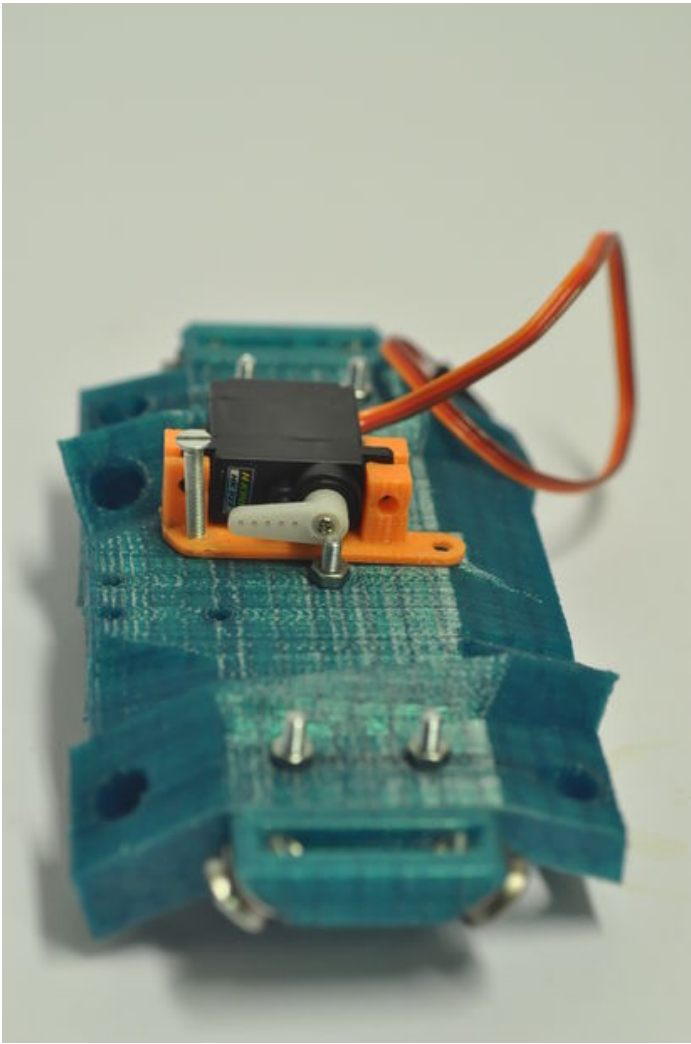
Put M3 x 16 bolts through holder and motor to fixate them





Step 24: Place the servo on the top plate

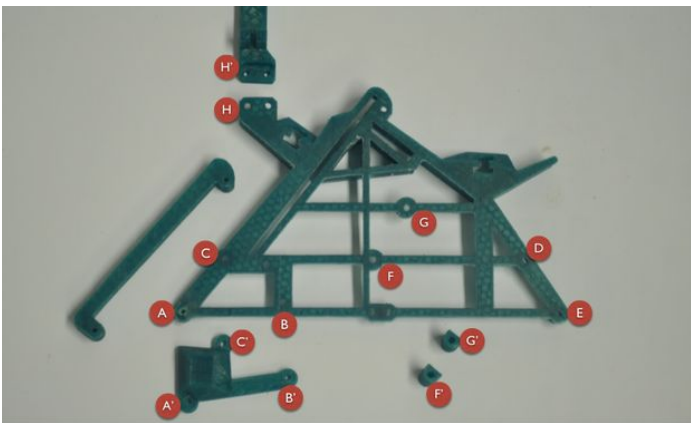
Attach the servo on top with 3 bolts



Step 25: Prepare the main carriage

These are the parts you need.

Each hole corresponds to a letter

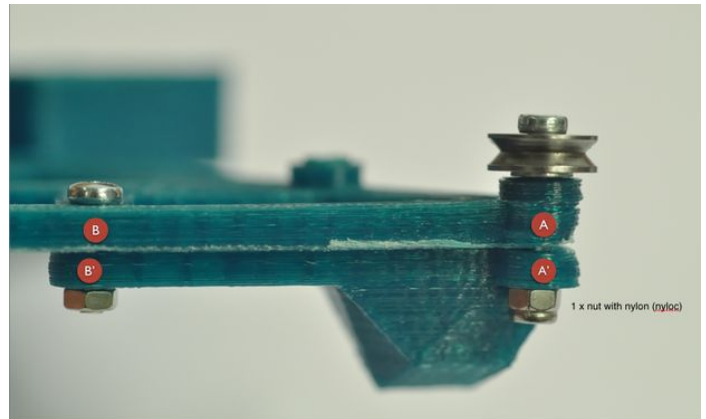
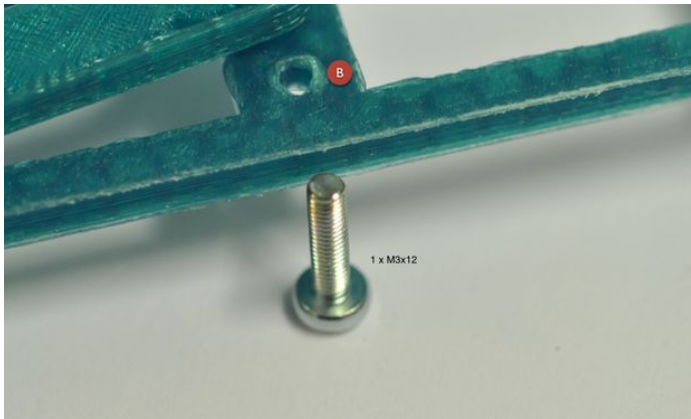
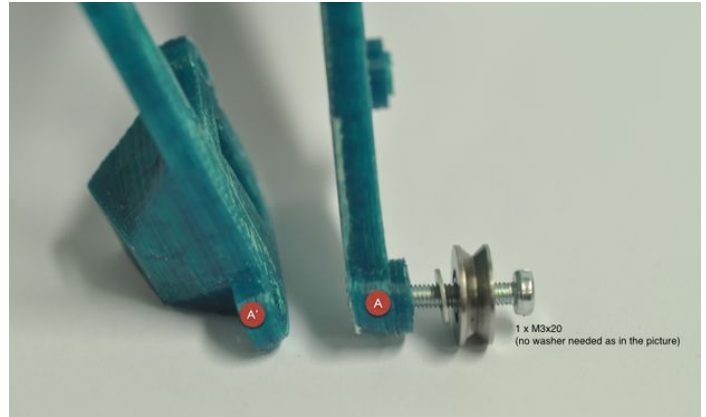
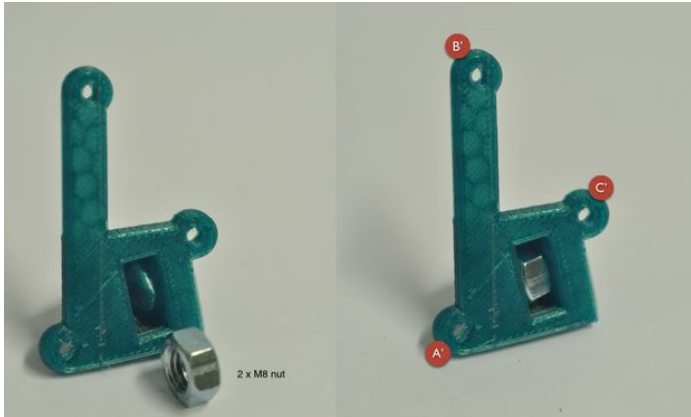


Step 26: Attach the N-mount part

Place M8 nut into the "N_mount"

