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BLACKBOX CE

Electronics Mounting.

DOCUMENTATION VERSION 1

Blackbox CE Mechanical Assembly:

08. Electronics Mounting

Authored by Kris Brickman

Change Log

Version	Notes
1	Initial Release

Tools

Description	
Reamers	
Electric Drill	
Hex Wrenches	
Soldering Iron with Heatset insert tip	

Parts

QTY	Description
1	CAT6_Jack_Coupler
1	3010 24V Blower Fan
1	PowerSupply_LRS-350-24
2	Daylight_XXL
1	IGUS XY Cable Chain (10-15-018) with End Links
8	M3x3.4x2.5mm Heatset Insert
1	ACSwitch_WithC13_CE
1	DCConverter_12V
1	DCConverter_5V
2	DIN_RAIL_35_460mm
7	DINRail_Mount
1	Duet3_Exp_3HC
1	Duet3_MB_6HC
1	Honeywell_411sx21-t_sw
1	IGUS_CableChain_Z_CE
1	IGUS_E2i-10-10-018_RigidChain
1	PCB_SexBolt
1	RaspberryPi_4B
1	Relay_SolidState
2	Sleeve_5x7x8
5	WAGO_221-412_LeverNut
2	WireDuct_25x25_100mm
1	WireDuct_25x25_200mm
2	WireDuct_25x25_230mm
4	ISO7380_M2_6mm_BHHS
2	ISO7380_M2_8mm_BHHS
2	DIN7991_M2_6mm_FHHS
4	DIN912_M2_8mm_SHCS
12	DIN7991_M3_6mm_FHHS
20	ISO7380_M3_6mm_BHHS
7	ISO7380_M3_8mm_BHHS
8	DIN912_M3_6mm_SHCS
16	DIN9021_M3_Fender_Washer
22	DIN912_M4_6mm_SHCS
8	DIN912_M4_8mm_SHCS
3	DIN912_M4_10mm_SHCS
14	DIN912_M4_12mm_SHCS
2	DIN912_M4_14mm_SHCS
8	DIN912_M4_30mm_SHCS
1	Linear_Shaft_5x43mm
7	M3 20 Series Roll-in Nut
9	M4 20 Series T-Nut
26	Tnut_40Series_M4
38	M3_4.6x4mm_Heat_Set_Insert
8	M4_6x5mm_Heat_Set_Insert

Printed Parts

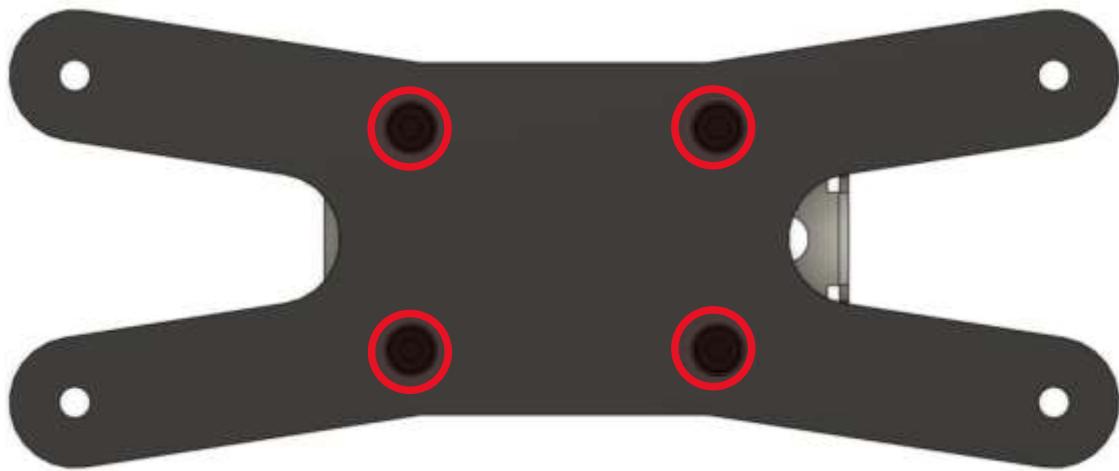
QTY	Description	Material	Ver
1	Print_ACSwHouse_CE	>=ABS	1
2	Print_DCConverter_Mount	>=ABS	1
4	Print_DINRailMount	>=ABS	1
1	Print_Duet3EXP_Mount	>=ABS	1
1	Print_Duet3MB_Mount	>=ABS	1
1	Print_IGUS_Rigid_Mount_Lower	>=ABS	1
1	Print_IgusMountFrame	>=ABS	1
1	Print_Jig_DINSpacerCenter	PLA	1
1	Print_Jig_DINSpacerRight	PLA	1
1	Print_Jig_StaticChainLower	>=ABS	1
4	Print_LED_Mount	>=ABS	2
4	Print_LineHolder_Part1	>=ABS	1
4	Print_LineHolder_Part2	>=ABS	1
1	Print_PowerSupply_Mount	>=ABS	1
1	Print_RPI_Mount	>=ABS	1
1	Print_SexBolt_Housing_V2	>=ABS	2
1	Print_Wago_Mount	>=ABS	1
2	Print_Wire_Duct_Mount_2010	>=ABS	1
4	Print_Wire_Duct_Mount_2040	>=ABS	1
1	Print_Wire_Duct_Shield	>=ABS	1
1	Print_Z_Chain_Mount_Top_Installation_Tool_(138.89)_CE	PLA	2
2	Print_ZChainMount_Bottom	>=ABS	1
1	Print_ZChainMount_Top	>=ABS	1
1	Print_ToolHead_Wire_Cover	>=ABS	2

Step 1 – Electronics DIN Brackets

Blackbox CE makes use of DIN rails and clips for easy service and reconfiguration by simply removing the floor panels. In the next few sub-steps, we will assemble these subassemblies in preparation for installation.

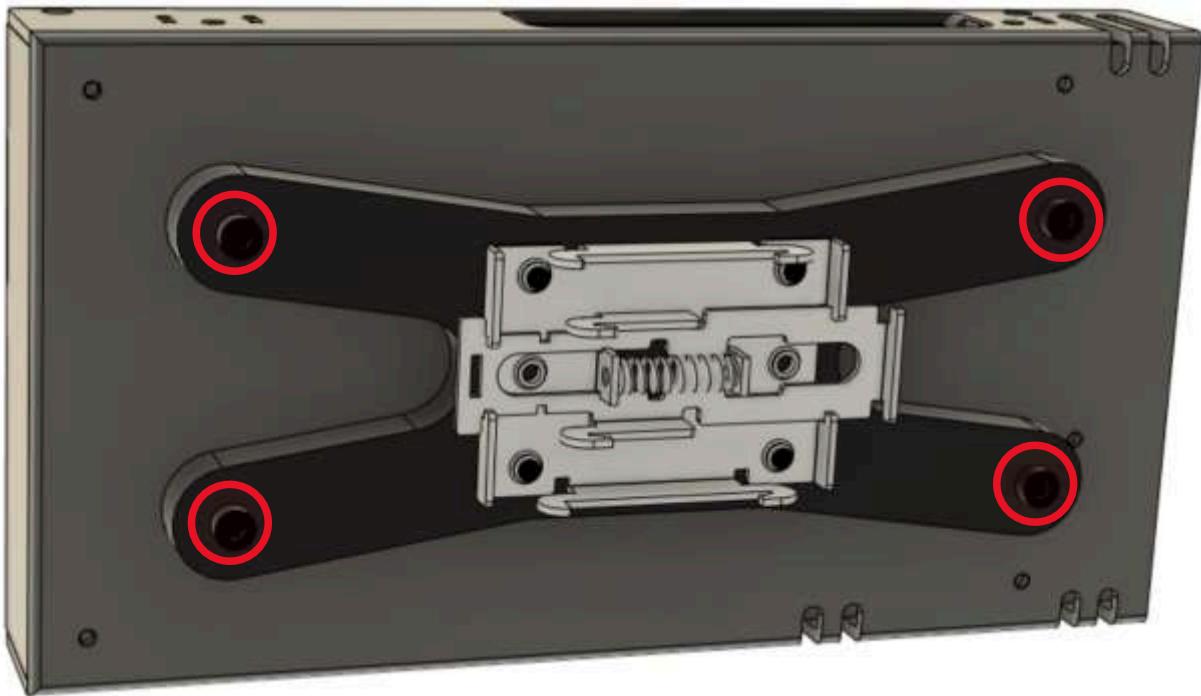
Step 1a – Power Supply

Locate Print_PowerSupply_Mount and secure to a Din Rail Mount using (4) M4x8mm SHCS.



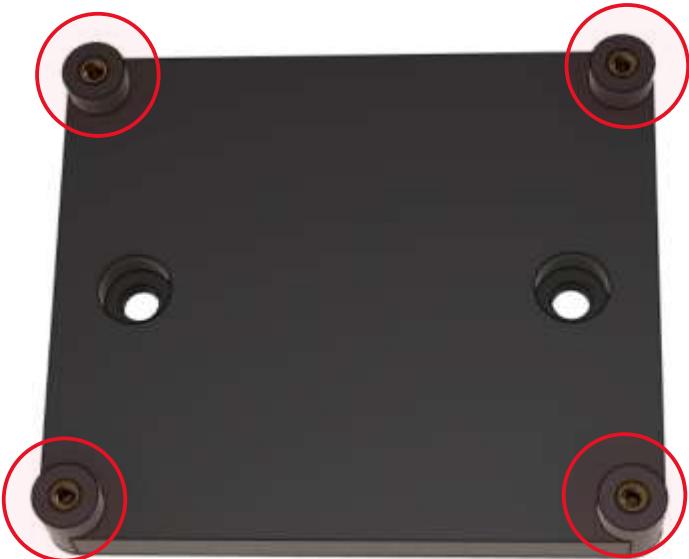
Position the LRS-350-24 Power Supply onto the printed mount as shown below and secure using (4) M4x12mm SHCS.

