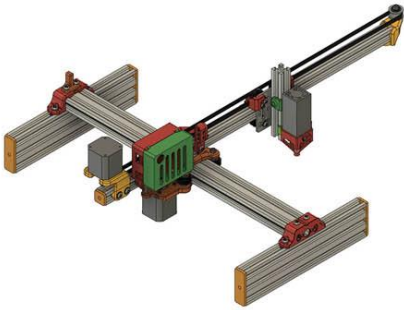
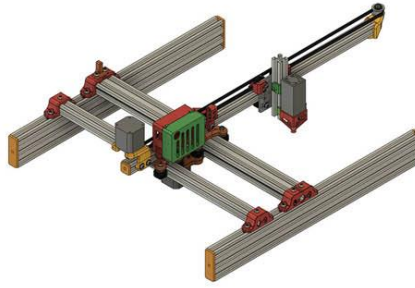


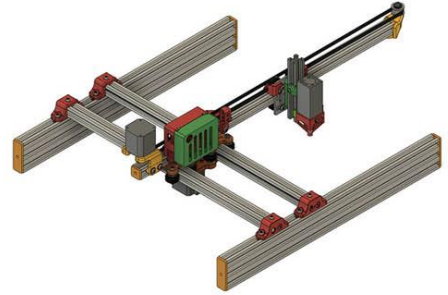
Assembly Guide for Horizontal/Vertical Cantilever Laser Engraver V821.1



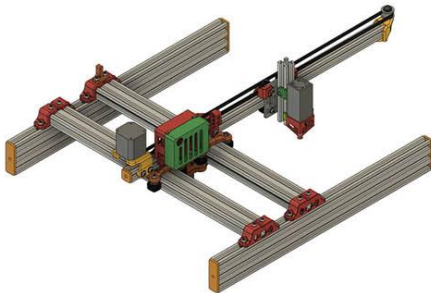
A_2040_Horizontal.jpg



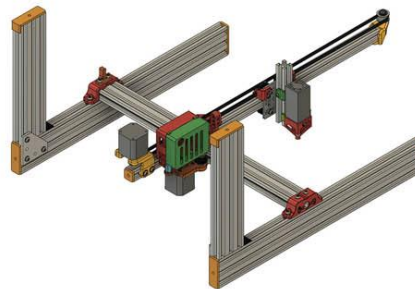
B_2040x2020_Horizontal.jpg



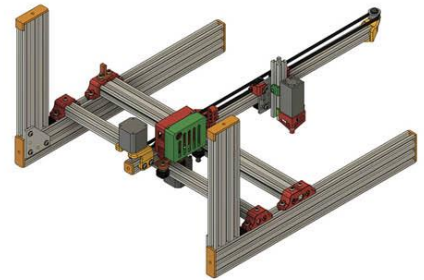
C_2020x2020_Horizontal.jpg



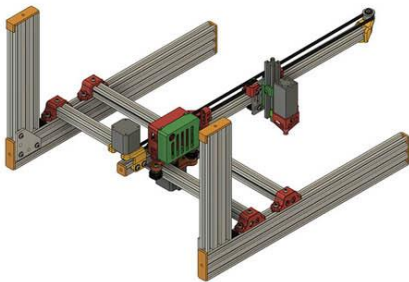
D_2040x2040_Horizontal.jpg



E_2040_HorizontalVertical.jpg



F_2040x2020_HorizontalVertical.jpg



G_2020x2020_HorizontalVertical.jpg



H_2040x2040_HorizontalVertical.jpg

Warning:

Be sure to get some good laser safety glasses that protect your eyes against the wave length laser you are using. If using this outside or around other people, make sure you block any stray laser light from their view. The mechanical part of this build is fairly easy, but I found the electronics the most difficult part of this build because of the laser connections. Be sure to understand how to connect your particular laser before attempting this project because you could easily destroy your laser or controller board. Soldering maybe required for the laser wiring depending on your laser & controller board.

This build uses V-Slot aluminum extrusions. Any comment referencing 2020, 2040 or 2060 is assumed to be V-Slot. There are several options for this build now depending on your requirements. I show 8 different configurations in the front page image. Using 2060x500mm for the feet & 2060x250mm for the 90 degree vertical leg will allow you to use this machine in horizontal or vertical mode which to the software you are using will make no difference. This is shown in versions E-G configurations on 1st page. For clarity in this document, I will call the V-Slot 2040 where the main plates are connected the Main Beam & the V-Slot 2020 where the laser rolls back & forth the Cantilever. If you are using either a 2040/2020 or 2020/2020 for double beams, the beam with the bottom motor attached will be called the Main Beam & the other one the Back Beam.

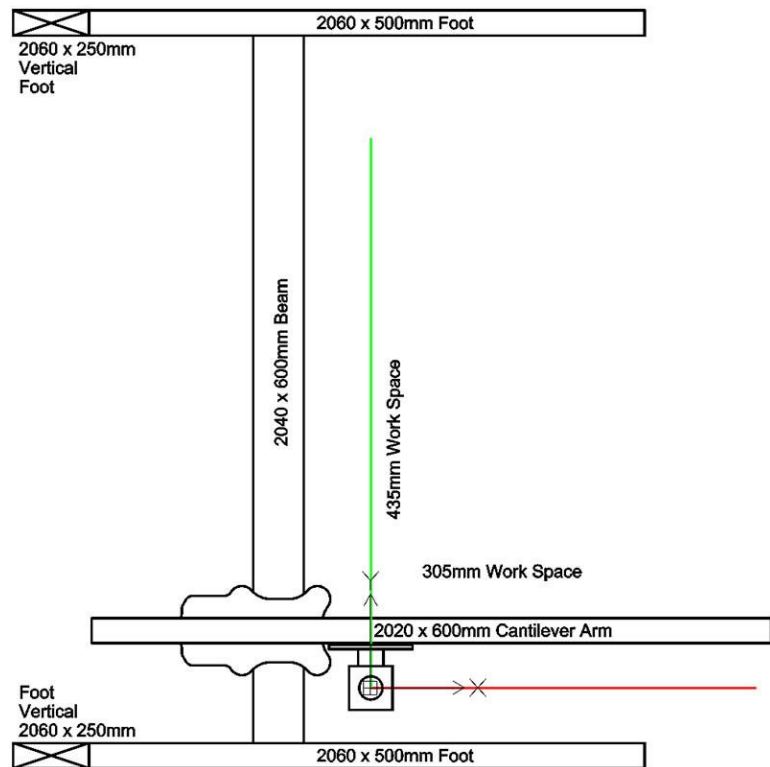
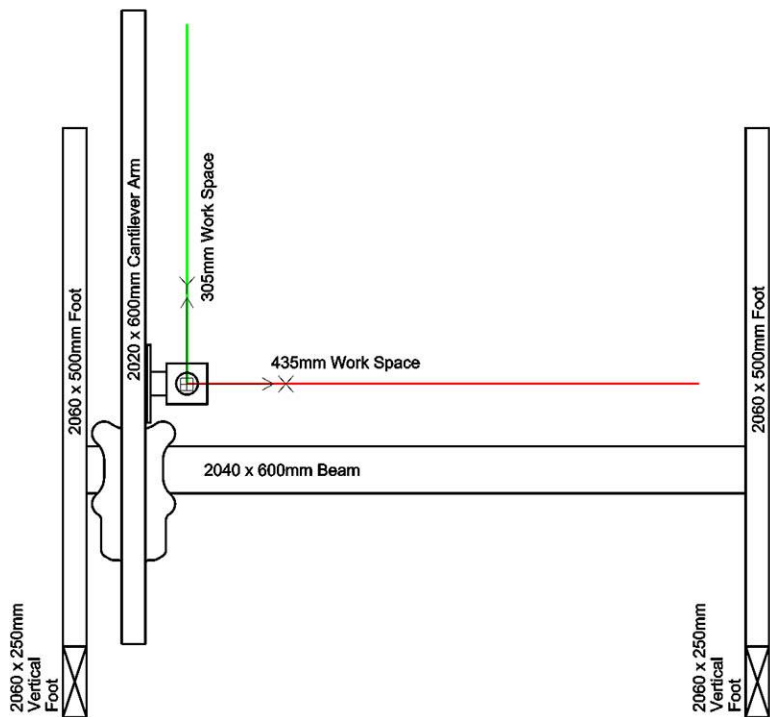
There is also an option to use double V-Slot 2020 to give you more rigidity with smaller printed plated top & bottom plates & 4 - OverHd_2020x2060_Bracket_V821.1.stl (Shown in option C & G). This will allow you to use a longer cantilever. You will also need 4 additional wheels & related hardware & a few more Tee Nuts with M5x12mm screws for the double beams. In vertical mode, a 1000mm V-Slot 2020 will work. You can also use a 2040 from previous build as the main beam going across & add the additional 2020 later. The option I am using is F with a 2040x600mm Main Beam, 2020x600mm Back Beam & a 2020x700mm Cantilever. This gives me a working area of 425mmx425mm (16.7"x16.7"). Using a 2020x600mm Cantilever will give you 305mm (12"). I am using a NEJE 6W laser which weighs 3.6oz.

I am using stainless steel screws & Locknuts, Socket Button Head M5 screws and M3 Socket cap screws. I don't use the M3 button heads as they take too small of an Allen wrench for my liking. There are no clearance problems with using standard Socket head M5 screws. There are no tapped holes needed in this build as there were before, but you might consider tapping the short Z-axis 2020 and one end of the 2020 cantilever for future use if you are comfortable tapping M5 holes. The short 125mm length of V-Slot 2020 for the Z-axis was cut from a 250mm length with a hack saw. The Z-axis does not have to be a perfect cut on one end, but you might want the top flat if you tap that hole. The controller board I am using is an EleksMaker Mana 3 board, but I have successfully setup an Arduino UNO clone with a CNC Shield V3 and also setup a Keyestudio CNC Shield V4 board. The laser connections are simpler on the EleksMaker board, but the limit switch wiring on that board is not as straight forward. I am not using endstops, but created the mounts for them. The end caps for the V-Slot 2060 & V-Slot 2020 are press fit, so not additional hardware needed for them.

The offset of the cantilever V-Slot 2020 can easily be adjusted after the build by loosening 3 - M5 screws attached to Tee Nuts below the V-Slot 2020 (4 screws if using 2020/2020 (C or G), 2040/2020 (B or F) or 2040x2040 (D or H) beam option). This will allow you to find a happy medium between counterbalance & burning width.

Before starting this build you should also consider which axis you want to use for X and Y. I initially wanted my X-axis to be along the Main Beam & Y along the Cantilever. If you are planning to use the rotary turntable (<https://www.thingiverse.com/thing:4958047>), you might want to consider using the Cantilever as the X-Axis since the Lightburn currently does not have a way to use Y-axis for what they call the "scanning axis" in rotary mode & they say they are not likely to add it.

Below are 2 images that show how the X and Y axis look in either configuration. The Red line denotes the X-Axis & the Green line denotes the Y-axis If you are using the Cantilever axis as the X-axis as shown in 2nd image, you might consider using the mirrored motor & idler mount, (MotorMount_Above_M_V821.stl & IdlerMount_Above_M_V821.stl). This would allow you to move the laser carriage to the opposite side of the cantilever.



Below is a chart of the 3D printed parts info for 1st version (A) in image from front page. My total print time was less than 17 hours & used 7.5oz of filament. Total weight of my machine should be from 6lbs 5oz – 12lbs.