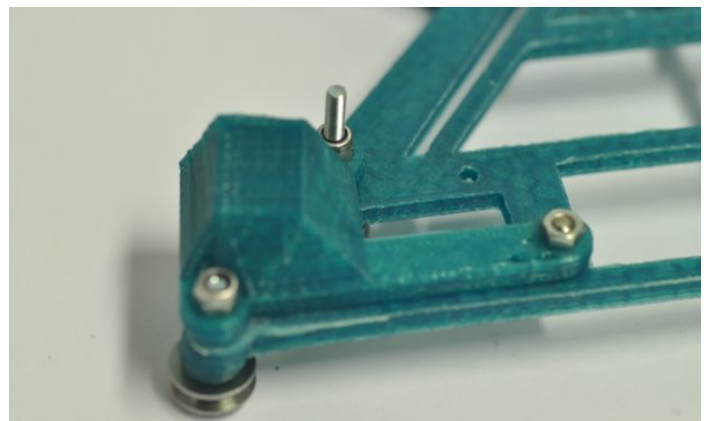
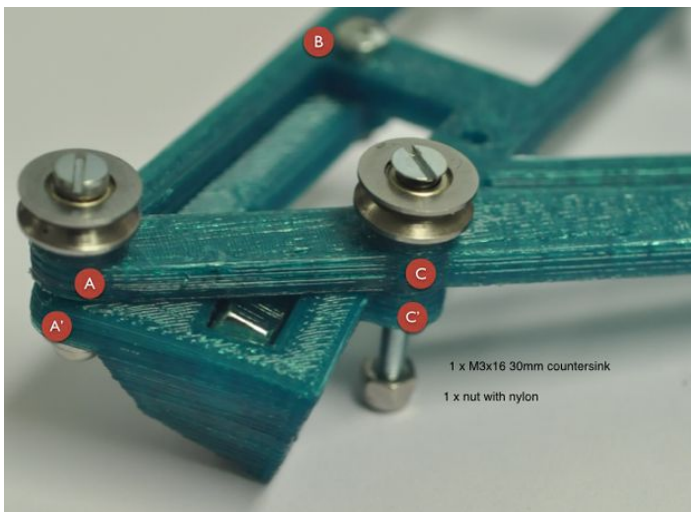
Position it with the "carriage" part and a bearing

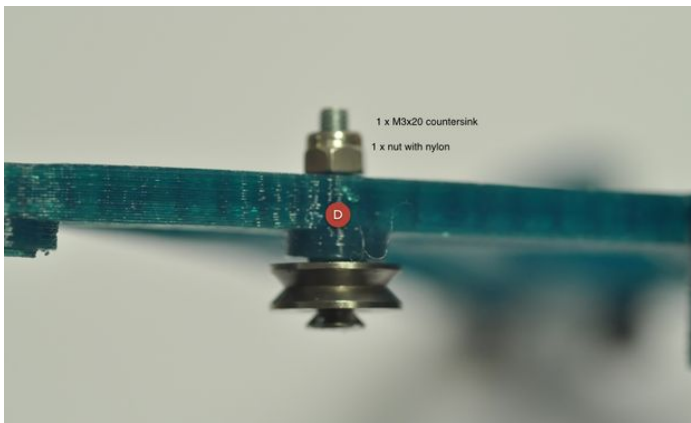
Attach the long end with a bolt



Step 27: Add another

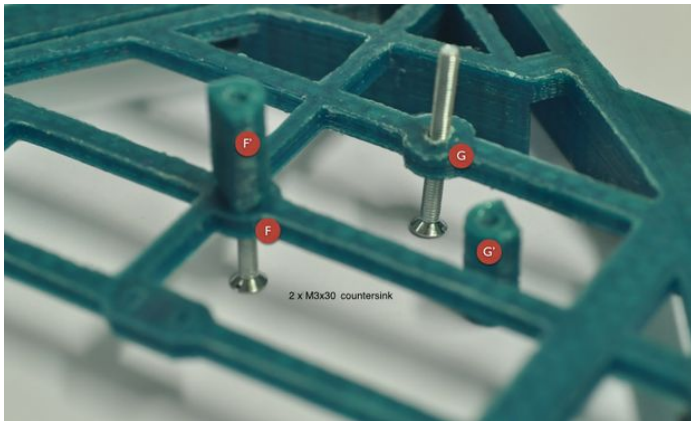
Use M3x16 30mm countersink bolt and nylock nut to attach the bearing.





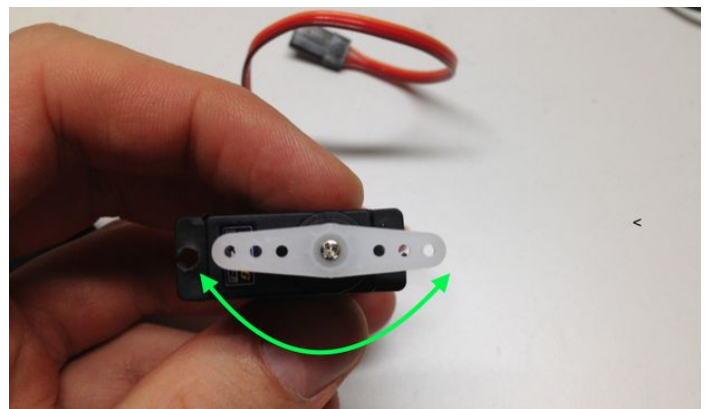
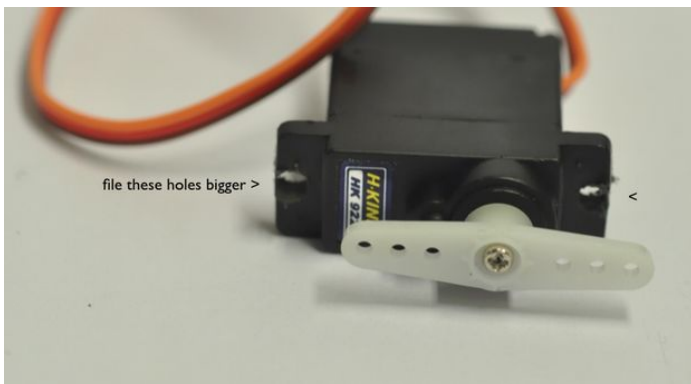
Step 28: Place “servo_mount_carriage” parts

You'll need 2 x M3x30 countersink bolts to place the servo mount carriage parts.



Step 29: Prepare the servo motor

Position the 'wings' of the servo motor like this and fix with the tiny screw from the package. File its holes on both sides of the black plastic, they need to be a bit wider. Make sure the arm moves as indicated in green.



Step 30: Make the 'servo beam mount'