IMPORTANT! Take the opportunity to be sure the voltage selector switch is in the correct position! 110/120V for the US and Canada.

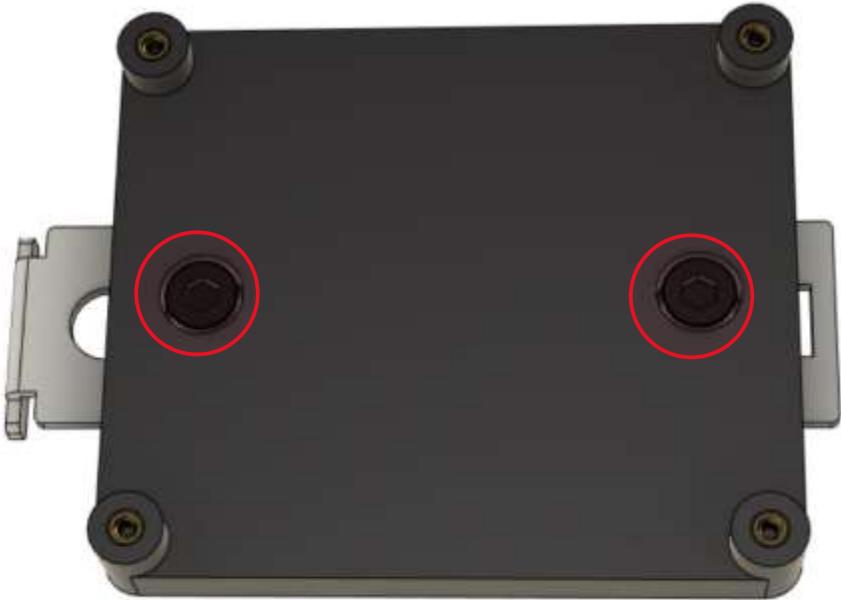


Step 1b – Raspberry Pi

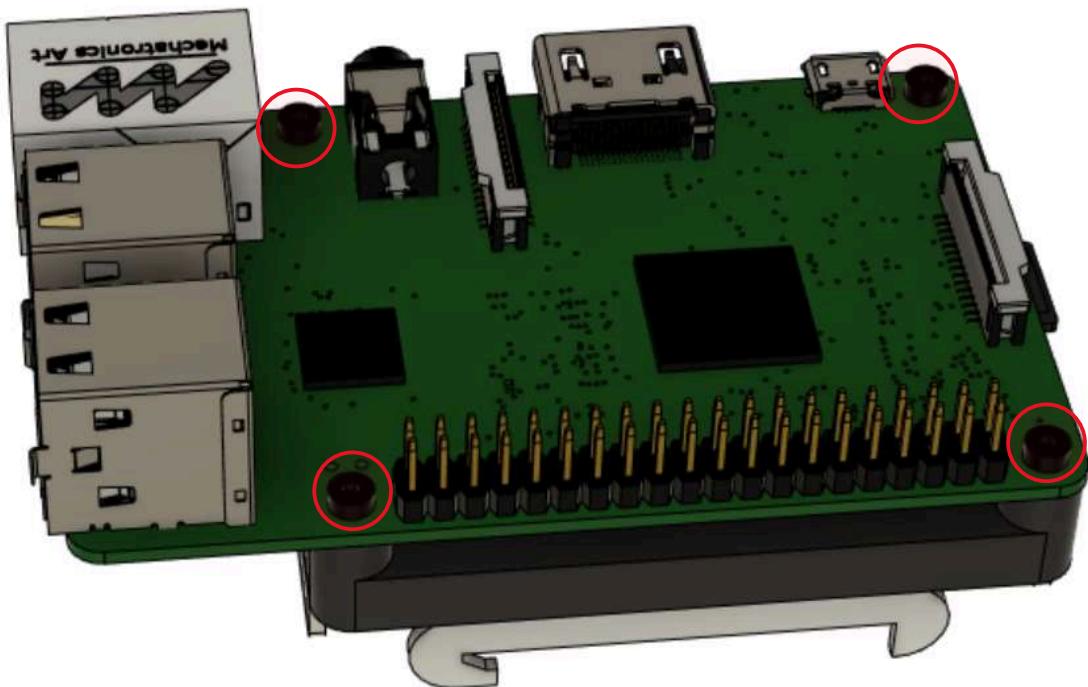
Locate Print_RPI_Mount and install (4) M2 heat set inserts into the locations marked below.



Secure to a DIN rail mount using (2) M4x6mm SHCS.

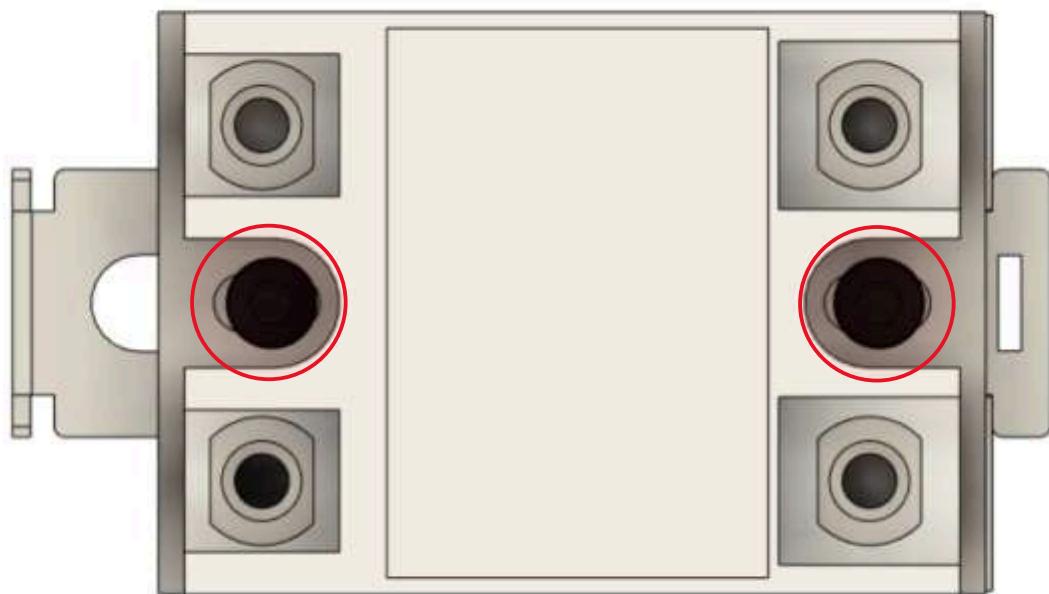


Secure the Pi to the printed part using (4) M2x8mm SHCS.



Step 1c – Solid State Relay

Secure the solid state relay directly to a DIN rail clip using (2) M4x6 SHCS as shown.