File Name	Print Time	Weight(oz)	Perimeters	Infill %
BottomPlate_V821.1.stl	2:25:00	1.37	8	80%
TopPlate_V821.1.stl	1:30:00	0.85	8	80%
M5x29_2_Standoff.stl	0:19:00	0.08	3	20%
MotorMount_Above_V821.stl	1:42:00	1.1	8	80%
IdlerMount_Above_V821.stl	1:04:00	0.43	8	80%
CarBeltConnect_V821.1.stl	0:20:00	0.13	6	60%
CarBeltConnect_V821.1_M.stl	0:20:00	0.13	6	60%
LE_Z_TopSlider_V2017.stl	0:32:00	0.19	3	20%
LE_Z_BotSlider_V2017.stl	0:09:00	0.04	3	20%
Shim_Plate_6_4mm_V821.stl	0:37:00	0.25	6	60%
LaserAirAssist_V4.stl			3	
LaserAirAssist_V4_M.stl (or Mirrored)	1:16:00	0.35	3	20%
Laser_focus_Wheel.stl	0:07:00	0.03	3	20%
Y-Axis_Mech_LS_Bracket_V821.stl	0:21:00	0.15	3	20%
X-Axis_Mech_LS_Bracket_V821.stl	0:35:00	0.15	3	20%
OverHd_2040x2060_Bracket_V821.stl	1:43:00	0.7	8	80%
OverHd_2040x2060_Bracket_V821.stl	1:43:00	0.7	8	80%
X_LS_Stop_V821.stl	0:16:00	0.12	6	60%
V2060_EndCap.stl	0:27:00	0.17	3	20%
V2060_EndCap.stl	0:27:00	0.17	3	20%
V2060_EndCap.stl	0:27:00	0.17	3	20%
V2060_EndCap.stl	0:27:00	0.17	3	20%
V2020_EndCap.stl	0:12:00	0.05	3	20%
Total	16:59:00	7.5		

Bill of Materials is in the file:

Cantilevered_LaserEngraver_V821.1_BOM.xlsx

The BOM has a different TAB for each configuration.

With all the different configurations, I may not have the basic hardware count correct, so I would order a couple of extra screws & Tee Nuts to be sure you have enough. Some of the brackets you buy might need a spacer for the M5 screw & Tee Nut to fit correctly. There are several Spacers included in 3d printed parts.

Build log for this started in July of 2020. Link to that log is here:

<https://forum.v1engineering.com/t/cantilevered-laser-engraver/19179>

Another build log with duplicate & some different info can be found here:

[Horizontal Cantilever or Vertical Diode Laser Engraver | OpenBuilds](#)

Design files: <https://www.thingiverse.com/thing:4934772>

Optional Turntable Design files: <https://www.thingiverse.com/thing:4958047>

Start off with the Main Plate Assembly



Need 3 Printed Parts for this Assembly (Same or Similar for all configurations)

BottomPlate_V821.stl or (BottomPlate_2020_V821.stl for double 2020 Beam Options C or G)

TopPlate_V821.stl or TopPlate_2020_V821.stl for double 2020 Beam Options C or G)

M5x29_2_Standoff.stl or (M5x23_Standoff.stl for double Beam Options B, C, D, F, G or H)

4 – M3x10mm screws for Nema17 motor mount

5 – M5x40mm socket head screws for wheels & back standoff (1 screw used later)

4 – M5 Locknuts

2 – M5x12mm screws for V-Slot 2020 Tee Nut mount

3 – M5 Tee Nuts (1 Tee Nut used later)

4 – 6mm spacers

4 – Eccentric spacers

4 – V-Wheels with bearings

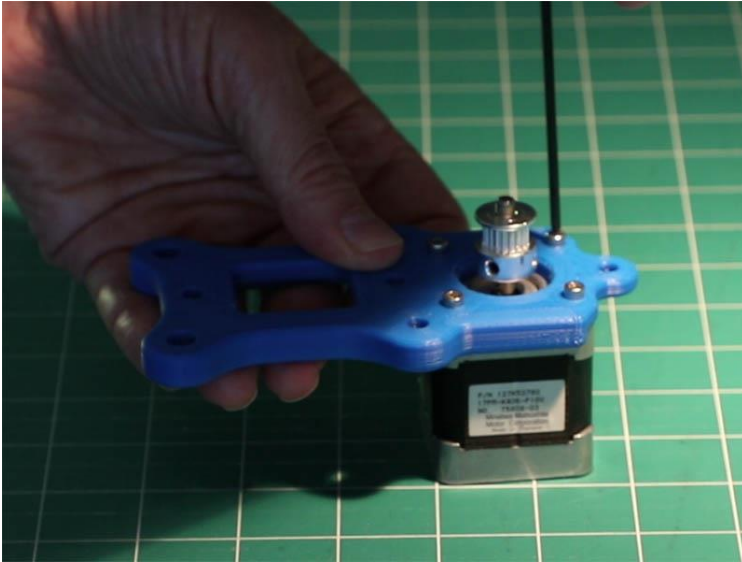
1 – Nema 17 motor

1 – 20T timing pulley (need 20T instead of 16T since the Cantilever arm needs a wider belt width for better clearance)

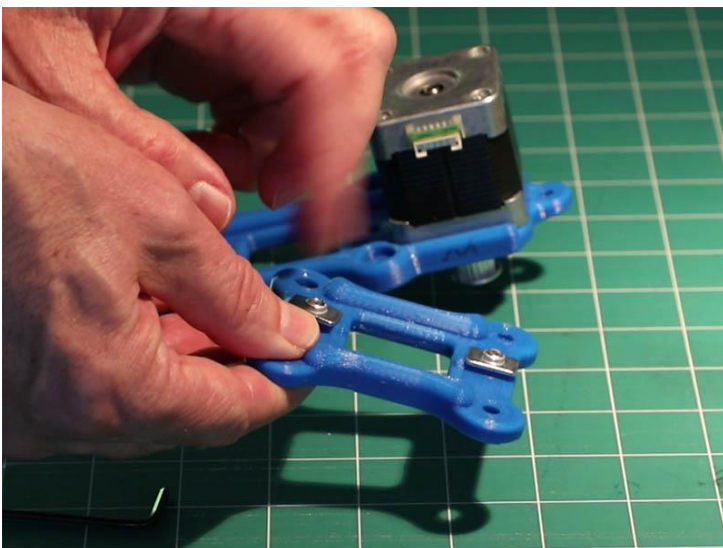
Allen wrench for M3 & M5 screws & wrench for Locknuts & adjusting Eccentric spacers

Attach the 20T timing pulley to Nema 17 motor with grub screws. Use a 6mm Allen wrench to space bottom of the pulley to bottom of motor. Tighten screws just enough to keep it in place as it might need a little adjusting once attached to the V-Slot 2040 beam.

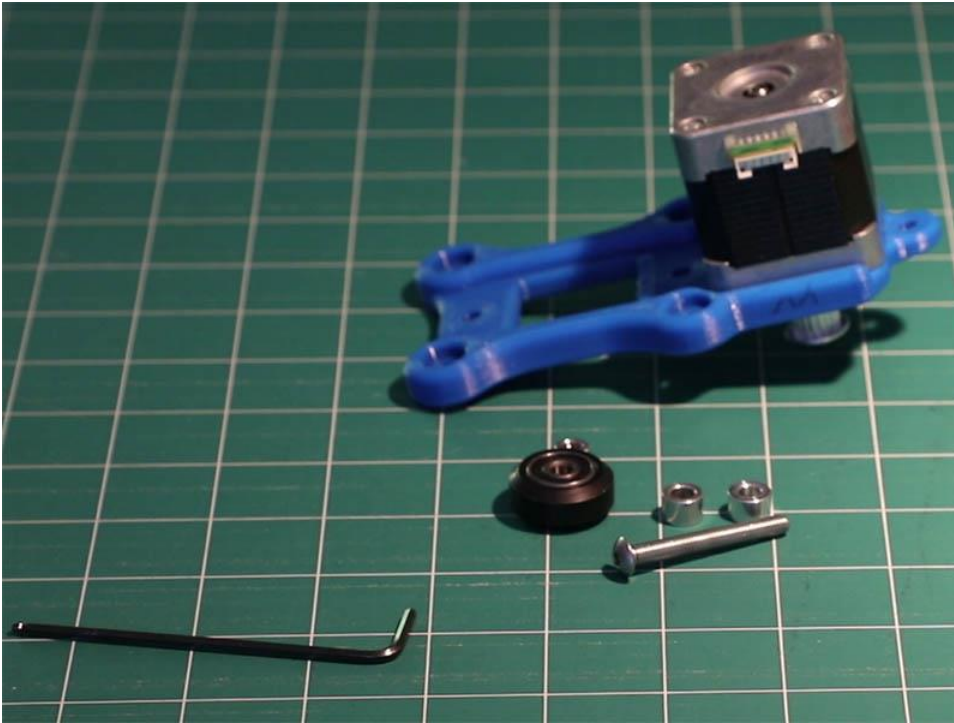
Attach the Nema 17 motor to the bottom plate 1st using the 4 – M3x10mm screws. My motor is 42mm deep. A shorter 34mm deep motor will work & pancake 22mm deep motors might work, but I would not go any deeper than 42mm as you might have clearance problems. Note the location of wire connection for motor on 2nd photo.



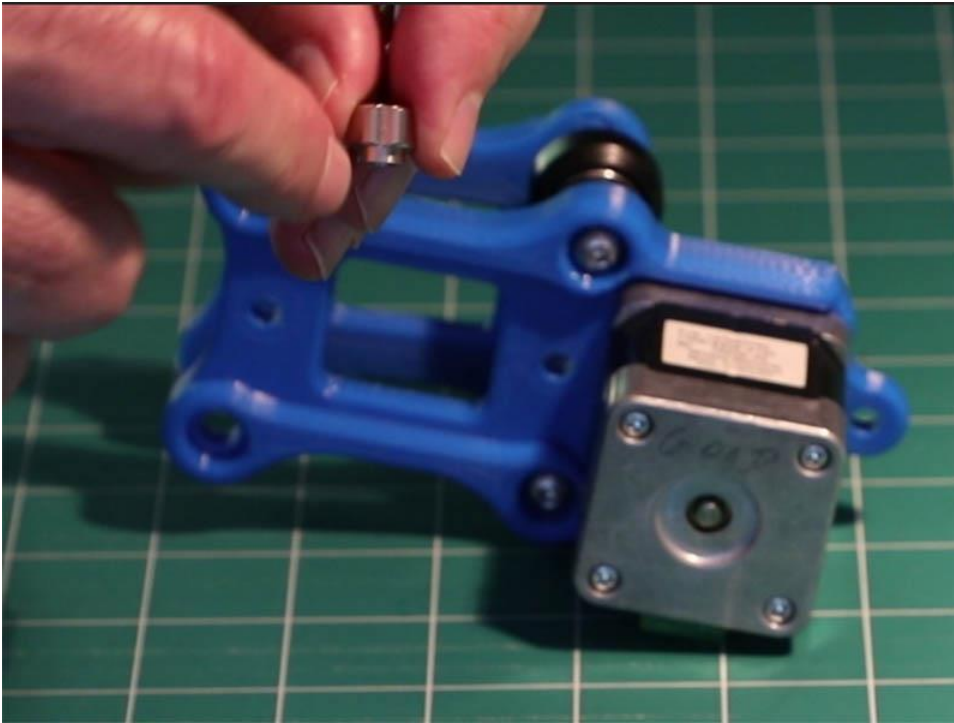
Next attach the 2 – M5x12mm & Tee Nuts to top plate as shown below.