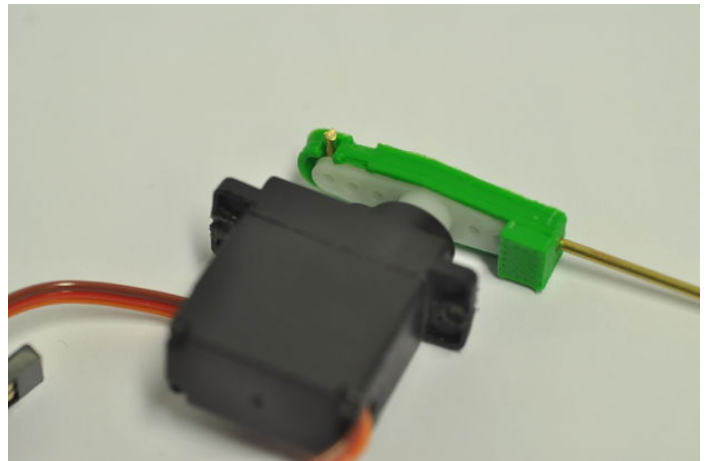
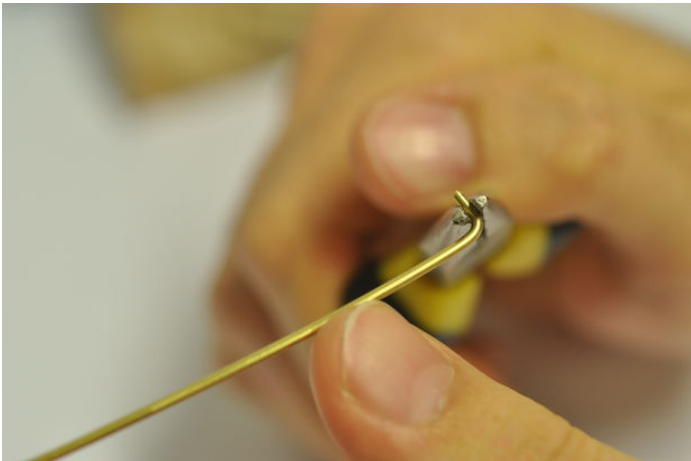
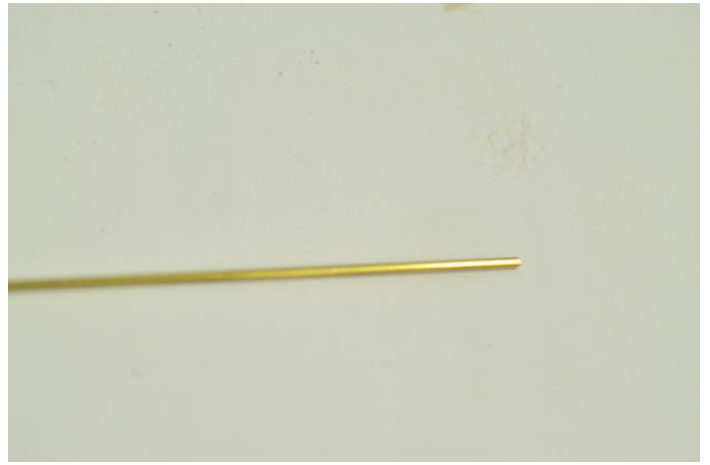
Take the 3D printed 'servo beam mount' part.

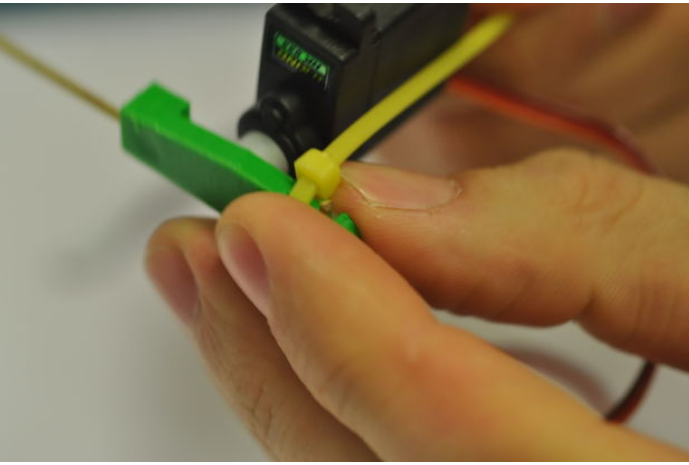
Bend the pin

Slide the pin into the part

Position it over the servo motor wings

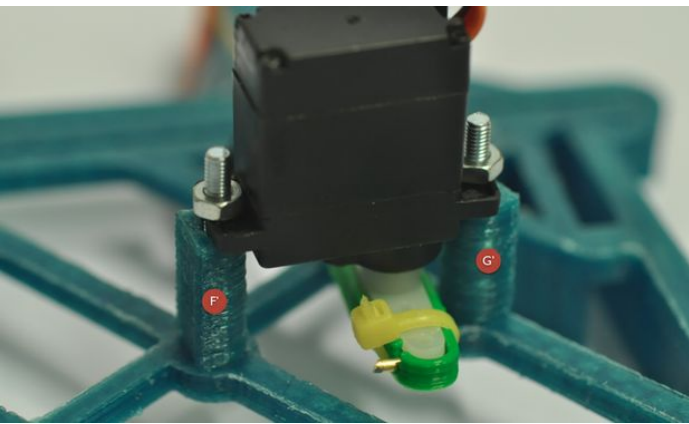
Tie the pieces together





Step 31: Attach the motor to the carriage

Using long M3 bolts and nuts



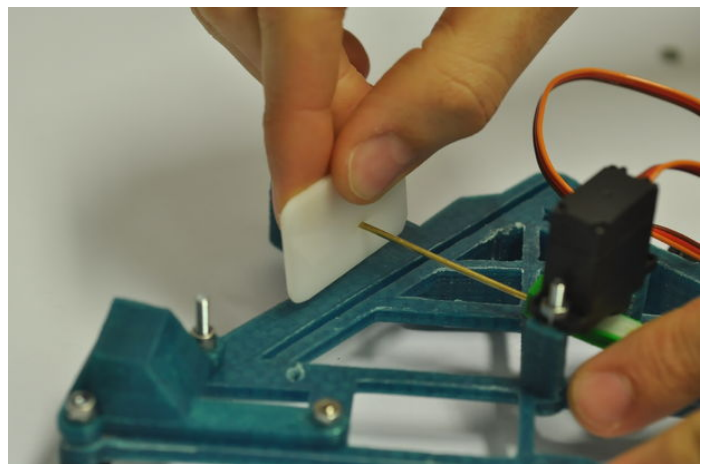
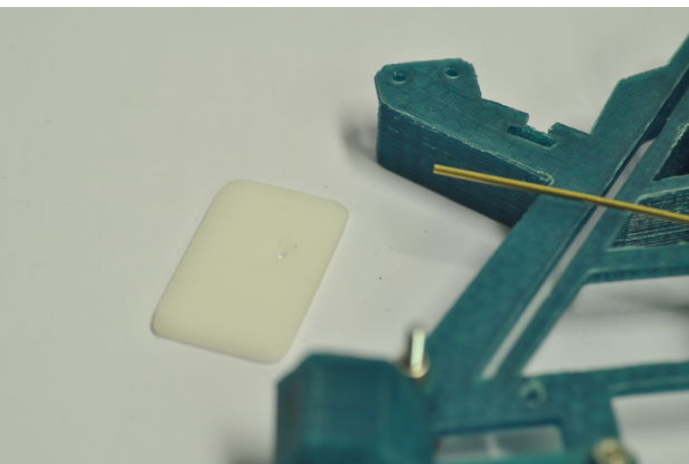
Step 32: Assemble the slider part