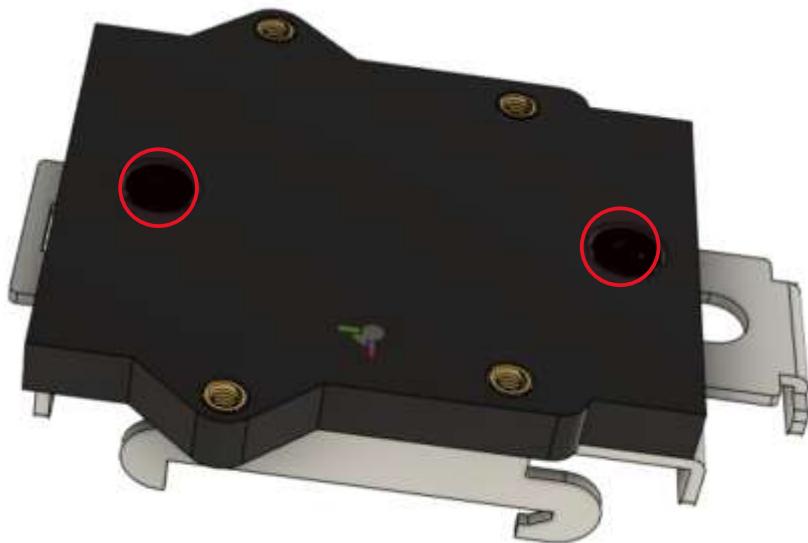


Step 1d – DC Converters

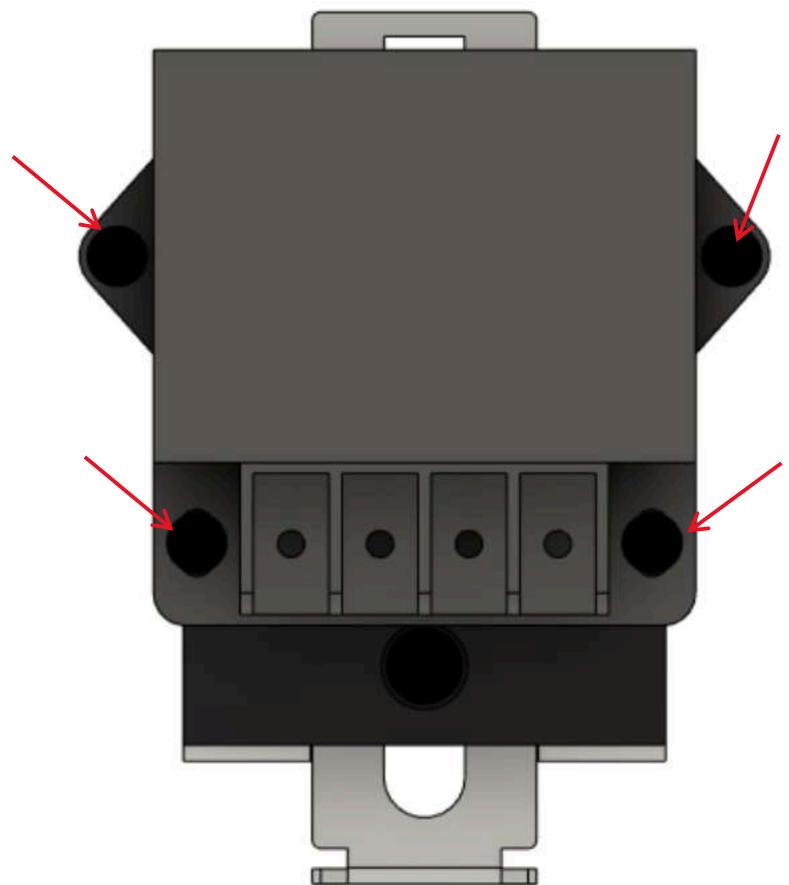
Locate Print_DCConverter_Mount and install (4) M3 heat set inserts at the shown locations.



Secure to a DIN rail clip using (2) M4x6mm SHCS.



Secure one of two DC converters to the printed part using (4) M3x6mm SHCS.



Repeat this step an additional time for the second DC Converter!

Step 1e – Duet Expansion Board

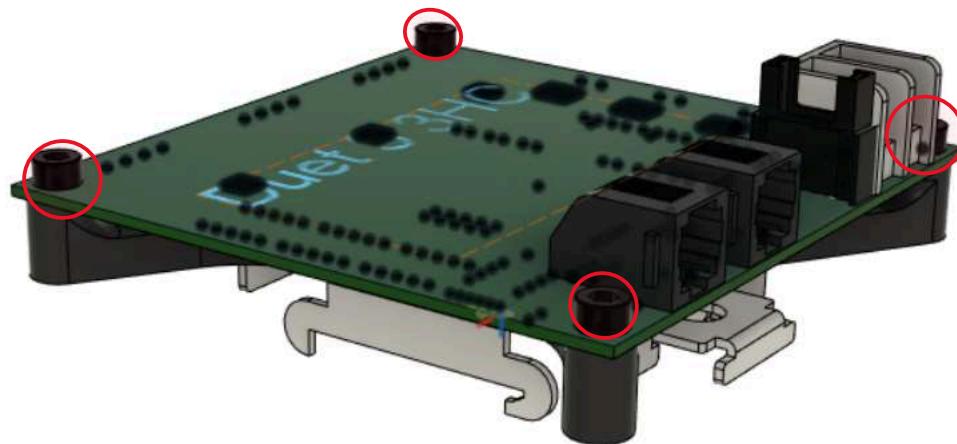
Locate Print_Duet3EXP_Mount and install (4) M4x6x5 heat set inserts at the locations shown below:



Secure to a DIN rail clip using (2) M4x6mm SHCS



Secure the Duet 3 3HC Expansion board to the assembly using (4) M4x6mm SHCS. Note the orientation of the board during installation.



Step 1e – Duet Main Board

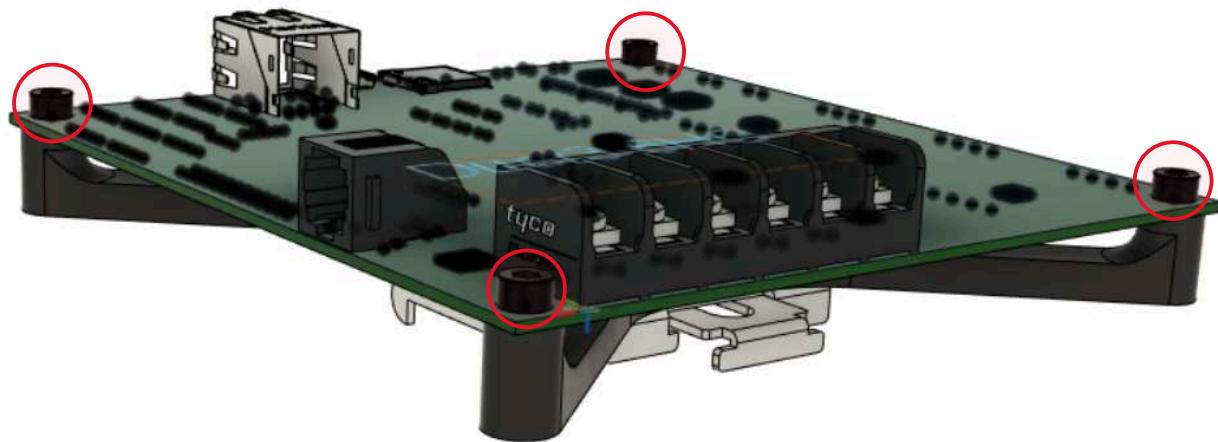
Locate Print_Duet3MB_Mount and install (4) M4x6x5 heat set inserts at the locations shown below:



Secure to a DIN rail clip using (4) M4x6mm SHCS



Secure the Duet 3 6HC Main Board to the assembly using (4) M4x6mm SHCS. Note the orientation of the board during installation.



Step 2 – DIN Rail Assemblies

Locate (2) Print_DINRailMount and 1 460mm length of DIN 35 rail. Slide the rail into each printed part.



Repeat the above for a second time resulting in two total DIN Rail assemblies.

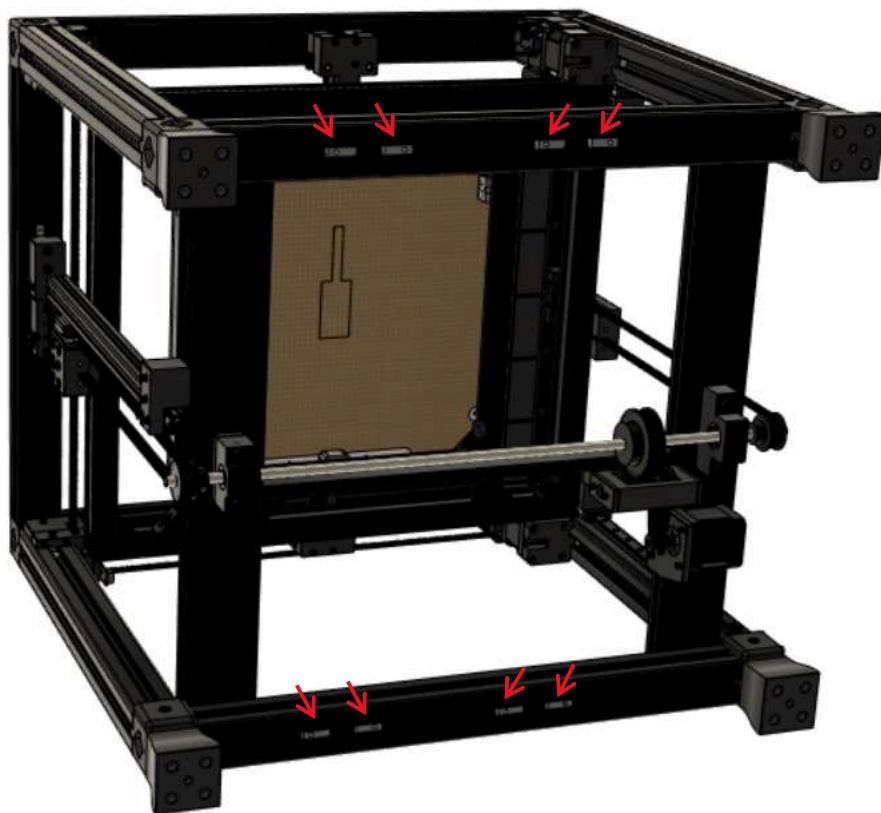
Orient the machine as shown with the “Front” of the machine facing the work surface:



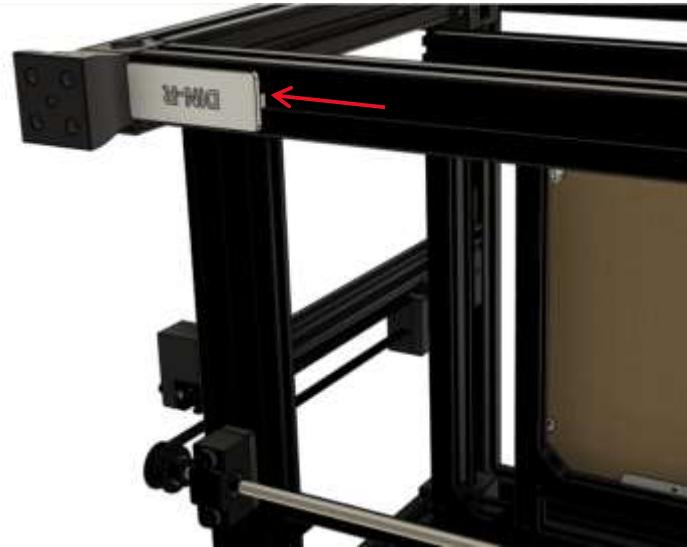
Locate and install (8) 4040 M4 T-nuts into the extrusions as follows:

(4) on the downward facing slot of the upper 4040 extrusion

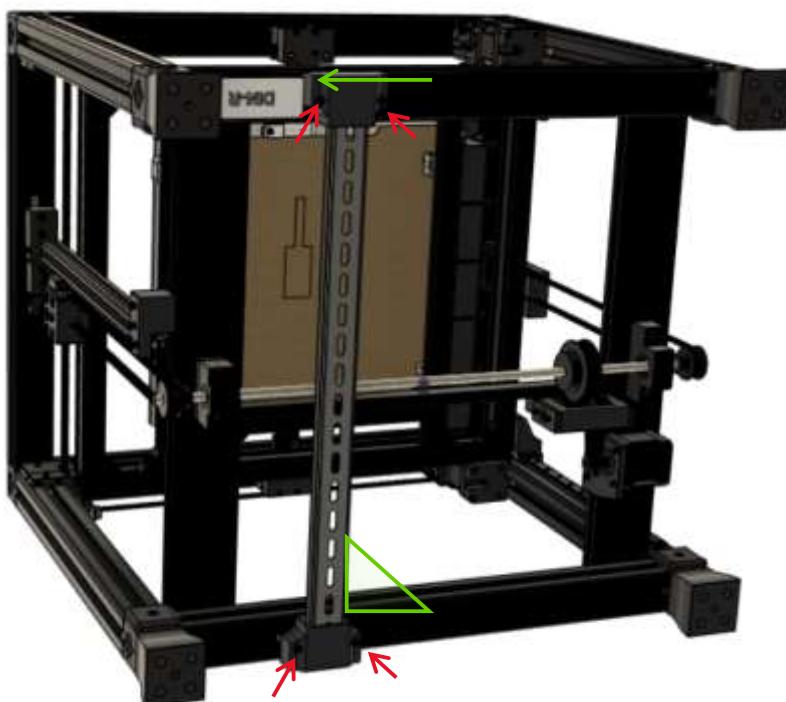
(4) on the downward facing slot of the lower 4040 extrusion



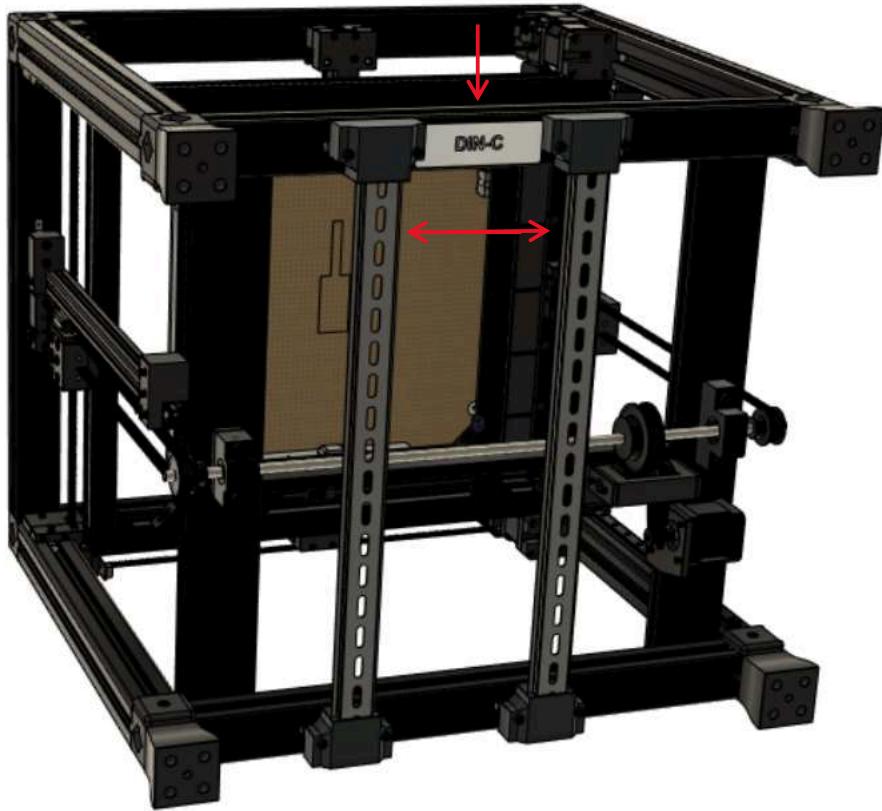
Locate Print_Jig_DINSpacerRight and place into the upper left extrusion as viewed from the angle below. Seat against the face of the machine foot.



Attach one of the DIN Rail Assemblies to the machine frame using (4) M4x30mm SHCS as shown in red below. Be sure to tighten into place against the printed jig. Confirm the DIN rail is square with the machine by moving the printed jig to the other side as well! Perfect squareness is not critical.



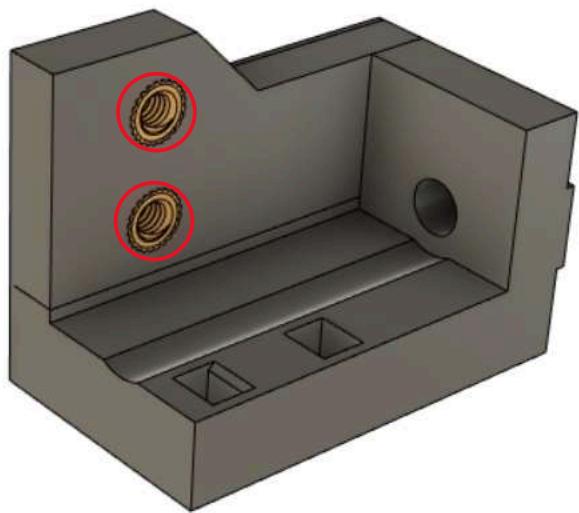
Remove the printed tool and set aside. Repeat the above procedure for the second DIN rail assembly but this time using Print_Jig_DINSpacerCenter to set the distance between the first and second DIN rail assembly as shown below.



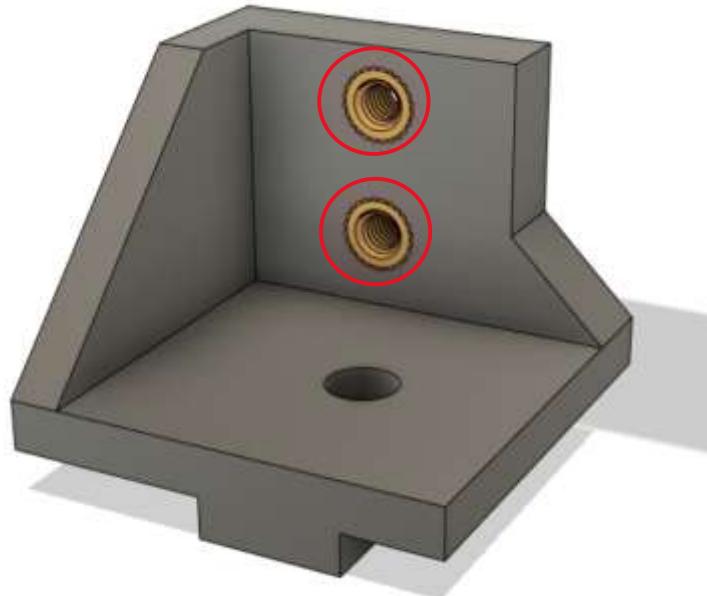
Remove the printed tool and set aside.