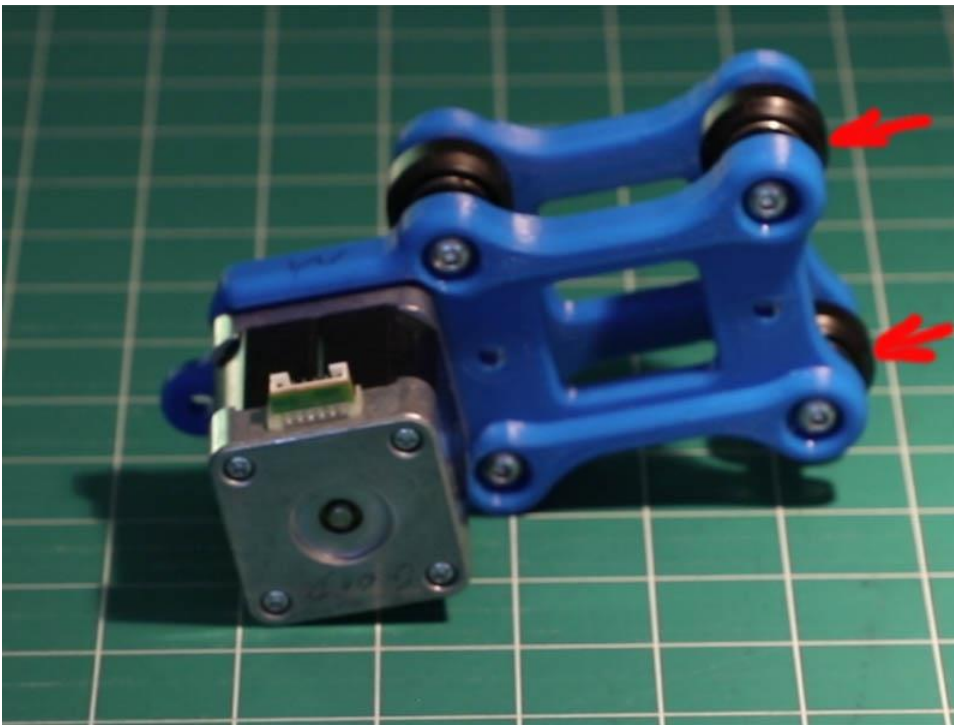
Then attach the wheels with spacers 1st using a M5x40mm screw going thru the bottom plate 1st & 2 – 6mm aluminum spacers on each side of the wheel with a locknut on the top plate. Do this for each of the inside wheels.



Next attach the wheels that have eccentric nuts on them. The eccentric nuts should have the groove marking to the outside of the plates which will be the outside of V-Slot 2040 beam. This gives the widest wheel width and then you can adjust the eccentrics for a good fit after attached to V-Slot 2040.



Red arrows in below photo show where eccentric grooves should be set to begin with. This completes main plate assembly.



V-Slot 2020 Carriage Assembly

3 – Printed parts, CarBeltConnect_V821.1.stl, CarBeltConnect_V821.1_M.stl, Shim_Plate_6_4mm_V821.stl

1 - Gantry Plate for V-Slot 2020

1 – V-Slot 2020x125mm aluminum extrusion

4 – M5x30mm screws for wheels

2 – 6mm aluminum spacers

2 – Eccentric spacers

4 – V-Wheels with bearings.

8 – 10x5x1mm shims

2 – 3mm aluminum spacers

4 – M5 Locknuts

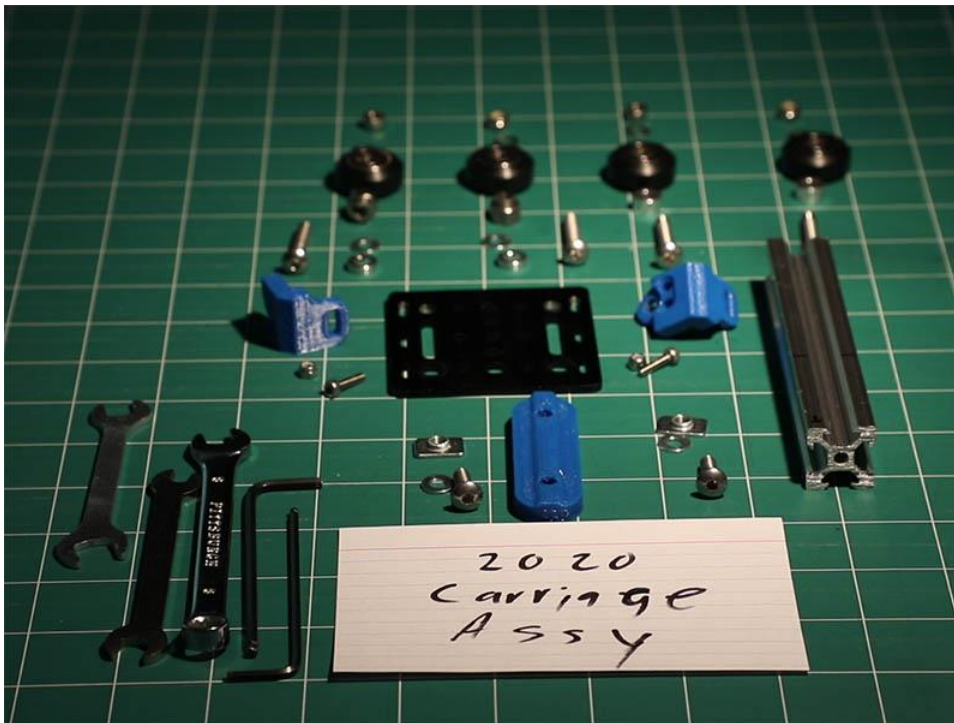
2 – M5x16mm screws (mounts Shim plate to V-Slot 2020)

2 – M5 Tee Nuts

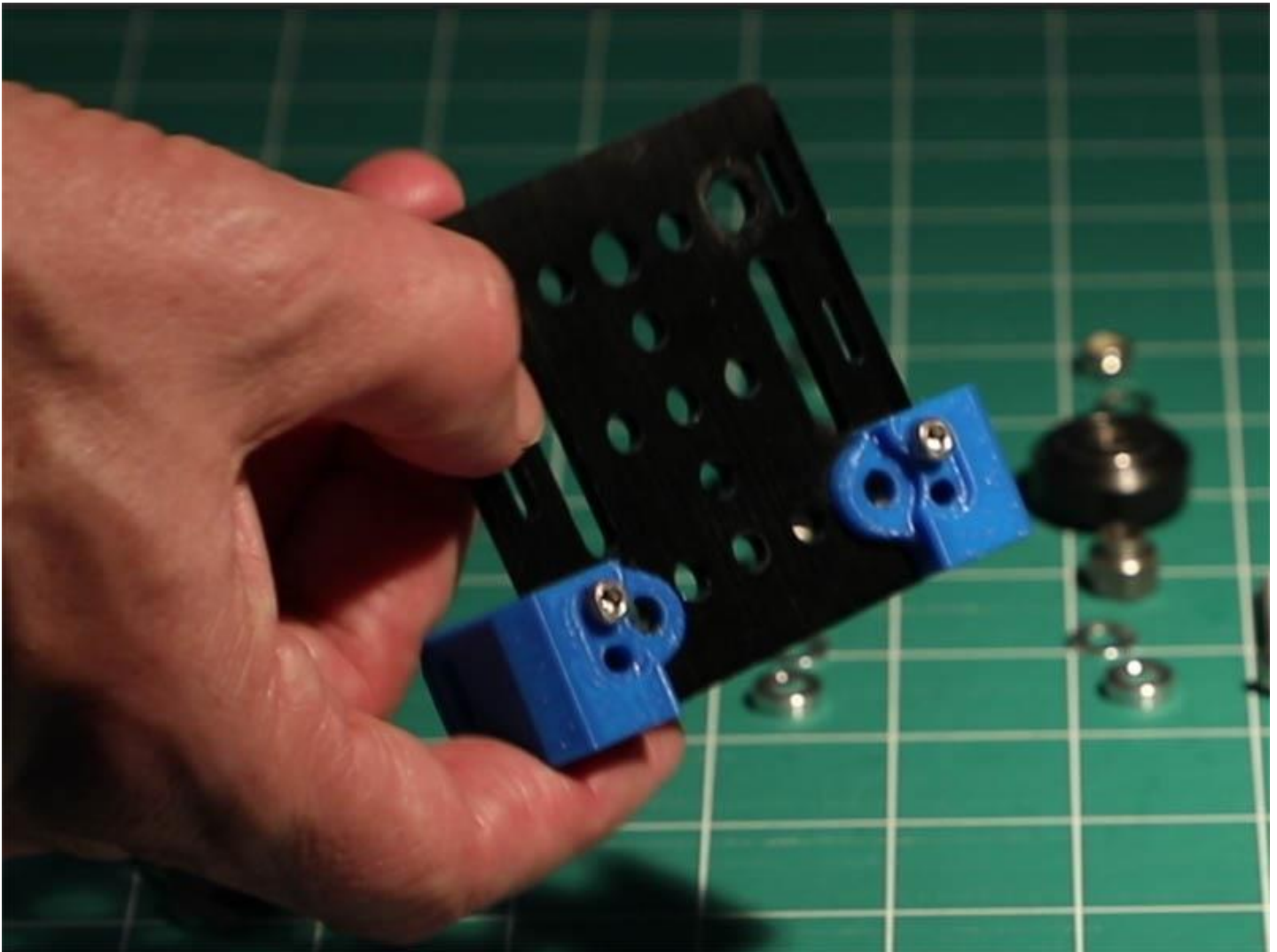
2 – M3x12mm screws (Carriage Belt clamp mount)

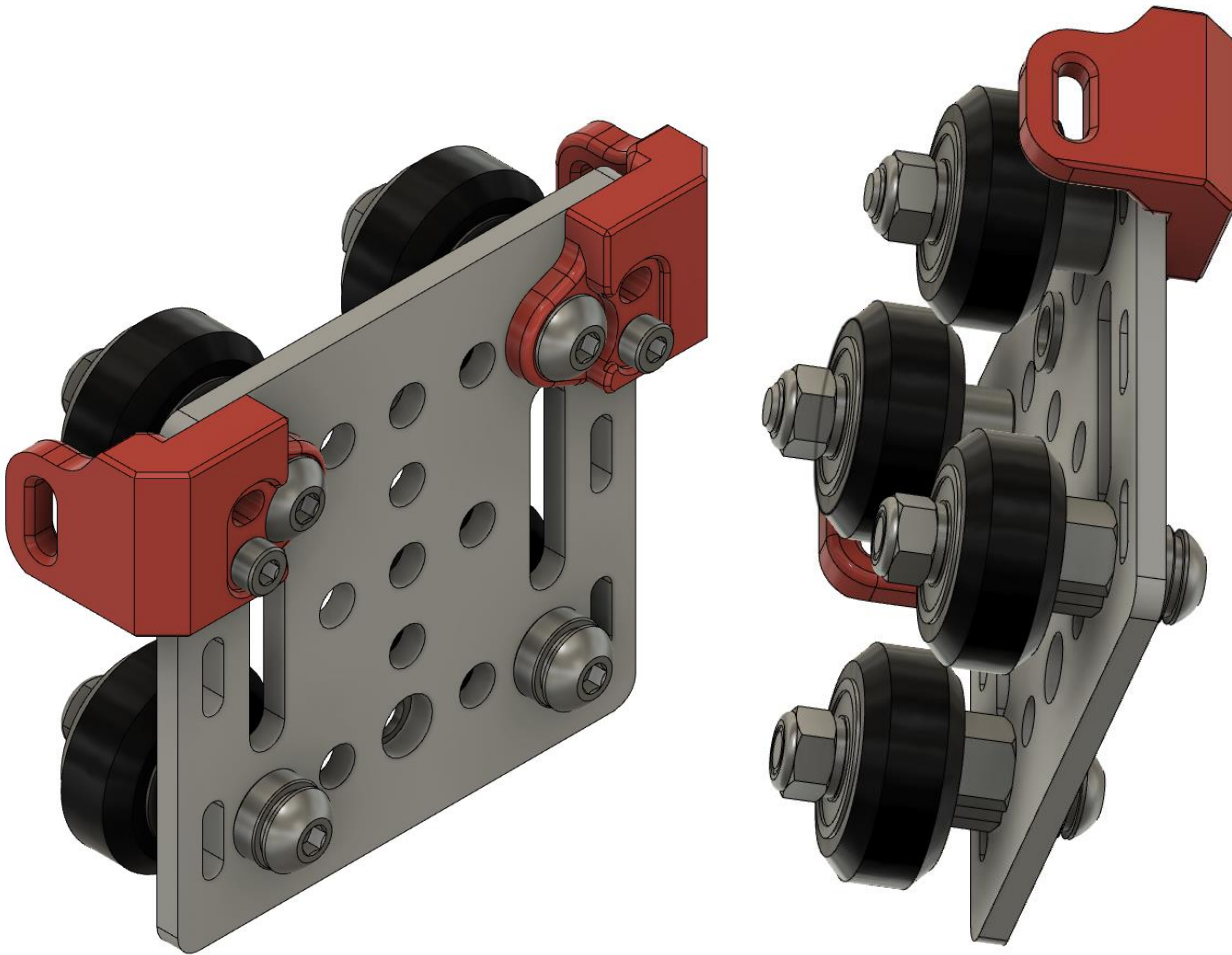
2 – M3 locknuts

Tools, Allen wrenches & wrenches for locknuts & eccentric spacers.