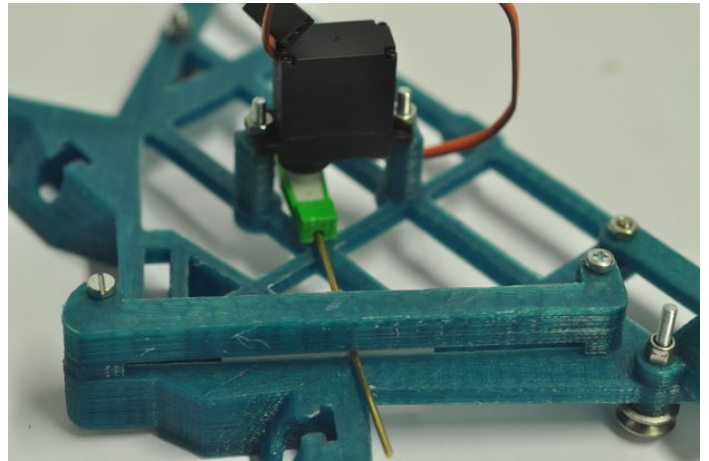
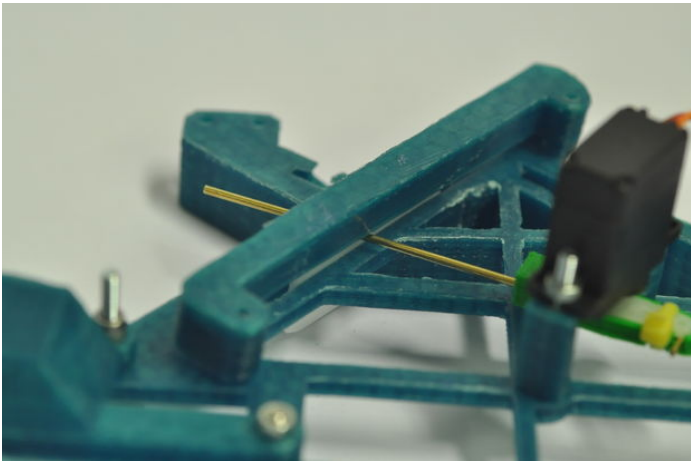
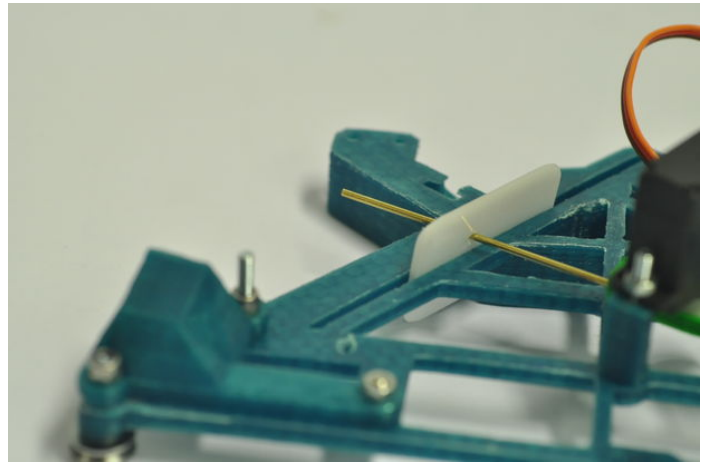
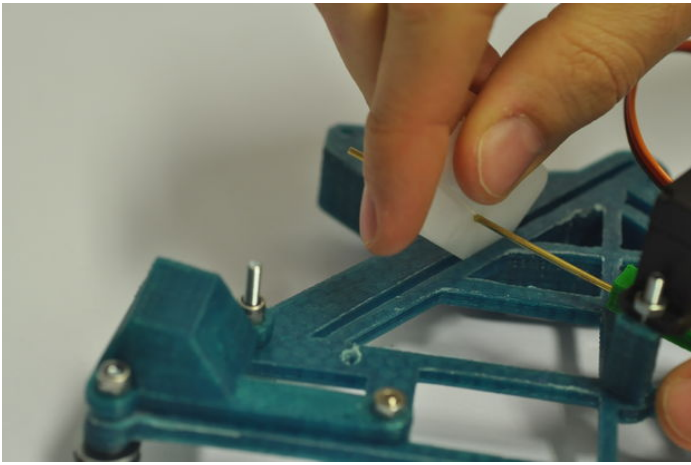
Take the white acrylic 'slider' square

Position it on the pin

Place it in the slid as indicated in the image. Now it should be able to slide.

Attach the 3D printed 'slider guide' on top with M3 cross bolts





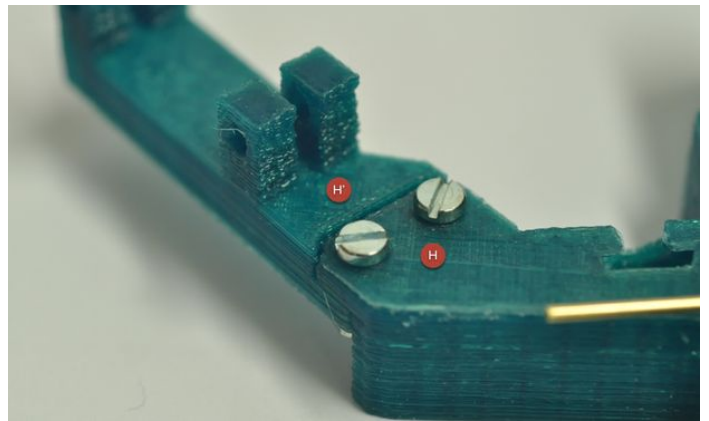
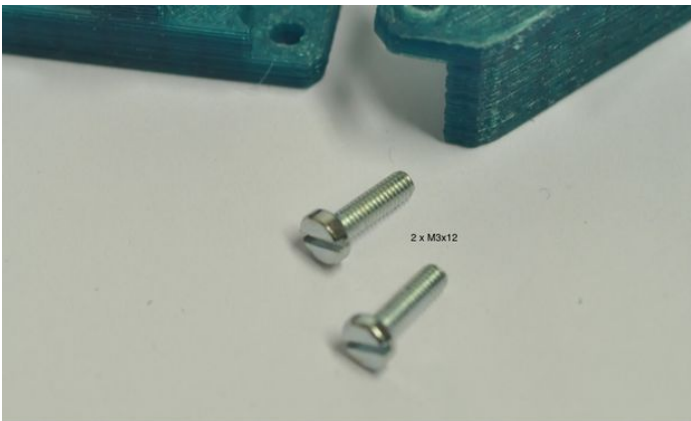
Step 33: Prepare the SLED mechanism

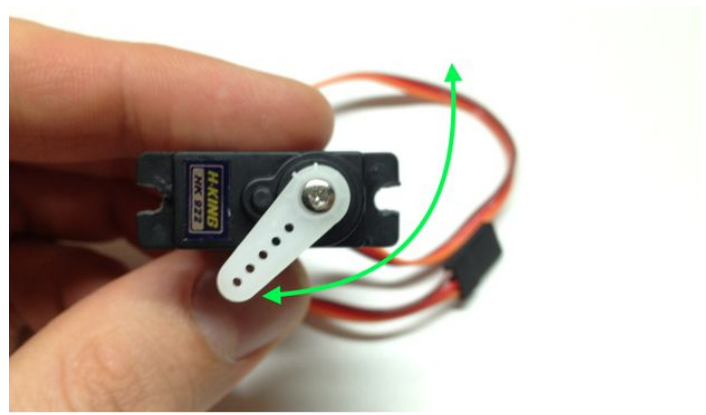
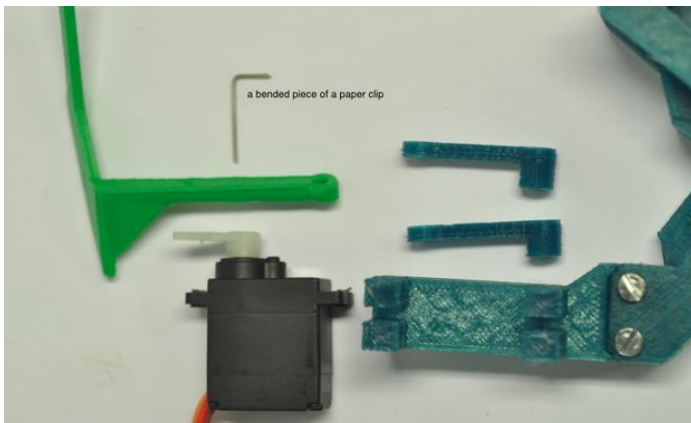
Use two M3 x 12 bolts

To place the 'sled mount' on the carriage

Take 'sled', 'sled arms' and a servo motor, plus a bended paperclip

Make sure the arm of the servo can move as indicated with the green arrow in the picture