Step 3 – Rigid IGUS Chain

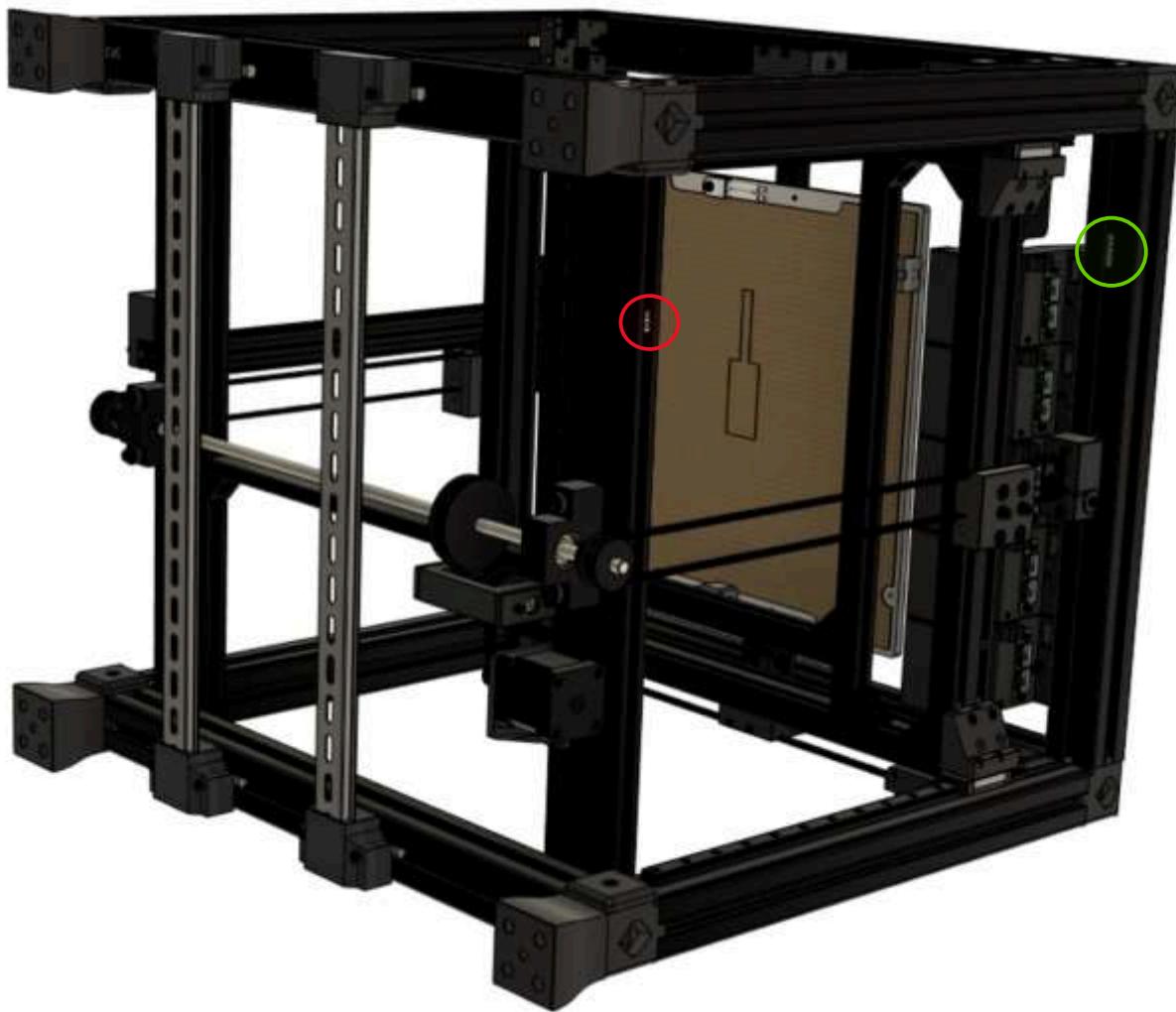
Locate Print_IGUS_Rigid_Mount_Lower and install (2) M3x4.6x4 heat set inserts at the shown locations:



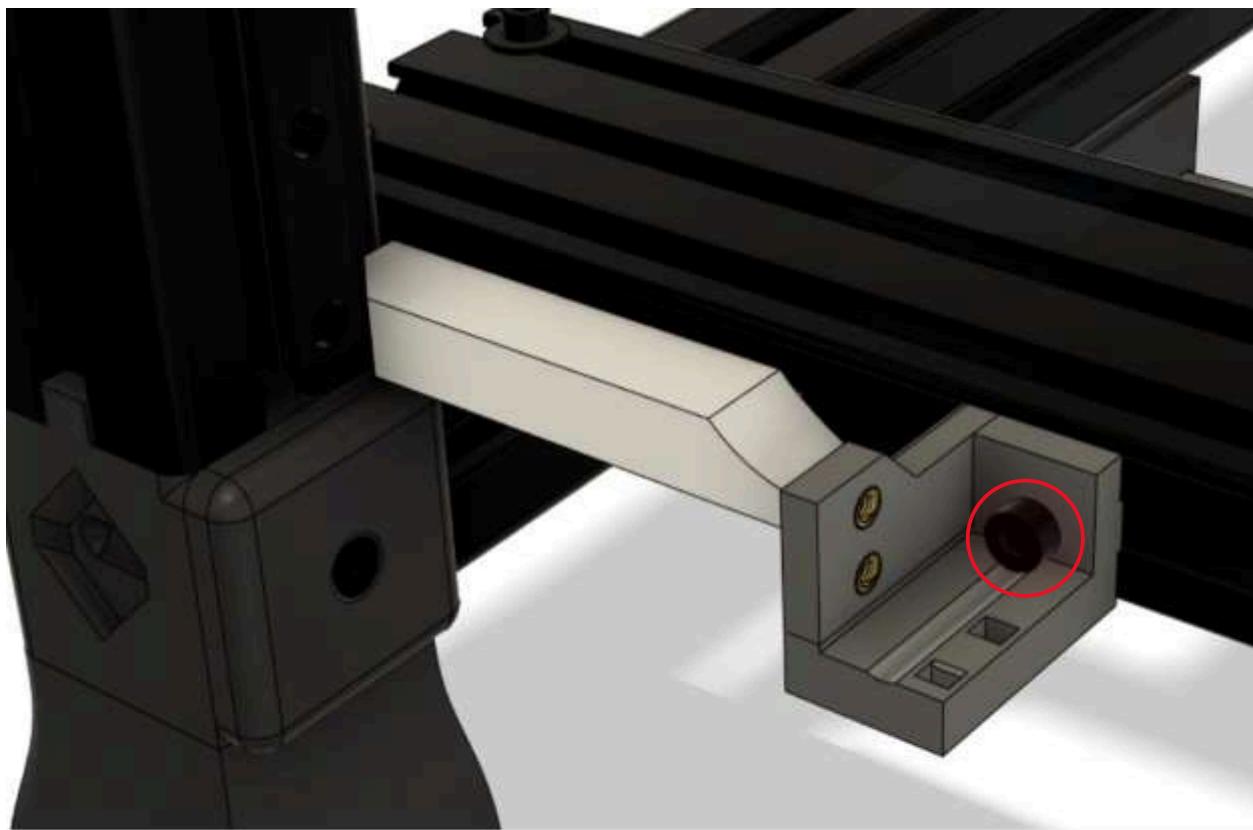
Locate Print_ZChainMount_Bottom and repeat the above with an additional (2) heat set inserts at the shown locations:



Insert (1) 2020 M4 Tnut into the location shown in red below. Note that we are now working with the machine from a slightly different angle. The 2020 Tnut goes into the outside facing slot of the shown 2060 extrusion. Insert (1) 4040 M4 Tnut into the location shown in green below. This Tnut goes into the lower most slot of the shown 4040 extrusion.



Locate Print_Jig_StaticChainLower and position as shown below to ensure that the lower static chain assembly is properly spaced along the 2060 extrusion. Secure the lower static chain mount assembly using (1) M4x10 SHCS into the previously inserted 2020 Tnut.

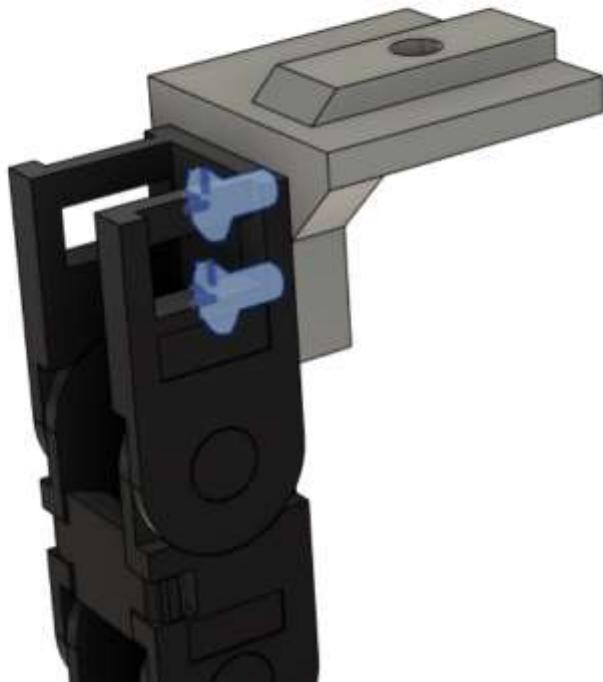


Remove the printed tool and set aside.

Locate the 17 link length of IGUS 10-10-018 drag chain and attach a matching end link set to both sides. Note that if your energy chains include a tie wrap mount protruding from the end of each link, this will need to be removed so that the face of the chain is a flush and flat surface as shown below.



Secure the static chain (either end) to the remaining 4040 chain mount assembly using (2) M3x6 FHHS as shown below:

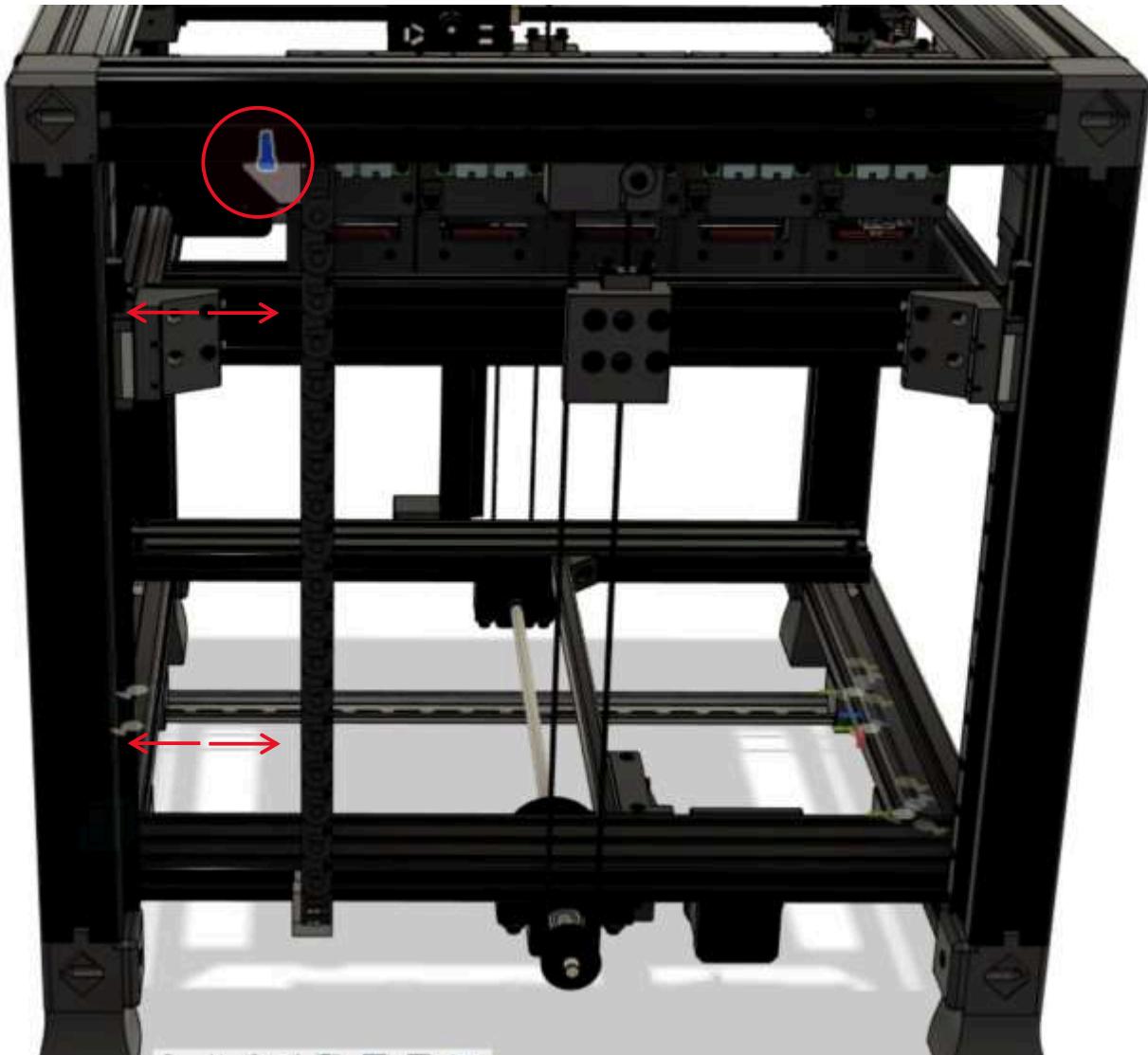


Secure the other end of the drag chain to the previously installed chain mount assembly using (2) additional M3x6 FHHS as shown below:



Loosely install the upper chain mount using the previously inserted 4040 Tnut and (1) M4x12mm SHCS.

Slide the loose assembly until the static chain is visually parallel to the 4040 vertical extrusion and the rest of the machine. Fully tighten the SHCS. The chain should be fairly taught when all fasteners are tightened.

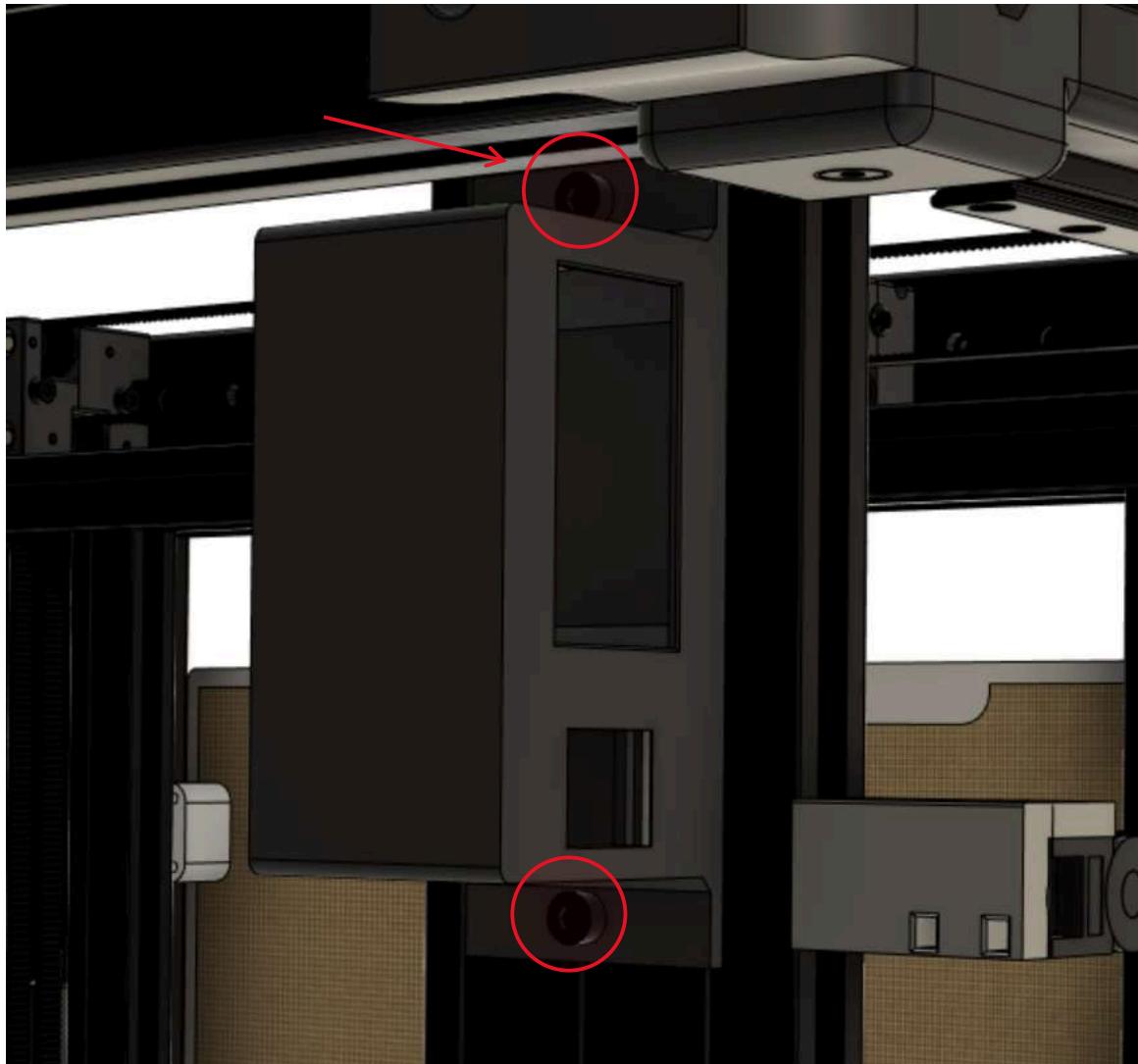


Step 4 – Power and Data Entry Housing

Install (2) 2020 M4 T-nuts into the bottom center slot of the 2060 extrusion as shown below:



Locate Print_ACSwHouse_CE and secure to the machine using the previously inserted Tnus and (2) M4x8mm SHCS. Be sure that the printed part meets the 4040 extrusion as shown below:

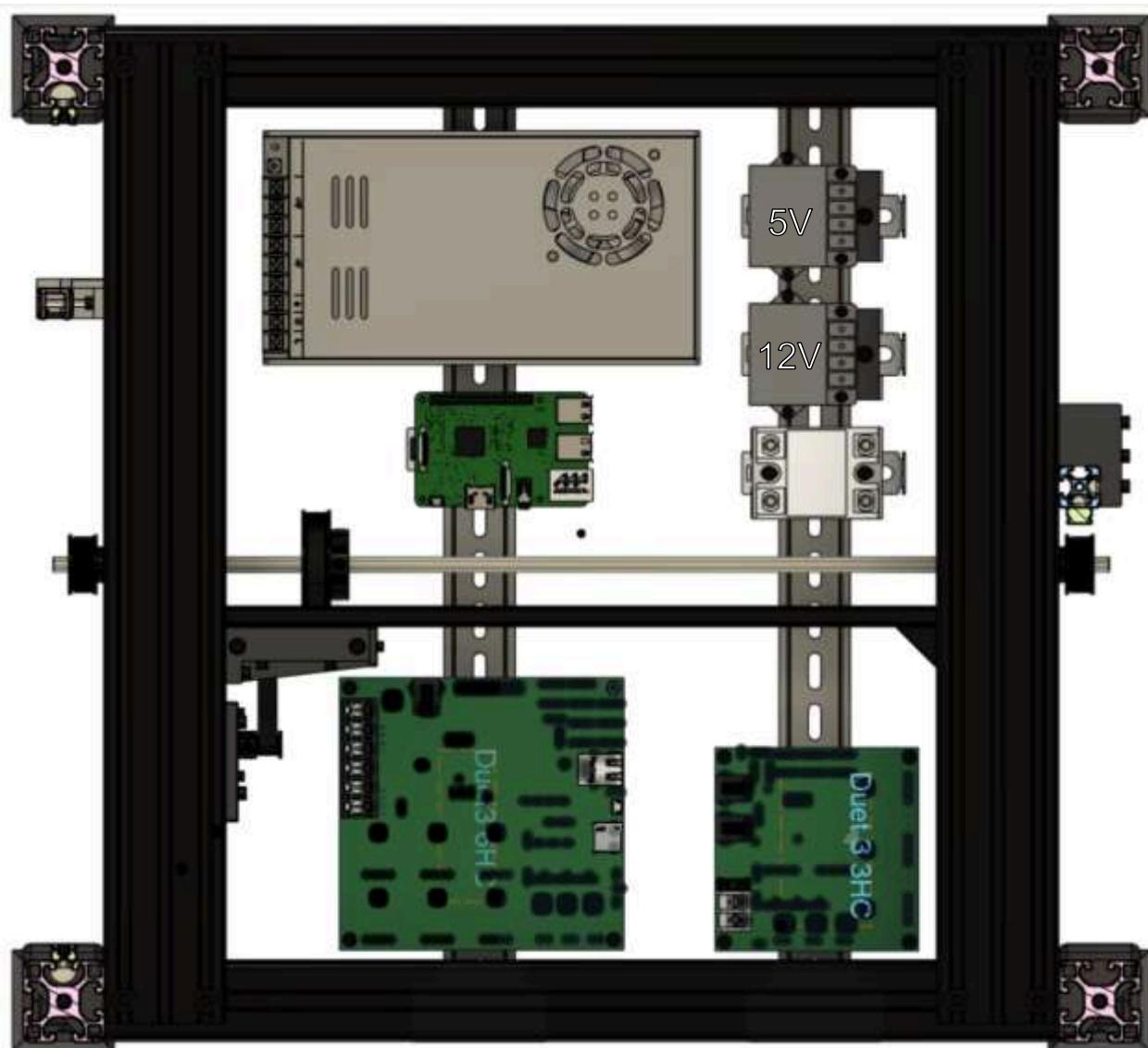


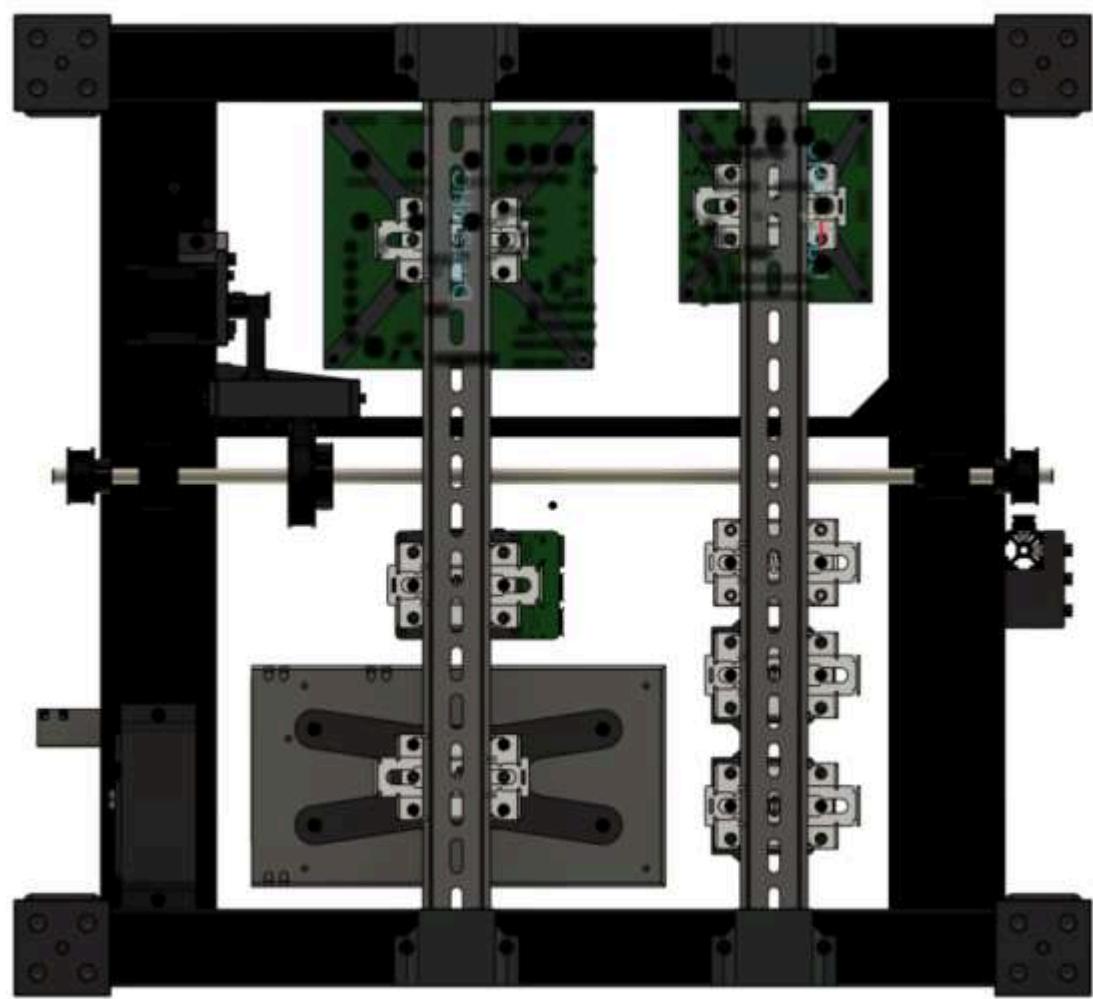
Install the CAT6 keystone jack into the housing as shown below. This is also the location for the Power Inlet/AC switch combination part. It is recommended to first pre-wire the AC switch before installation. Please see the CE wiring guide or leave the AC switch dismounted for now.



Step 5 – Electronics Distribution

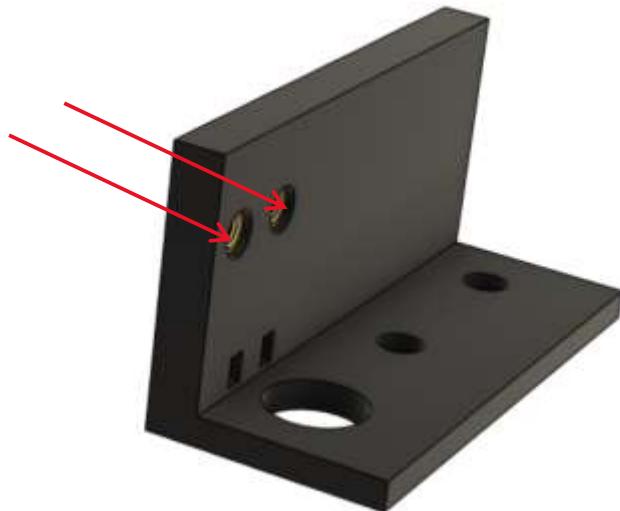
Flip the machine back on to its feet and raise the bed for better access to the top side of the DIN rails. Use the images below to guide you in attaching each DIN rail component in the correct location and orientation.





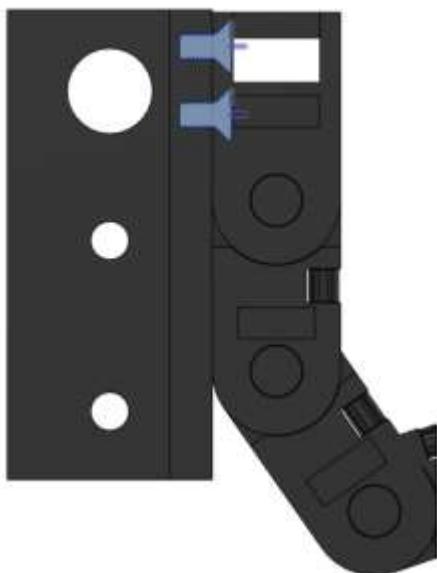
Step 6 – Z Axis Drag Chain

Locate Print_ZChainMount_Top and install (2) M3x4.6x4 heat set inserts into the locations shown below. Note that the inserts should be installed in the directions of the arrows.

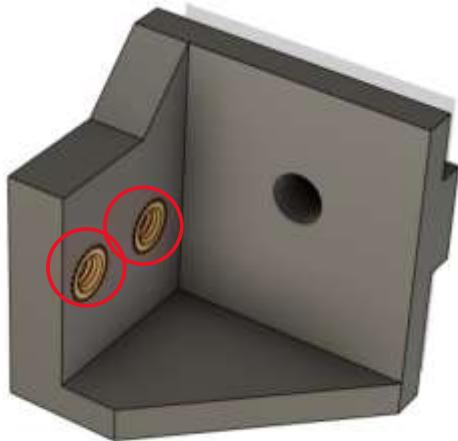


Locate the 18 link IGUS 10x10x018 length of drag chain and install end links just as done on the static chain. Remember to cut away any strain relief mounts molded into the end links.