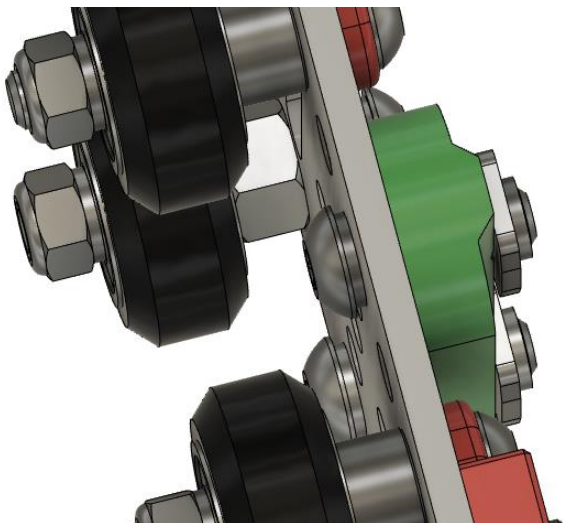
Attach **CarBeltConnect_V821.1.stl** & **CarBeltConnect_V821.1_M.stl** to Gantry plate with 2 - M3x12mm screws & leave the 2 – M5 holes lined up to install wheel screws. There are 2 holes for M3 screws, but one is all that is needed on each side since the M5 wheel screws will hold it further in place & keep it from twisting.





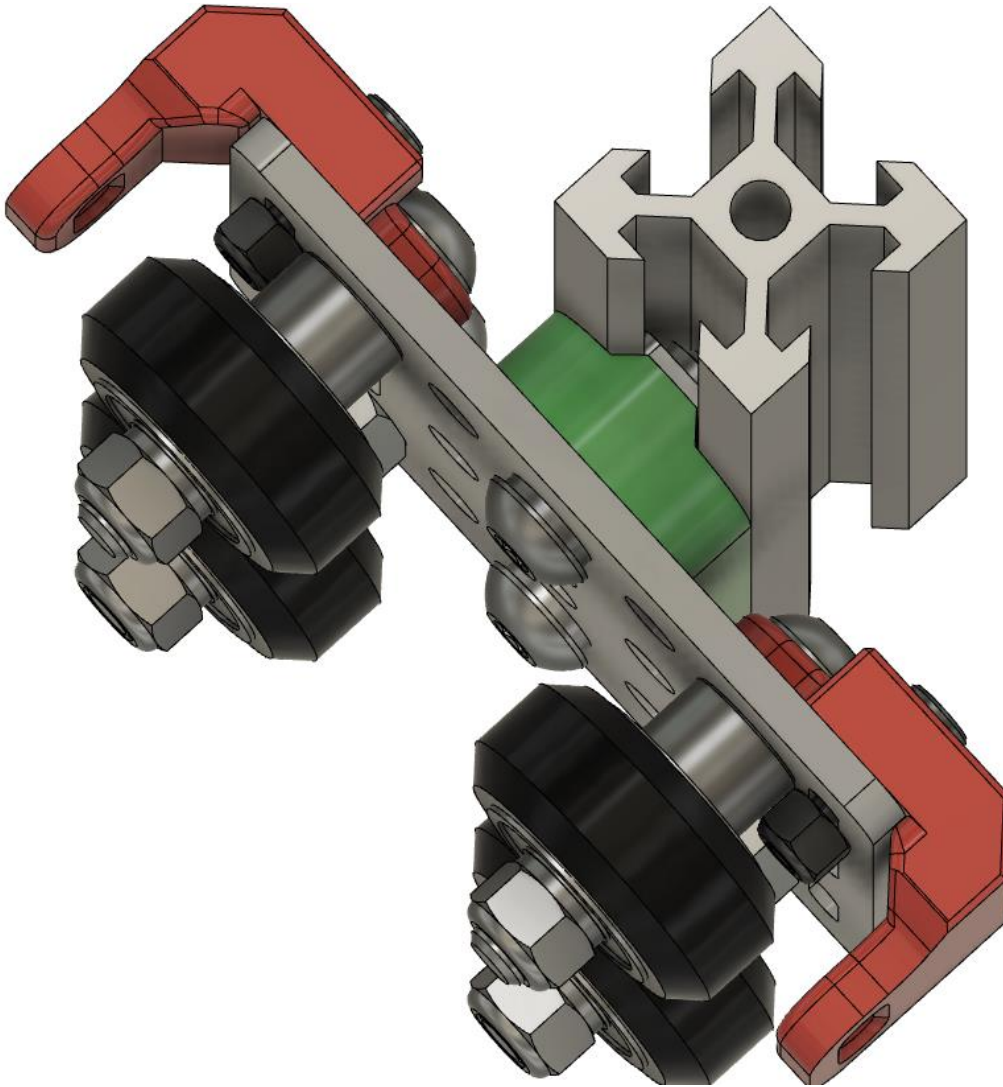
Bottom wheels with eccentrics have a 1mm & 3mm thick washer to balance out the carriage belt clamps at the top. Optionally, you can substitute **8x_M5x4mmSpacers.stl** plastic spacers instead of those. Top wheels have a M5x30mm screw going thru the plastic belt clamps with 6mm aluminum spacer on the plate side of the wheel with a 1mm spacer & locknut on the other side of wheel. The bottom wheels have a M5x30mm screw with a 1mm & 3mm spacer (optional **8x_M5x4mmSpacers.stl**) then thru the plate with an eccentric nut, the wheel with a spacer & locknut. Note the initial location of the notch in the eccentric nuts.

Attach the 2 – M5x16mm screws with 1mm spacers, **Shim_Plate_6_4mm_V821.stl** & Tee Nuts as shown in below image. Tee Nuts should be loose.



If you familiar with tapping M5 thread holes, consider tapping the top of the short Z-axis hole for future use. I am using that to attach a 10" paper plate to block laser light from that side when burning in vertical mode outside.

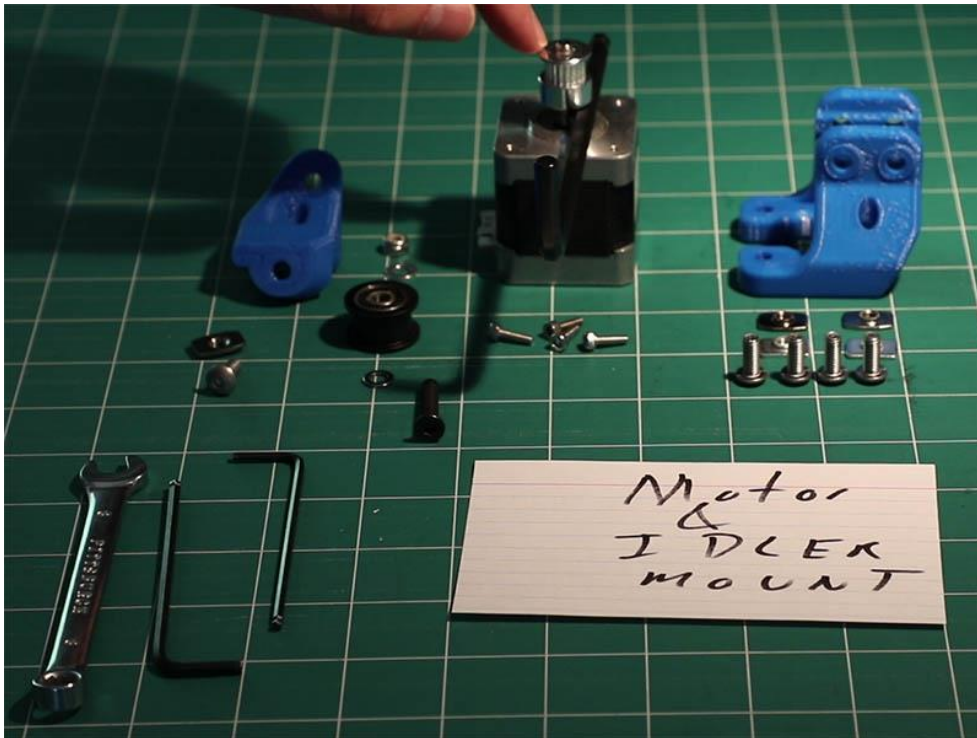
Slide the short V-Slot 2020 for the Z-Axis into place as shown in photo below. I have the V-Slot 2020 positioned about 14mm below the bottom of the Gantry plate, but is easily adjusted later by loosening those 2 – M5x16mm screws. Below is what this assembly looks like.



Motor and Idler Mounts for Cantilever Beam

- 2 – Printed parts MotorMount_Above_V821.stl & IdlerMount_Above_V821.stl
(or mirrored versions MotorMount_Above_M_V821.stl & IdlerMount_Above_M_V821.stl)
- 1 – Nema 17 Motor
- 1 – 20T timing pulley
- 1 – Smooth Idler Pulley Kit
- 4 – M3x10mm screws
- 5 – M5x12mm screws
- 5 – M5 Tee Nuts
- 1 – M5x25mm screw
- 2 – 1mm aluminum spacers
- 1 – M5 Locknut
- Allen wrenches for M3 & M5 screws & wrench for M5 locknut

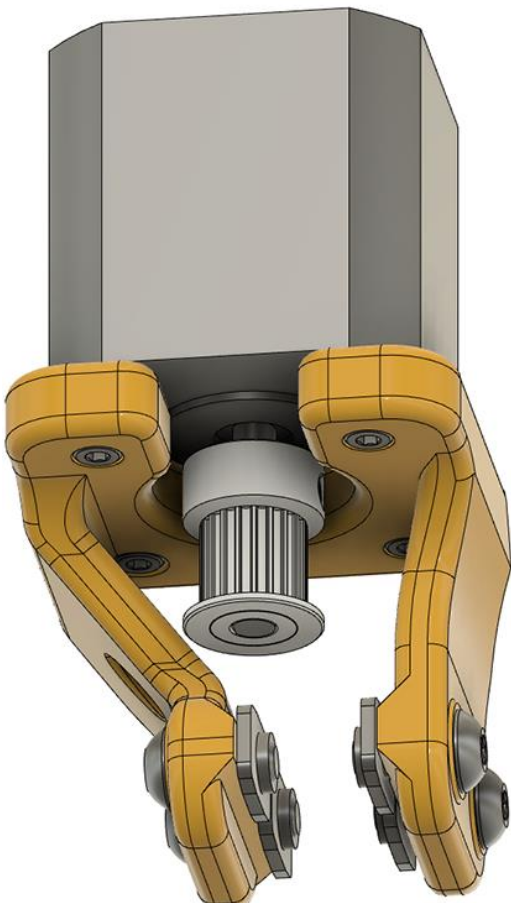
Mount 20T timing pulley to motor using a 6mm Allen wrench to adjust the offset of pulley to motor as shown below. Tighten the grub setscrews enough so that shaft with one screw against flat part of shaft if it has one. Do final tighten later when we attach the belt.



Note the location of the Nema 17 wire connection on the flatter side of the plastic mount.