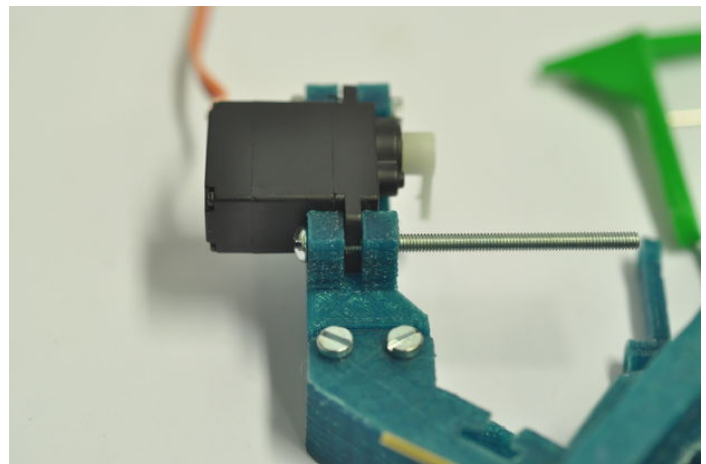
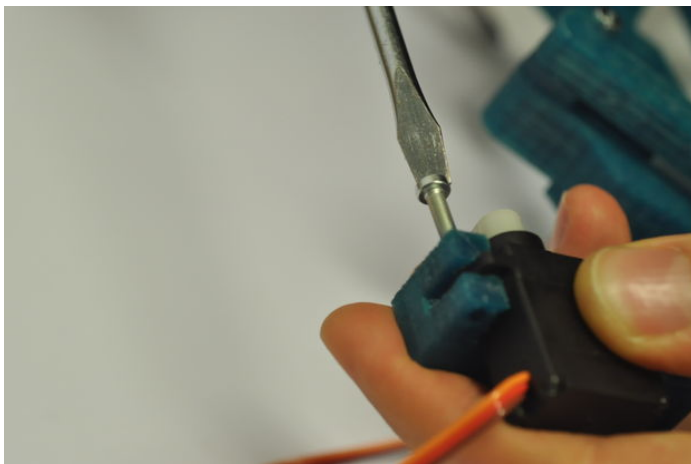




Step 34: Attach the motor

Screw the motor to the sled mechanism using an M3 x 16 bolt

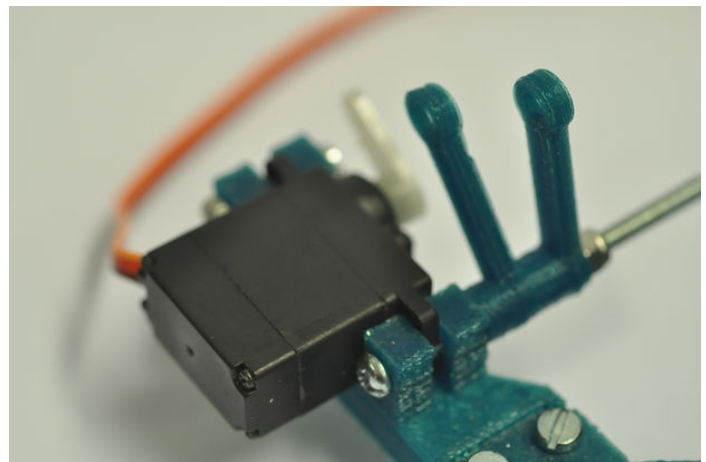
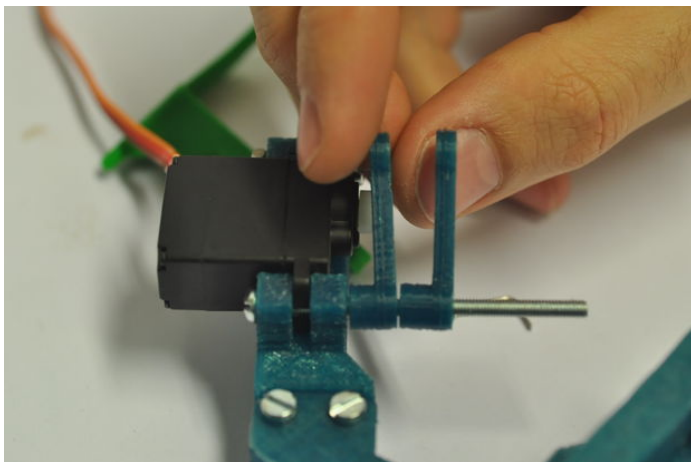
Slide the long M3x35 bolt through the hole



Step 35: Add arms

Now slide two of the arms over the 35mm bolt towards the motor. Finish it with a nut with nylon, allowing the

arms to turn freely

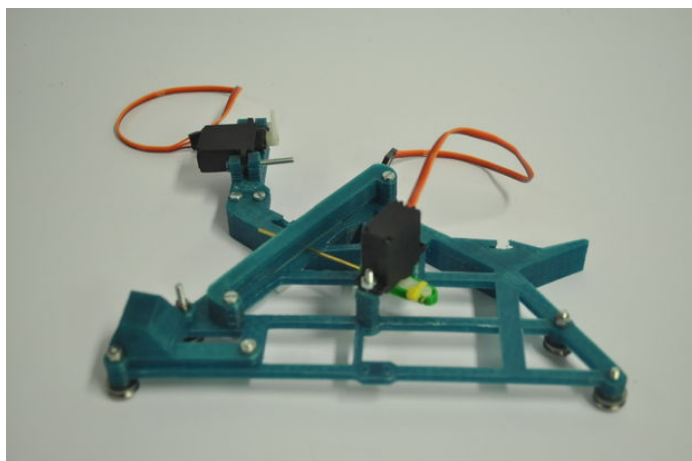
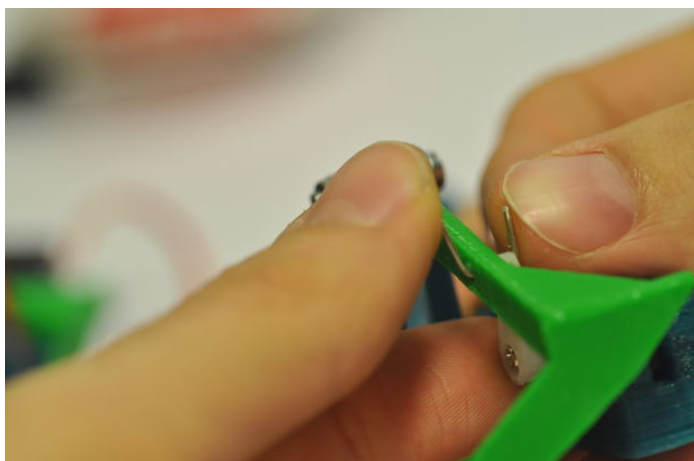
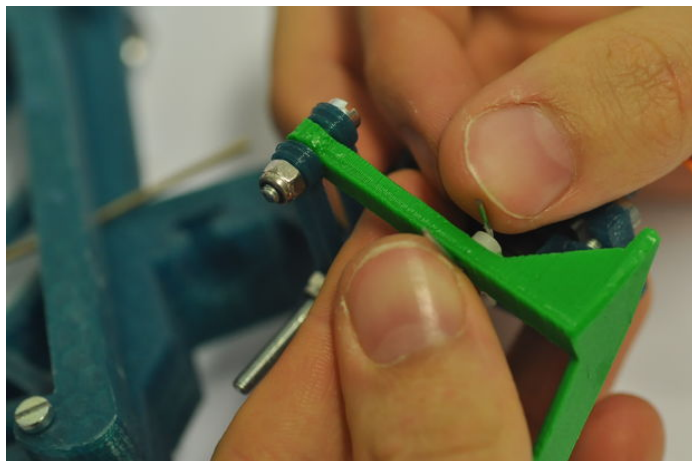
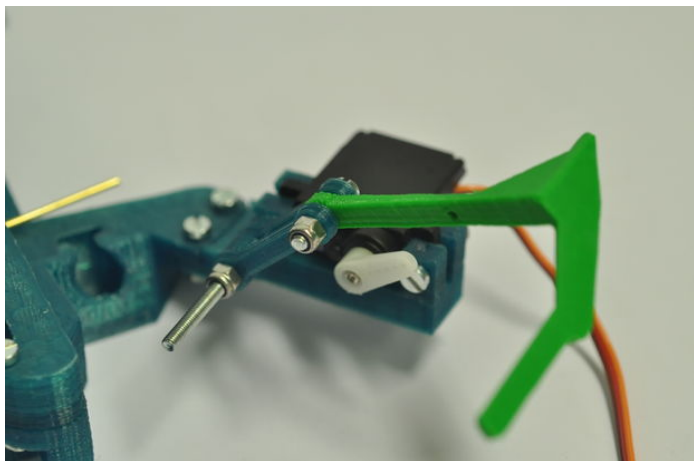


Step 36: Almost done with the carriage...