Tighten the motor to **MotorMount_Above_V821.stl** (or **MotorMount_Above_M_V821.stl**) with the 4 – M3x10mm screws & add the 4 – M5x12mm screws with M5 Tee Nuts to the Plastic mount as shown in the image below. Put this part aside.



Idler Mount Assembly

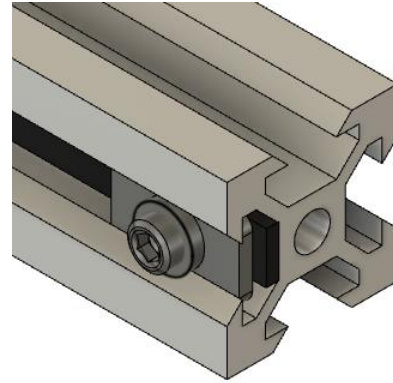
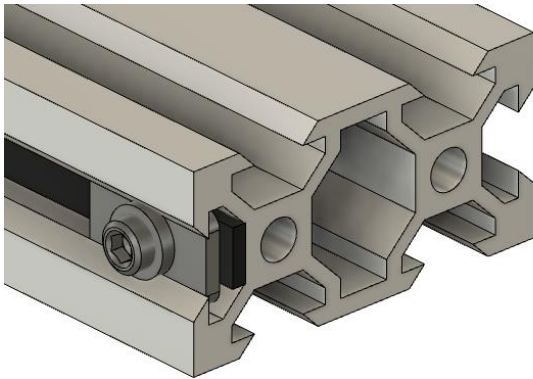
As shown in image below, add an M5x12mm screw with M5 Tee Nut to **IdlerMount_Above_V821.stl** (or **IdlerMount_Above_M_V821.stl** if you are orienting laser on other side of cantilever).

Add a M5x25mm screw thru plastic part with 1mm spacer on each side of idler pulley assembly & a M5 locknut on top. Put this part aside.

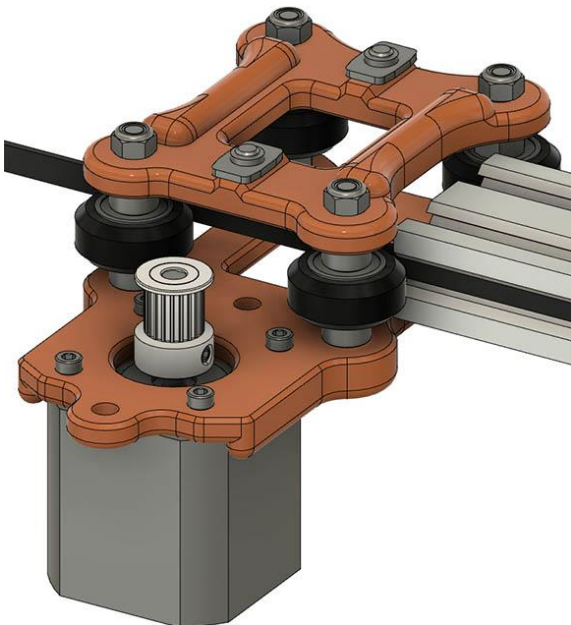


Assemble the Main plate assembly with belt to V-Slot 2040 beam with the Two V-Slot 2060 Feet

1. Insert one end of the GT2 belt you cut for the V-Slot 2040 axis with the teeth of the belt against the inside of the V-Slot. Mine is 800mm for a 600mm length of V-Slot 2040.
2. If you are considering making this V-Slot 2040 longer in the future, you could use longer belt.
3. Extend it 20mm or so beyond the end of the V-Slot 2040. Mine extends about 35-40mm on both sides.
4. Take a M5 Tee Nut with the M5x5mm set screw as shown in picture below.
This will be the right side as viewed from the back of the machine.
5. Insert the Tee Nut at that end & tighten the set screw against the belt.
6. If you are using a M5 screw instead of a set screw, you will not be able to have the Tee Nut at the end as it will hit the plastic part **OverHd_2040x2060_Bracket_V821.stl** or **OverHd_2020x2060_Bracket_V821.1.stl** if you are using the double V-Slot 2020 configuration.

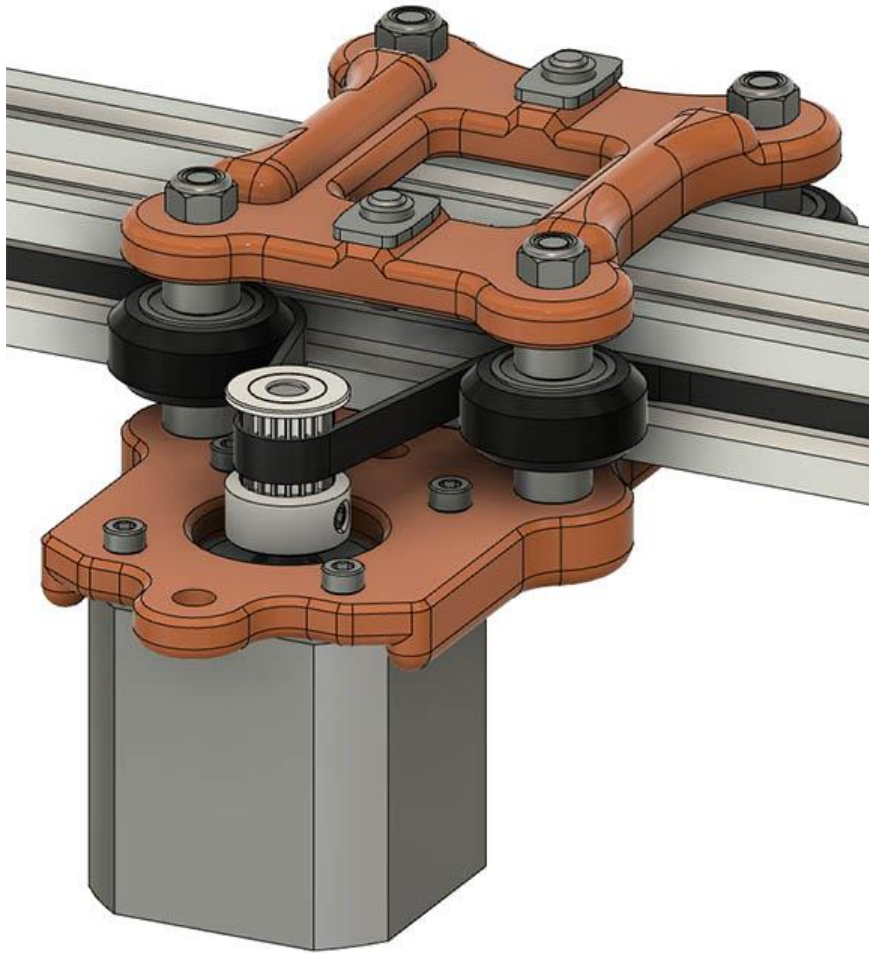


7. Slide the Main Plate assembly onto the V-Slot 2040 from the opposite side with the belt resting against the inside of the V-Slot 2040 extrusion. This procedure is the same for the 2020 Main Beam if you are using that setup.
8. Let the belt ride against wheels.

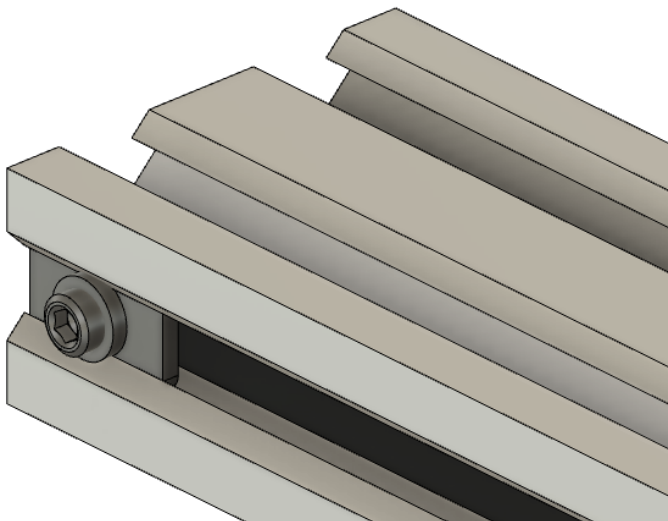


9. Roll the plate assembly 150mm or so inward to make it easier to attach belt & clamp.

10. Hold the belt on the attached side of the carriage assembly & push the unattached side until you get a loop you can grab and wrap around 20T timing pulley as shown below. You could also use needle nose pliers to pull it from the V-Slot groove.

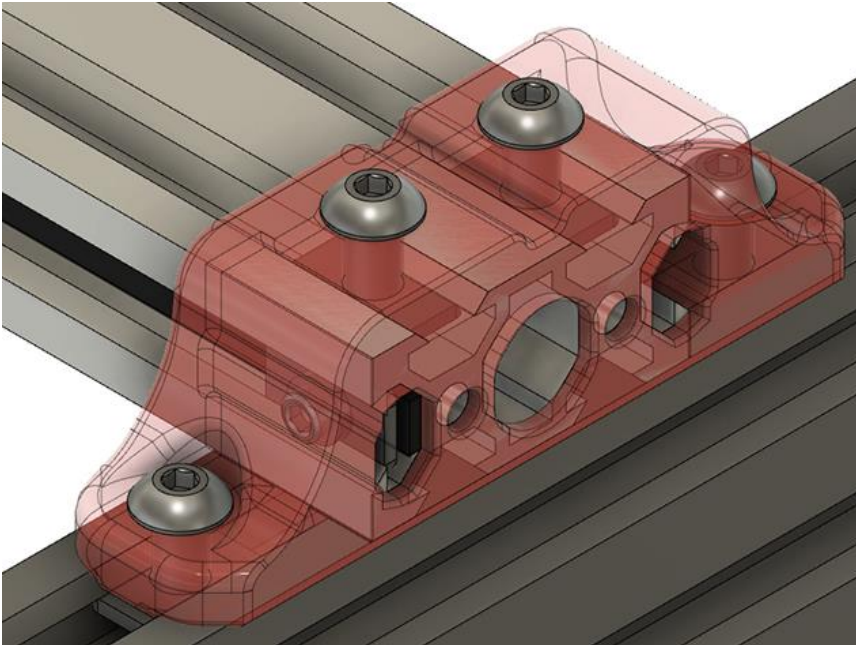


11. Add the M5 Tee Nut & M5x5mm setscrew to the other end.
12. Pull on unattached end of belt & tighten the set screw. You should have some belt extended beyond Tee Nut. I would leave a little belt extended beyond Tee Nut in case you need to take apart again.