At the top side of the arms, attach the bright green part, using a nut with nylon again. The sled should move freely.

Pull the paper clip though the wing of the motor and the bright green part and bend it to fix it, as shown in the picture

Now you have finished your first carriage piece! There is two of them, so one more to go...

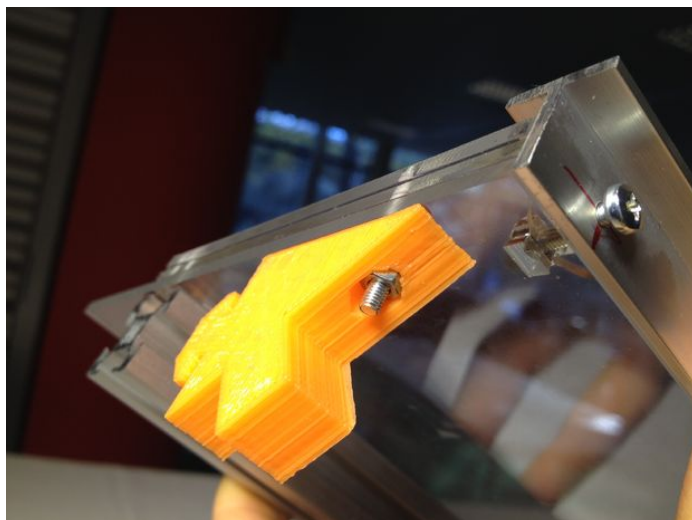
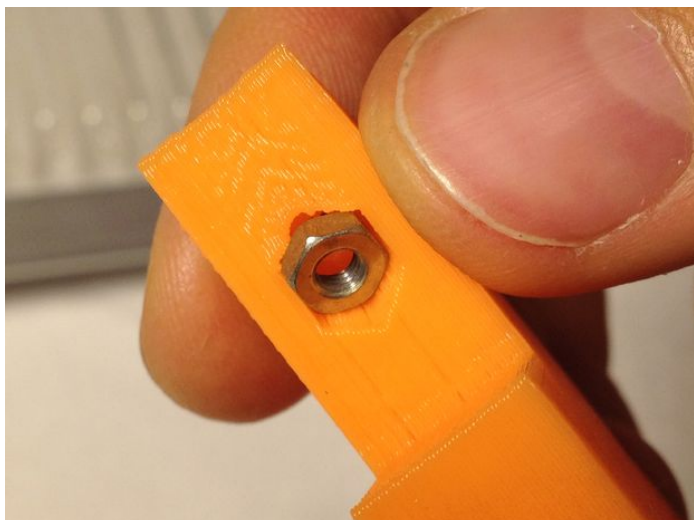


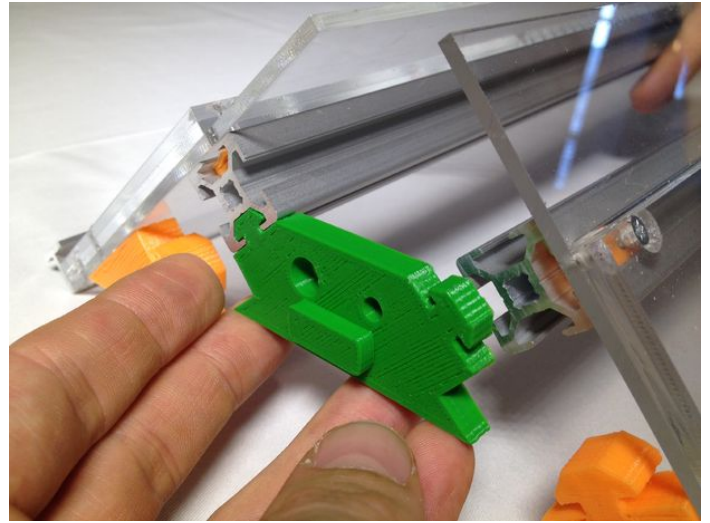
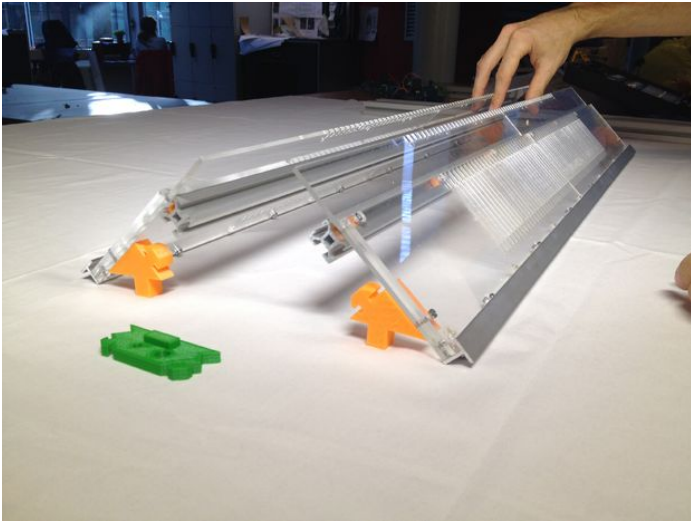
Step 37: Make the 'legs' of the machine

Take the four leg parts, place the nut with the help of the bolt.

Place them underneath the acrylic assembly

Slide in the 'space invader'

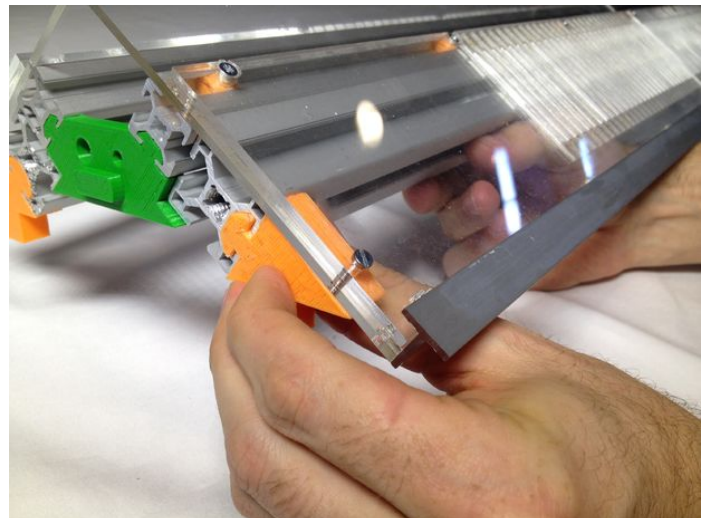
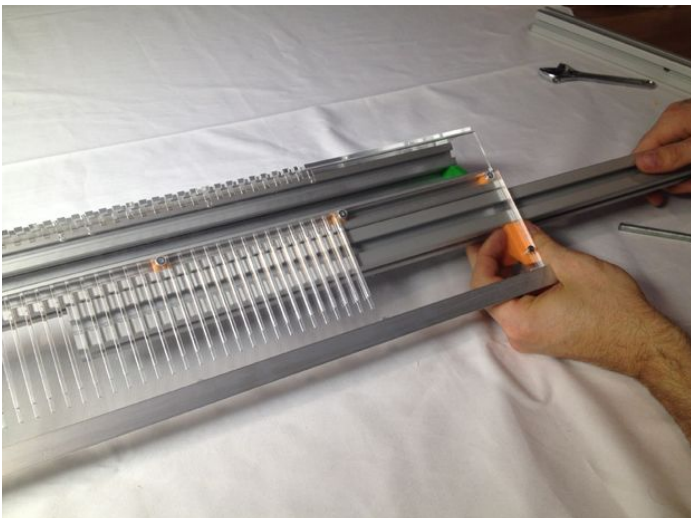
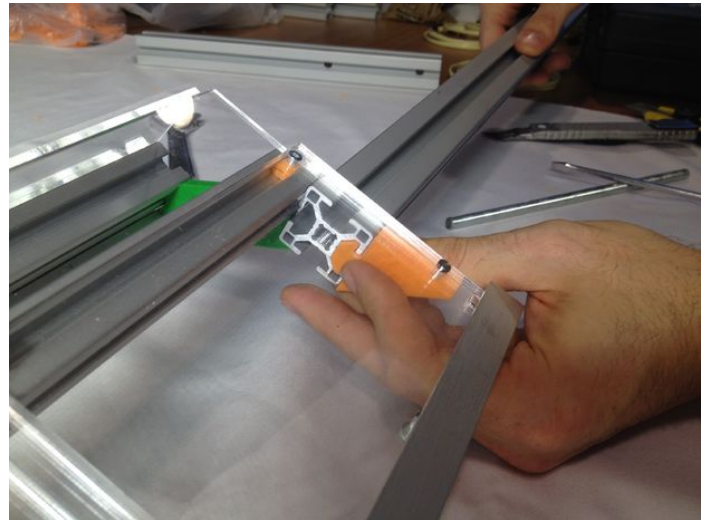
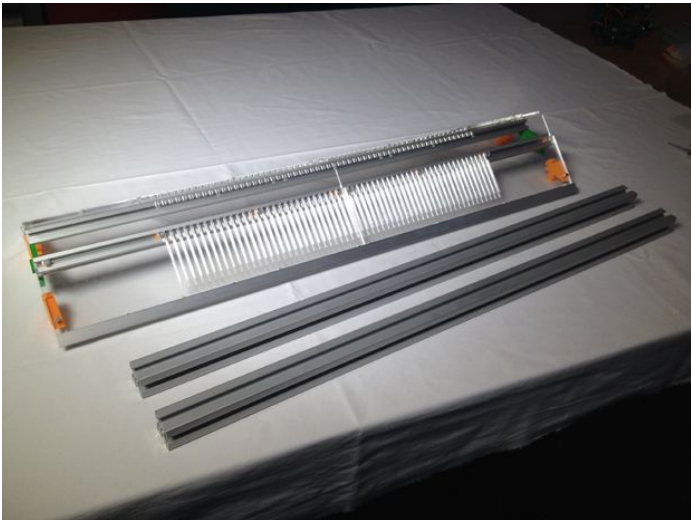




Step 38: Place the 3030 profiles

Take the 30 x 30 x 800 mm aluminum bars. Carefully slide the '3030' in, holding the 'leg' parts straight.

Do it really slowly slowly while holding the other 'leg' parts straight.

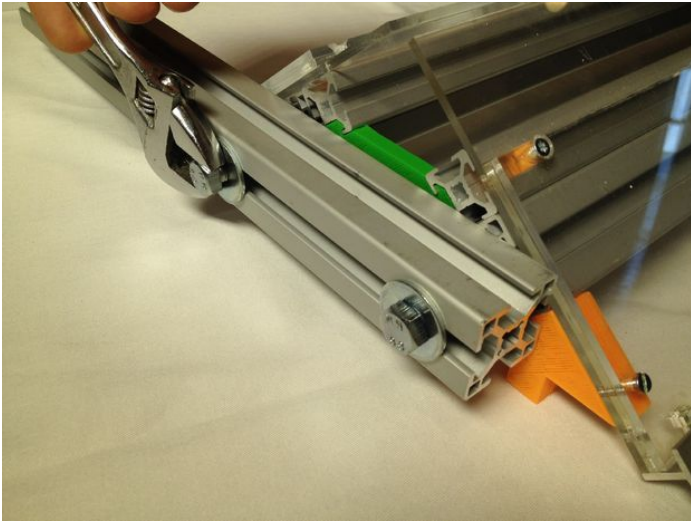
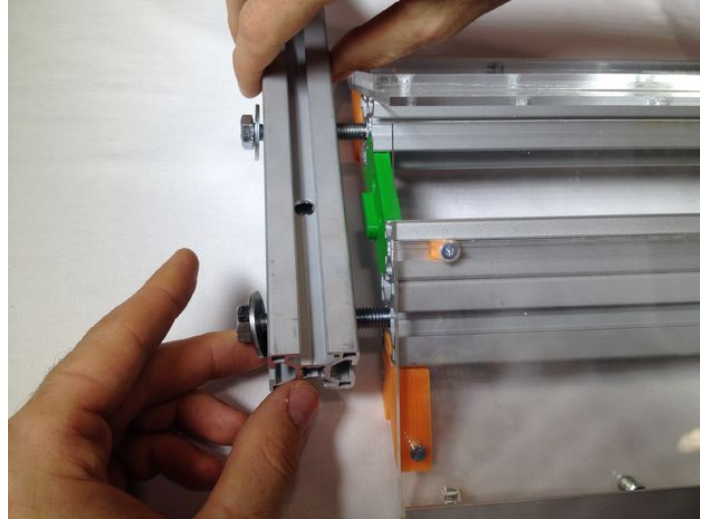
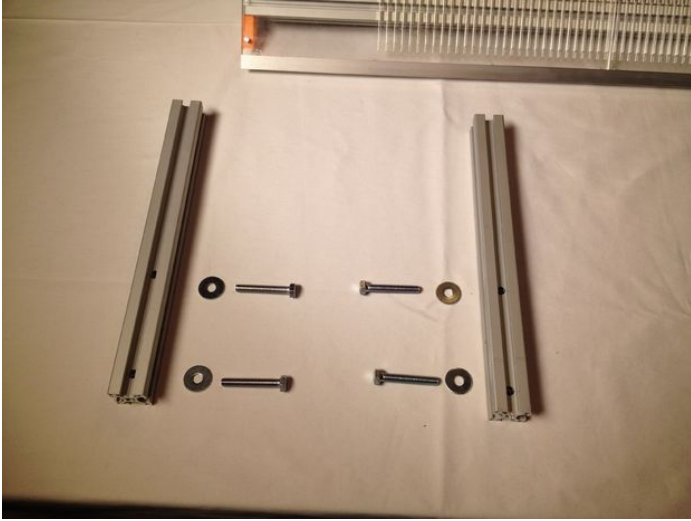


Step 39: Place the short aluminum profiles

You need the 320 mm long profiles, 4 M8 washers and M8 x 50 bolts

Place the profiles carefully on the side of the machine, don't tighten them all the way.