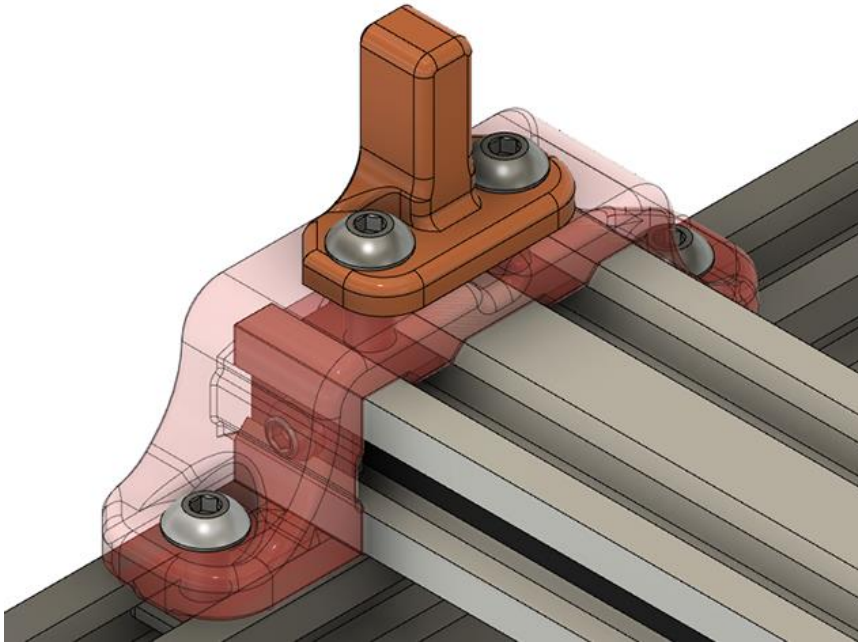


Add the V-Slot 2060x250mm feet to each end

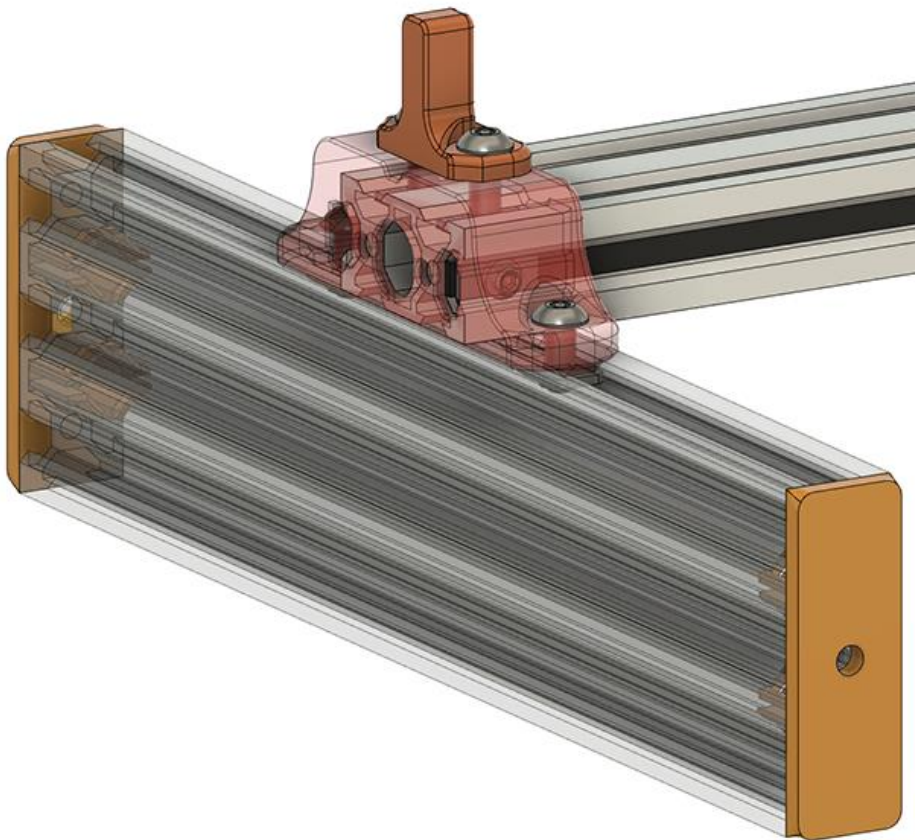
1. An **OverHd_2040x2060_Bracket_V821.stl** (**OverHd_2020x2060_Bracket_V821.1.stl** for 2020 Main Beam) printed part is used on both feet.
2. Using 4 – M5x12mm screws with Tee Nuts attach the side shown or 3-M5x12 screws with Tee Nuts for 2020 Main Beam.
3. Slide Tee Nuts into appropriate slots as shown before attaching plastic part.
4. Note the orientation of where the belt is in photo as the other side has an additional part.
5. Push the V-Slot 2040 or 2020 all the way into the plastic part.
6. Line up each Tee Nut as you tighten down each of the M5x12mm screws.
7. The plastic part is shown slightly transparent in picture for clarity.



8. Other side has the printed parts **X_LS_Stop_V821.stl** & **OverHd_2040x2060_Bracket_V821.stl**.
If you are not using end stops, you can connect this part like the other side.
9. Use 2 – M5x12mm screws with Tee Nuts on V-Slot 2060 connection
10. Place the **X_LS_Stop_V821.stl** part with slotted holes on top of the **OverHd_2040x2060_Bracket_V821.stl**
11. Use 2 - M5x16mm screws with Tee Nuts to attach the bracket to the V-Slot 2040 beam.
12. Make sure the V-Slot 2040 is all the way in the bracket & tighten all the screws.

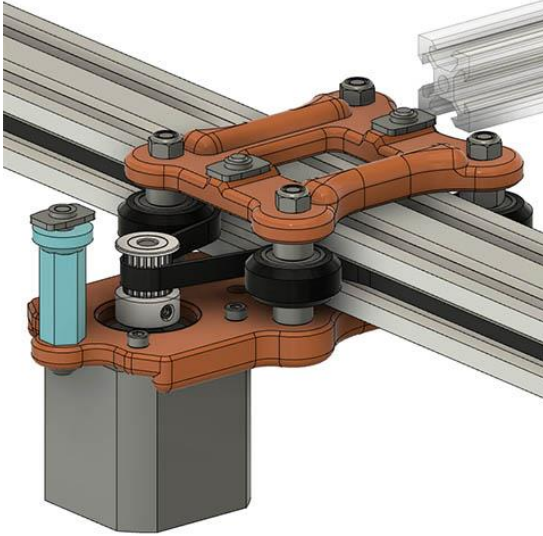


13. If you are not creating a vertical configuration, you can now press fit the 4 - V2060_EndCap.stl into the ends of the V-Slot 2060 feet. If you are doing a vertical configuration, you will later need to add some Tee Nuts.

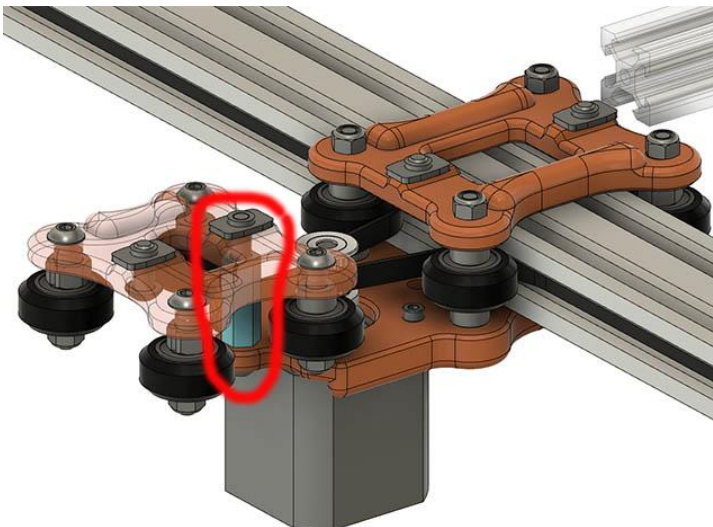


Assemble the Cantilever V-Slot 2020 and related parts.

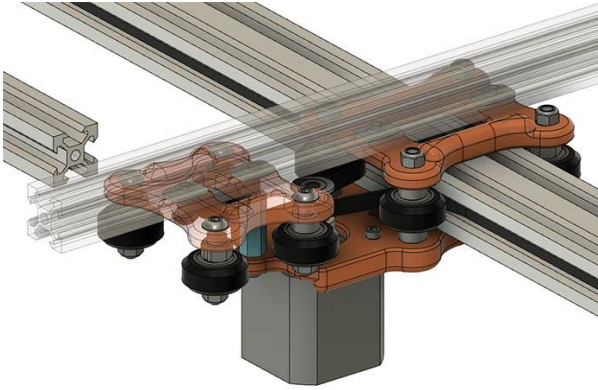
1. For Single Beam configuration A, B, C or D
2. Attach an M5-40mm screw from hole in back of bottom plate, add M5x29_2_Standoff.stl plastic part (Light blue in picture) on top of bottom plate with Tee Nut on top.
3. Loosen the 3 – M5 Tee Nuts enough to slide 2020 cantilever on.
4. Slide the Cantilever on as shown below until all 3 Tee Nuts are in. It can also be slid in from the other way if you prefer.
5. My setup has about 158mm of the 2020 extended from the back of the 2040 beam.
6. You can easily adjust this to meet your needs after it is all together by just loosening these same 3 screws attached to the Tee Nuts.



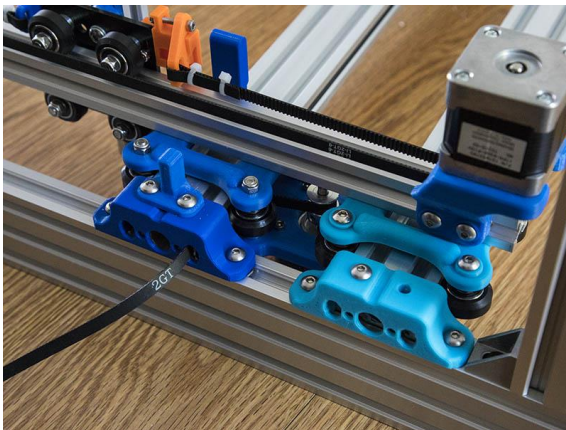
7. If using a 2020 or 2040 Back Beam, attach an M5-40mm screw from hole in back of bottom plate, add the M5x23_Standoff.stl plastic part between the bottom plate & back top plate with a Tee Nut circled in red. Note Eccentric nuts are on outside for easier adjustment.
8. Loosen the 4 – M5 Tee Nuts enough to slide 2020 cantilever on.
9. Slide the Cantilever on as shown below until all 4 Tee Nuts are in. It can also be slid in from the other way if you prefer.
10. Tighten Tee Nuts in place, but not really tight as you might want to adjust the offset of the cantilever later.



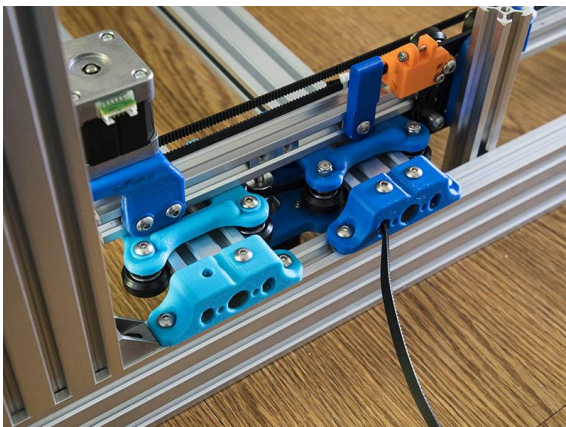
11. If using double beam, slide the back beam onto the back carriage & tighten eccentric nuts as needed.