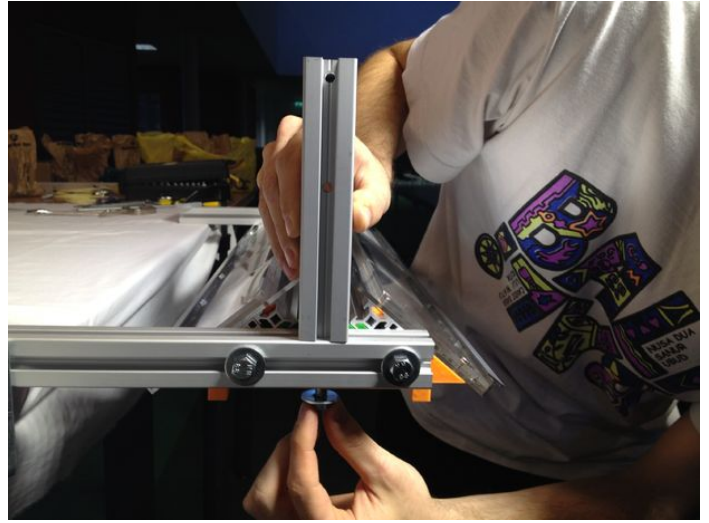
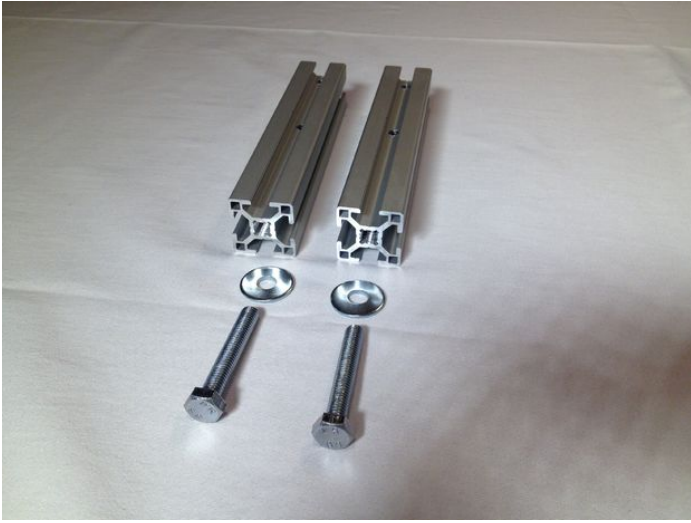
Then get the clamps. It is recommended to have 2 people for this task: clamping the machine on the table.



Step 40: Placing the vertical short bars

You'll need the 164 mm short aluminum bars, 2 M8 x 50 bolts and M8 washers

Place the bar as indicated in the picture. Put it so the holes on the side are at the top on the outside.



Step 41: Prepare the yarn carrier

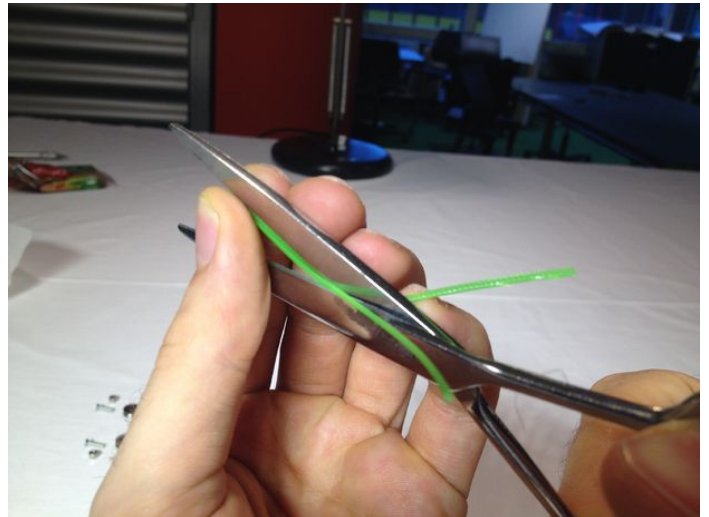
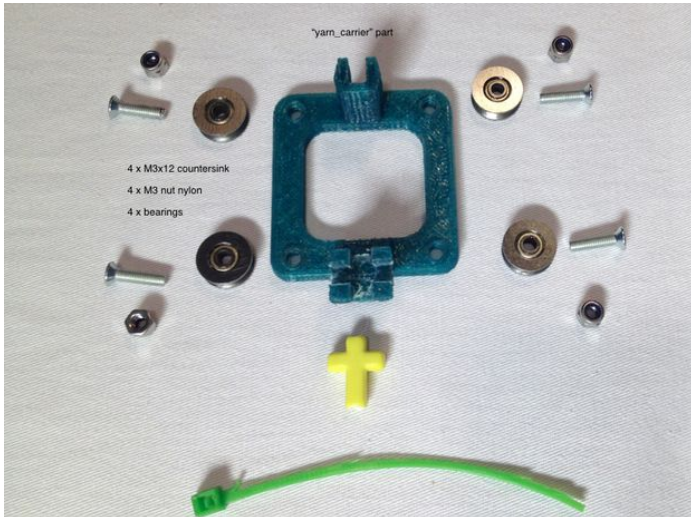
You need the yarn carrier part, 4 M3 nylon nuts, 4 M3x12 countersink bolts and 4 bearings, a cross shaped bead and a tie wrap.

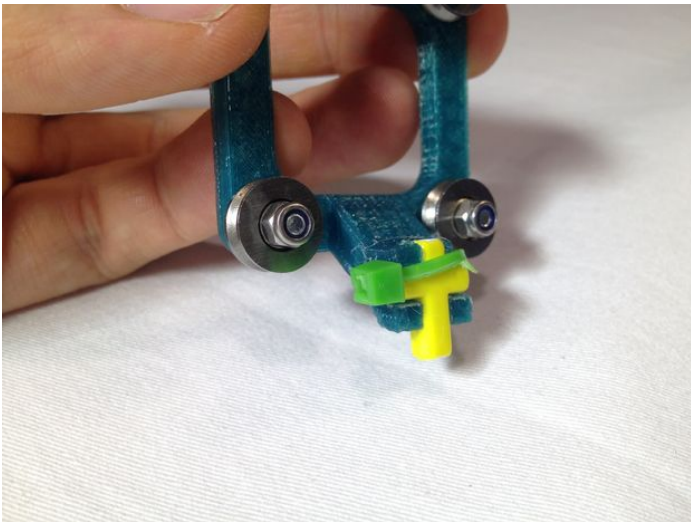
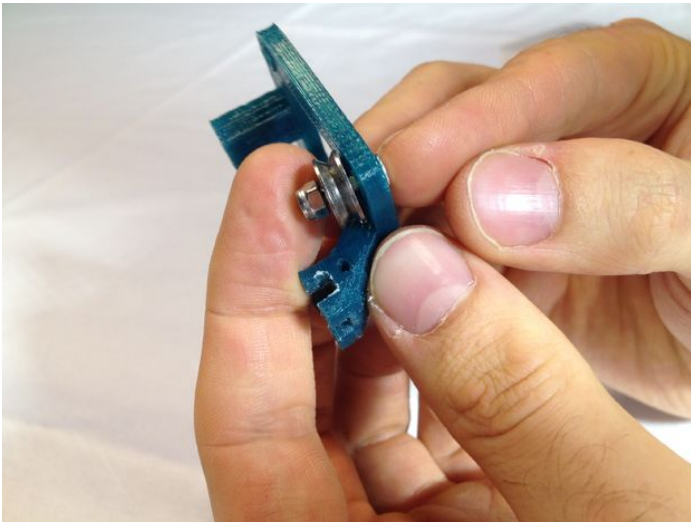
Narrow the tie if yours is too thick.

Tighten the nut without blocking the bearing

Smooth the cross shaped beads so the thread can move through easily

Snap the cross in, and use the zip tie carefully





Step 42:

Step 43:

Related Instructables



Knit a Working Circuit Board by jseay



Circular Knit Stretch Sensor by Plusea



Knit Touchpad by Plusea



The Mooshroom Hat by Teisha



Faux Tie Die Knit Lunch Bag by loangb



Text on fabric with Inkjet for KAY labels by beth.barlow.777

Comments

1 comments

[Add Comment](#)



seamster says:

Nov 26, 2014. 11:11 AM [REPLY](#)

This is really impressive! I enjoyed reading though and seeing the process of making this.

Do you have a video showing the machine in action, or additional info detailing how it is used? That would be great to include.