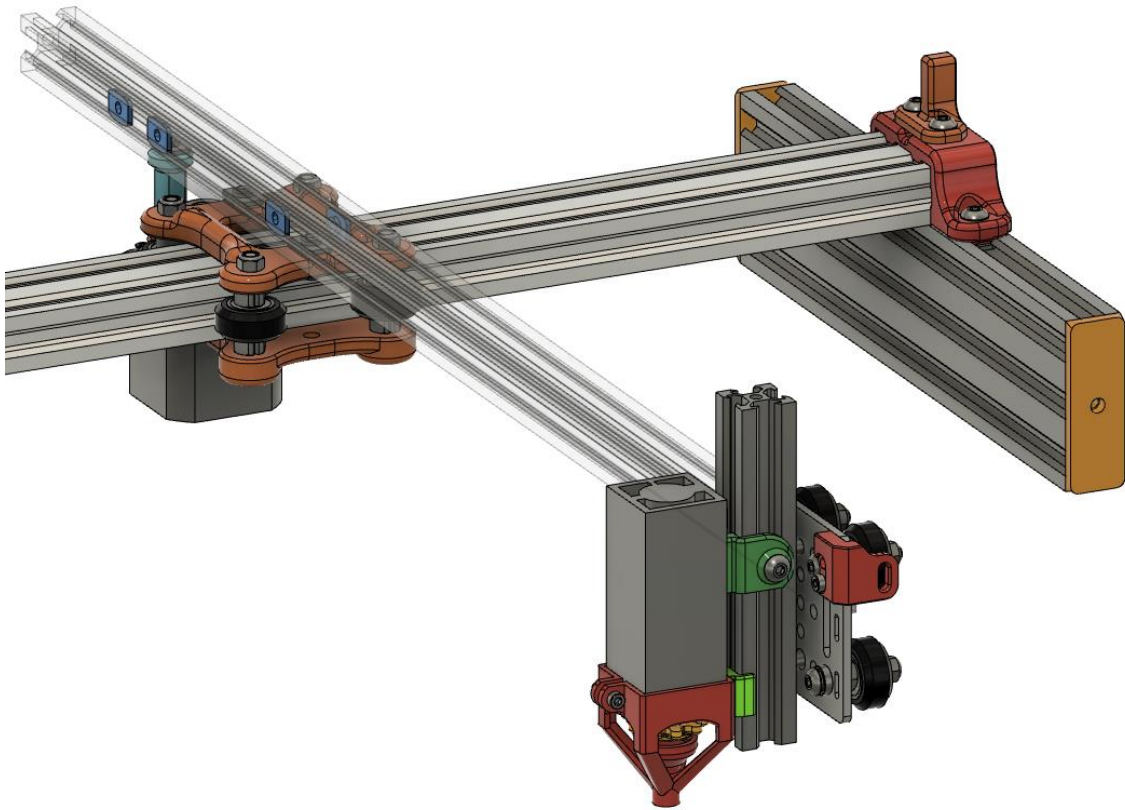
12. Loosen the Tee Nuts that hold the Main Beam to each of 2060 feet.
13. Slide this carriage all the way to end & attach the OverHd_2020x2060_Bracket_V821.1.stl or OverHd_2040x2060_Bracket_V821.stl as shown in photo below. Photo shows using 2040 for both the Main & Back Beam and only used one screw & Tee Nut to secure the top of Back 2040.
14. Tighten all the Tee Nut screws.



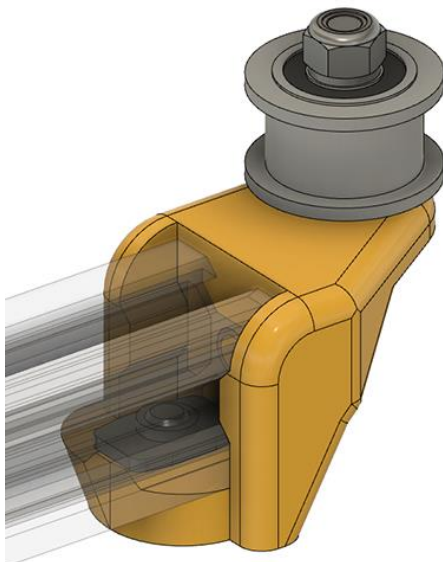
15. Now slide the carriage all the way to the other end and attach the same brackets with hardware on opposite side.
16. Tighten all the Tee Nut screws on this side.
17. This should insure that the beams are parallel.



1. Attach the V-Slot 2020 carriage assembly to the V-Slot 2020 cantilever as shown in picture below and slide it all the way on.
2. Check the play in the carriage & adjust the 2 eccentric nuts if needed.
3. Laser is shown attached to the carriage, but I would not add that until the end.

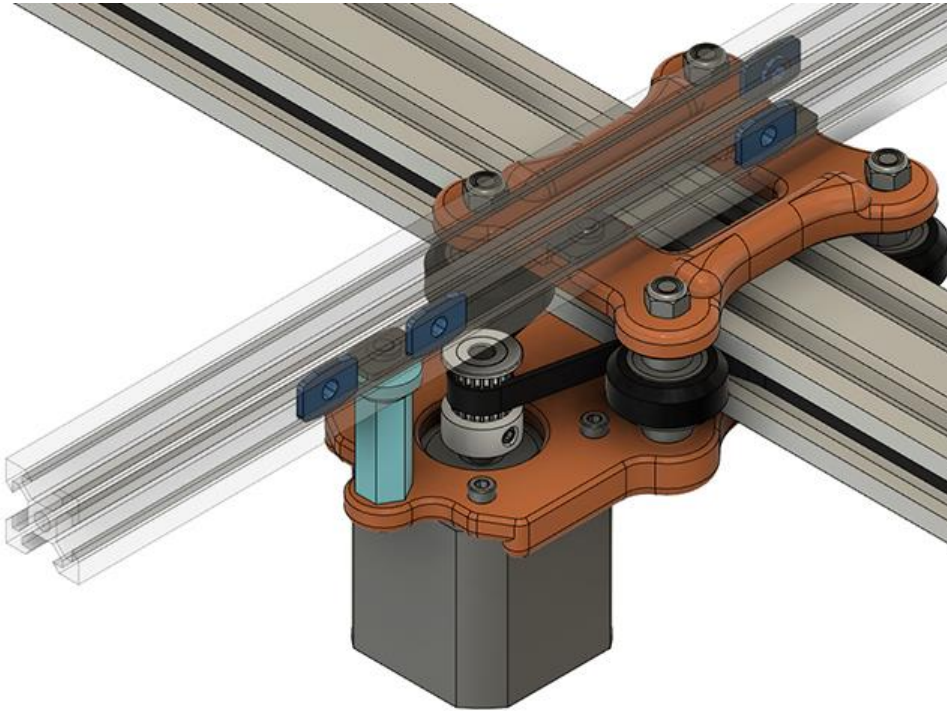


4. Attach the Idler assembly as shown in picture & tighten the M5x12mm screw underneath the V-Slot 2020.

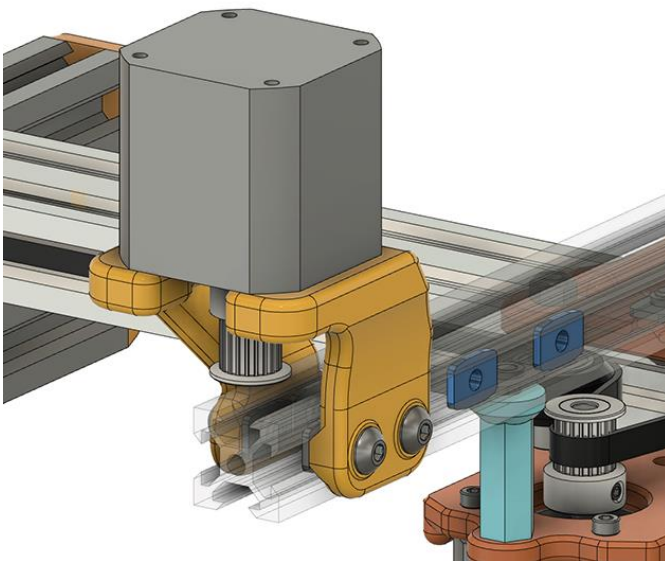


5. From the back of the V-Slot 2020 slide in 4 – M5 Tee Nuts as shown light blue in photo below.

6. The back 2 Tee Nuts on one side are for attaching the controller board mount.
7. The other 2 Tee Nuts are for the X & Y Mechanical limit switch brackets.
8. These need to be added before attaching the motor mount in the rear.



9. Attach the motor from the back of the V-Slot 2020 cantilever as shown in photo.
10. It will probably be easier to take the 4 – Tee Nuts off & slide them in as it is sometimes difficult to line up 2 Tee Nuts at a time.
11. Leave a little room at back of V-Slot 2020 to allow for moving the motor back during belt tightening process.
12. Also the V-Slot 2020 endcap extends 12mm into V-Slot 2020 side grooves, so allow clearance for that also.
13. Tighten up 1 Tee Nut screw on each side for now.

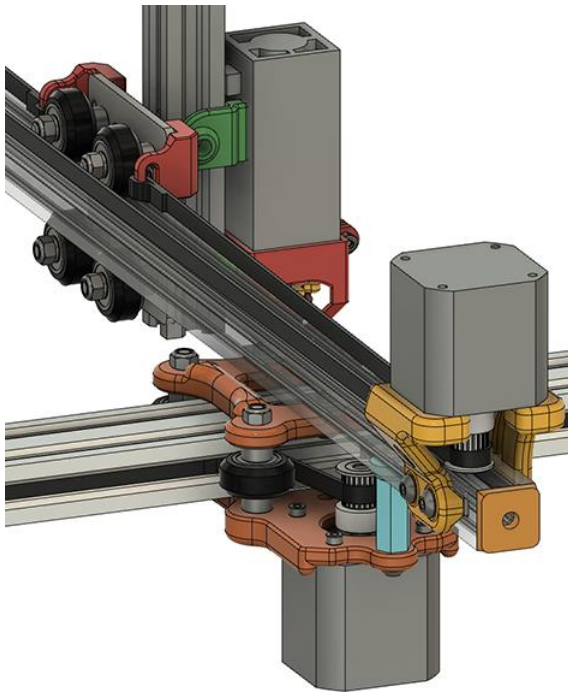


14. Get the belt you cut for your cantilever axis. The length I used for my configuration is 1270mm with the 600mm V-Slot 2020 extrusion.

15. Attach it to the outside belt clamp on the carriage first. You want this overlapped part to be as short as possible & still have a good connection. Mine extends about 20mm. You can always cut this shorter after it is clamped. Use 1 or 2 wire ties to clamp the belt overlap.

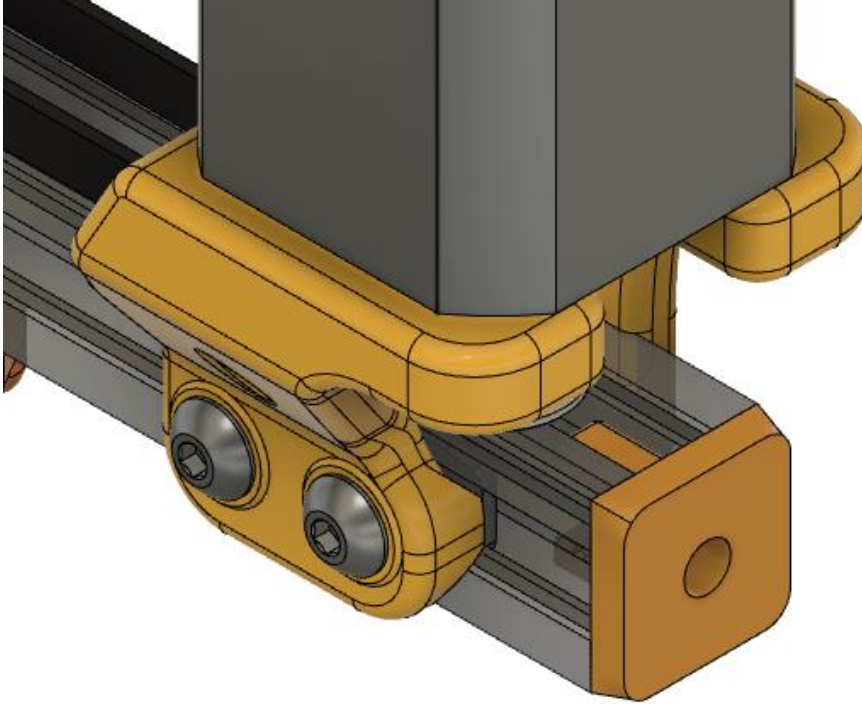


16. Wrap the belt around the Idler pulley at the end & then thread it thru the Motor Timing pulley at the back & attach the other end of the belt to the inside belt clamp on the V-Slot 2020 carriage as shown in picture below. Tighten as tight as possible. We will tighten it further after next step.

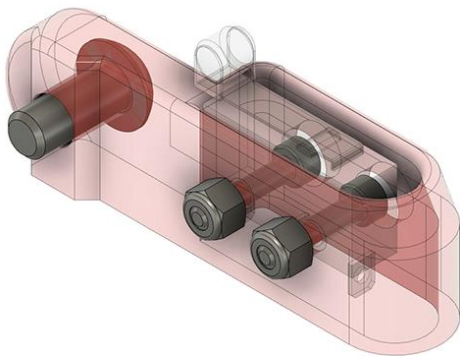


17. Add V2020_EndCap.stl to back of the V-Slot 2020. Internal 2 connections should be above & below to allow for motor to be pulled back as far as possible if needed.

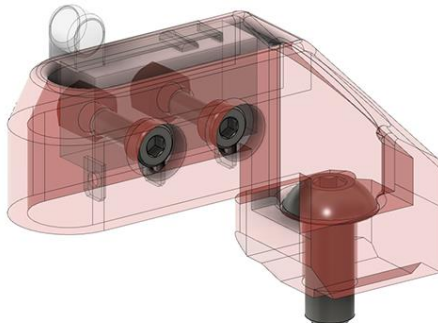
18. Loosen the M5 screws on the Motor Mount with your palm resting against the V-Slot 2020 endcap & pull it back to tighten belt further.
19. After you are happy with the tension, tighten the 4 – M5x12mm Motor mount screws.



Attach Mechanical Limit switch to Y-Axis_Mech_LS_Bracket_V821.stl with:
2 – M2.5x12mm socket head screws & M2.5 Locknuts
1 – M5x12mm screw

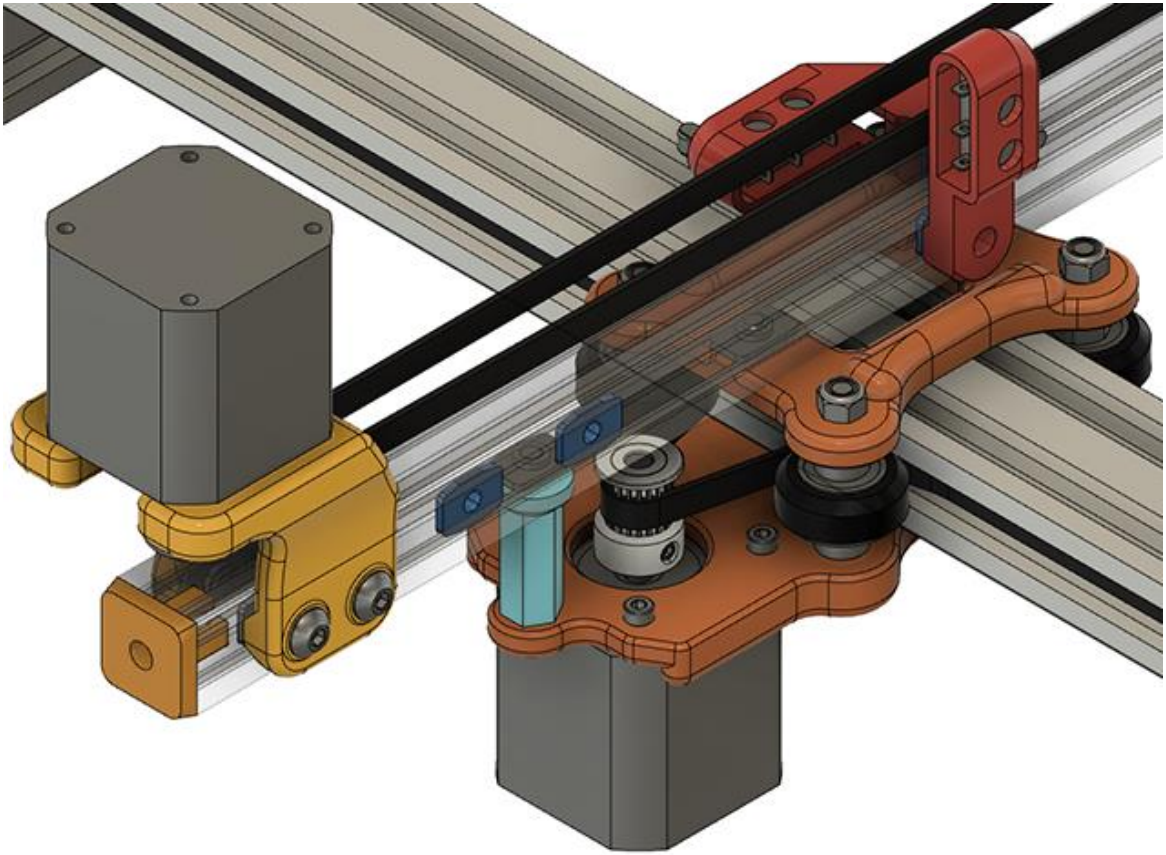


Attach Mechanical Limit switch to X-Axis_Mech_LS_Bracket_V821.stl with:
2 – M2.5x12mm socket head screws & M2.5 Locknuts
1 – M5x12mm screw



Attach the X-Axis & Y-Axis limit switch assembly to the V-Slot 2020 cantilever as shown in this picture.

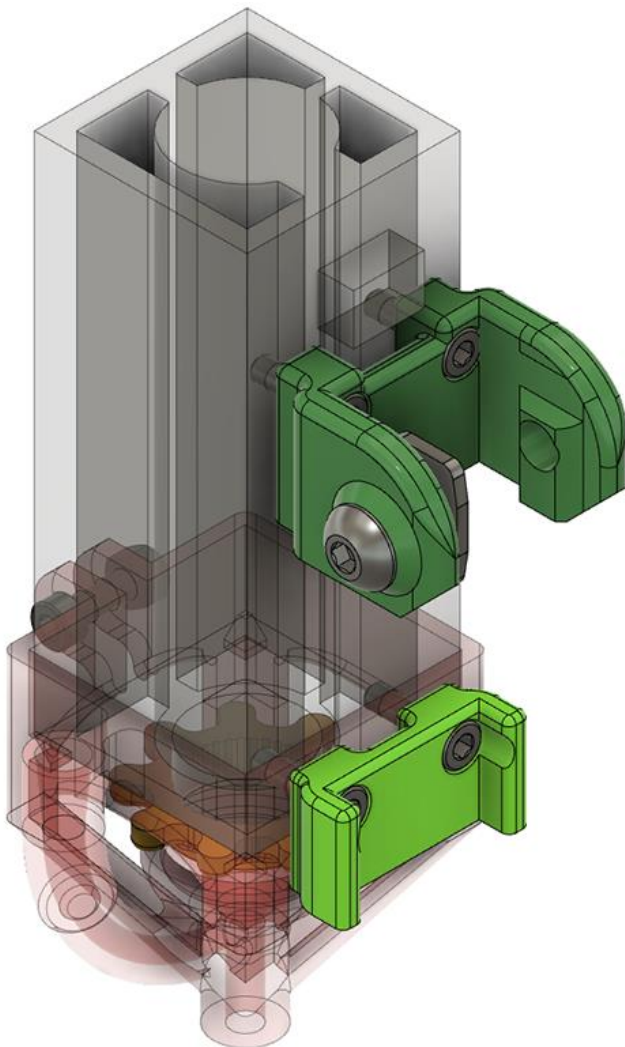
Then attach your controller board mount of choice to other 2 Tee Nuts.



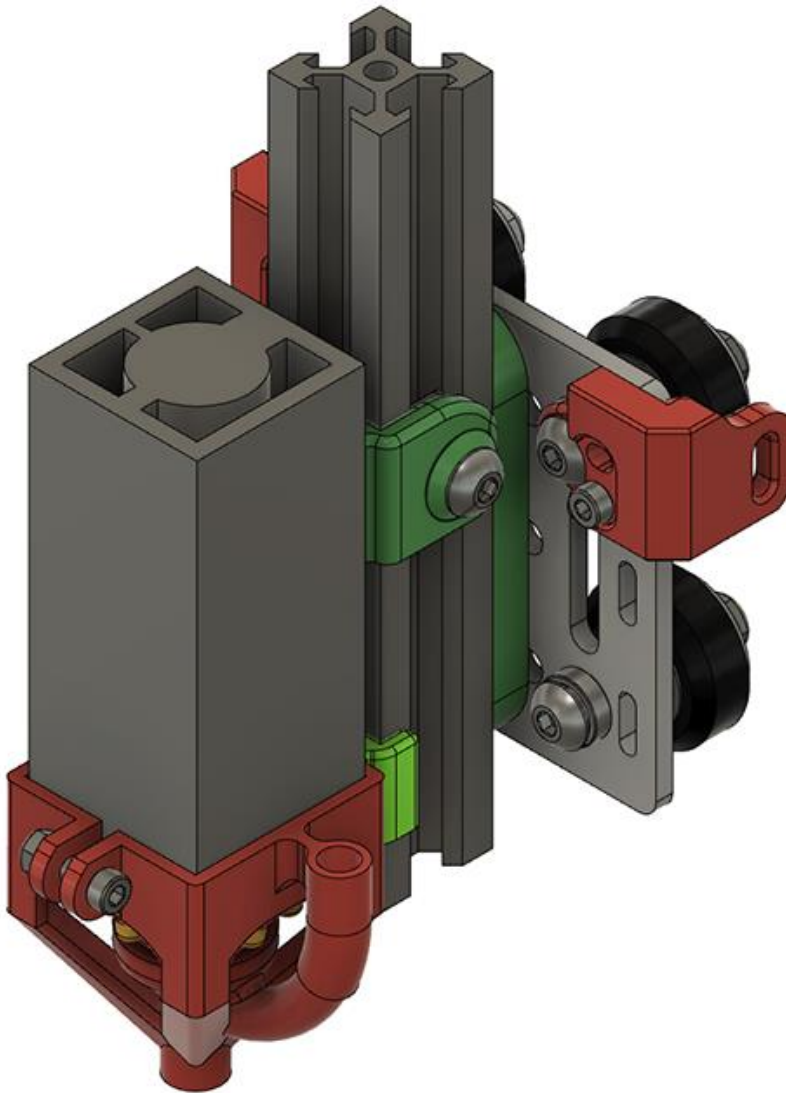
Put the Laser Assembly Together Last

Gather the following parts.

1. Printed parts, LE_Z_TopSlider_2020_V821.stl, LZ_Z_BotSlider_2020_V821.stl, Laser_focus_Wheel.stl and LaserAirAssist_V4_M.stl
(LaserAirAssist_V4_M.stl is used instead of other one to allow for most cantilever movement)
2. 5 – M3x10mm screws
3. 1 – M3 Locknut
4. 1 – M5x12mm screw
5. 1 – M5 Tee Nut
6. 1 – Diode Laser (Mine is a NEJE 6W)
7. Add Laser_focus_Wheel.stl to the focus wheel of the laser.
8. Mount LE_Z_TopSlider_2020_V821.stl to top laser threaded holes with the 2 - M3x10 screws.
9. Add the M5x12mm screw and M5 Tee Nut to one side of top slider.
10. Mount LZ_Z_BotSlider_2020_V821.stl and LaserAirAssist_V4.stl to bottom laser threaded holes.
11. Add the M3x10mm screw with locknut to the front bracket on the laser.



12. Mount the Laser Assembly to the V-Slot 2020 Carriage Assembly by sliding the top slider over V-Slot 2020 Z-Axis.
13. Tighten the Laser Assembly to Carriage Assembly with just the 1 M5x12mm screw & Tee Nut
14. You could add a `V2020_EndCap.stl` to the top of this V-Slot 2020 also, but it is just more weight on the carriage running on the cantilever V-Slot 2020.



Check all the screws to make sure they are tight. Adjust the eccentric wheel nuts if needed. Visually check for squareness on the cantilever to the V-Slot 2040 beam.

On a flat surface, check that the height of the cantilever beam is the same height at the V-Slot 2040 beam side as it is at the end where the idler is. If it is not, you might be cantilevering too far. Being slightly off is probably not a problem & you can verify this with your first test burn.

This completes the mechanical build.

You can find additional help with your wiring & troubleshooting from the build log listed at beginning of this guide.