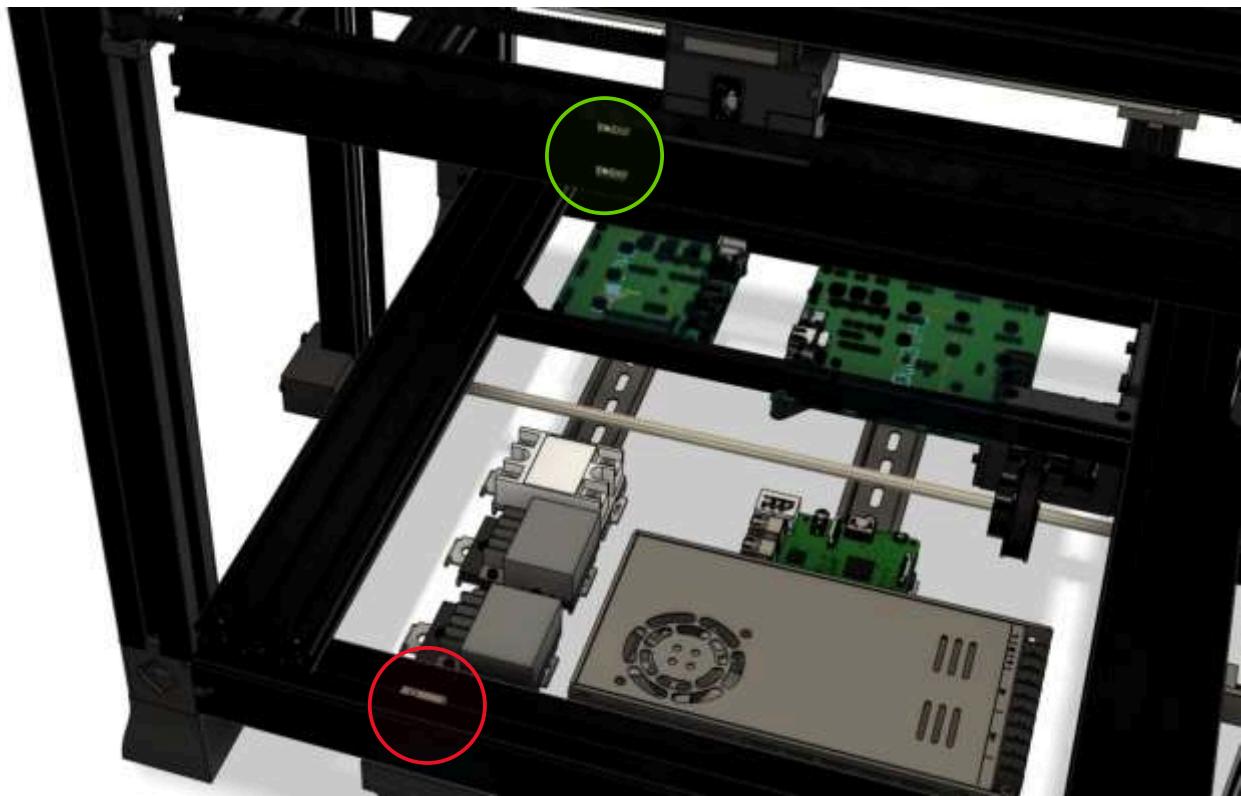
Secure one end (direction is not important) to the upper (bed side) Z chain mount using (2) M3x6mm FHHS as shown below:



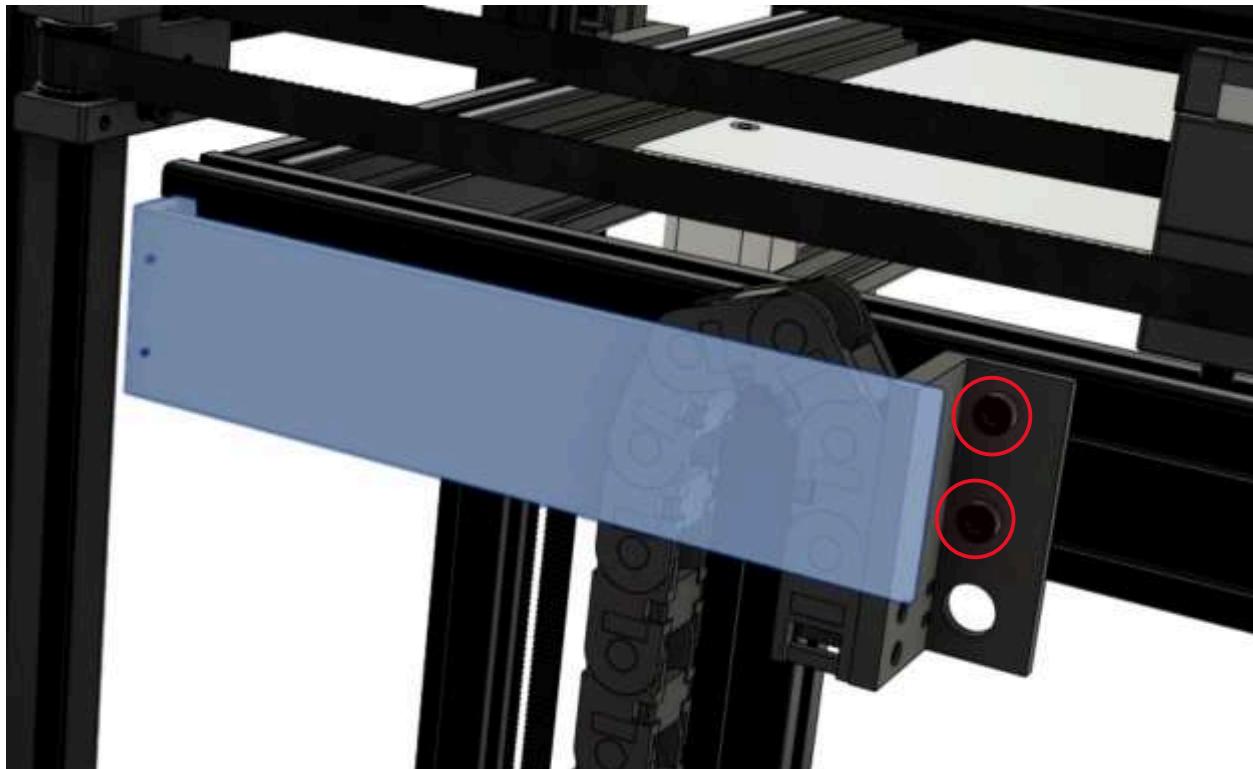
Locate Print_ZChainMount_Top and install (2) M3x4.6x4 heat set inserts into the locations shown below.



Install (1) **4040 M4 Tnut** into the upper slot of the rear lower extrusion and (2) **2020 M4 Tnus** into the outer slots of the rear Z axis extrusion as shown below:



Loosely attach the upper Z chain mount with drag chain to the previously inserted 2020 Tnuts using (2) M4x8mm SHCS shown below in red. Locate Print_Z_Chain_Mount_Top_Installation_Tool (shown in blue below) and use it set the location of the z chain mount. Fully tighten the fasteners once this location is achieved.

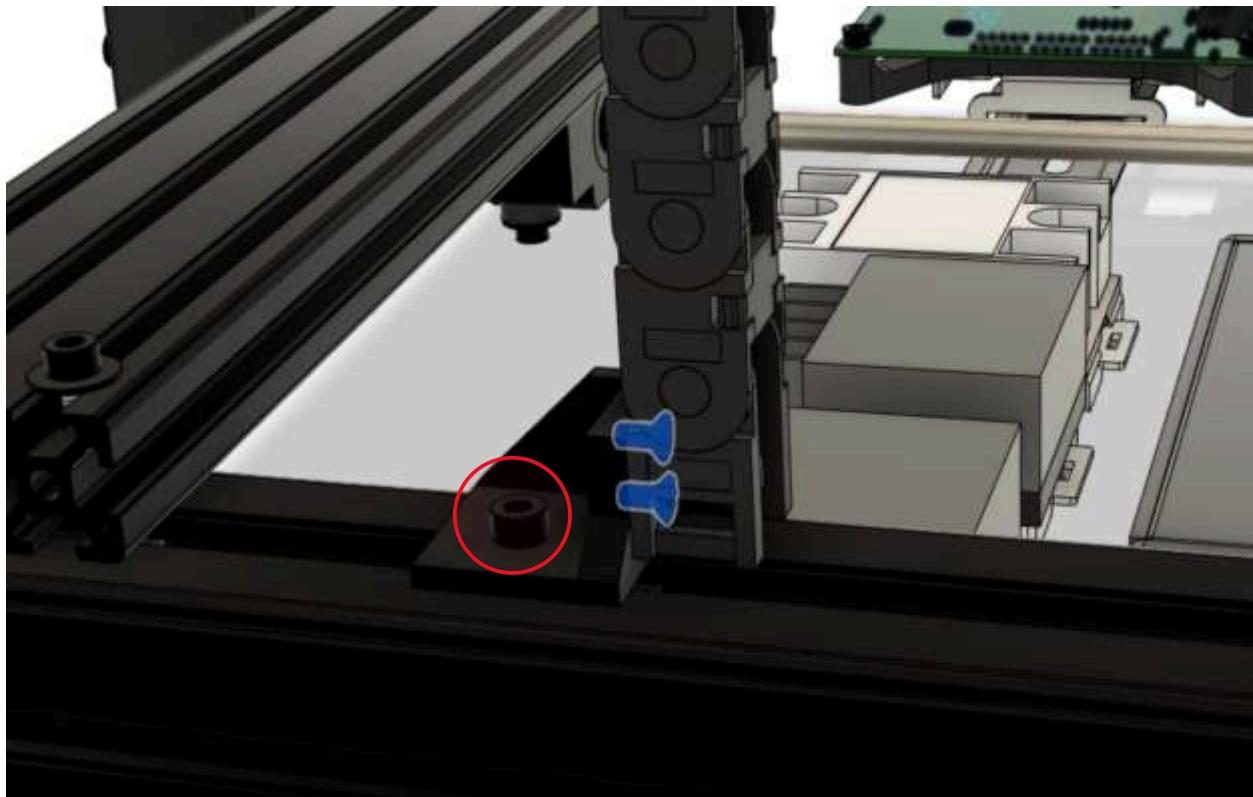


Set aside the printed locating tool.

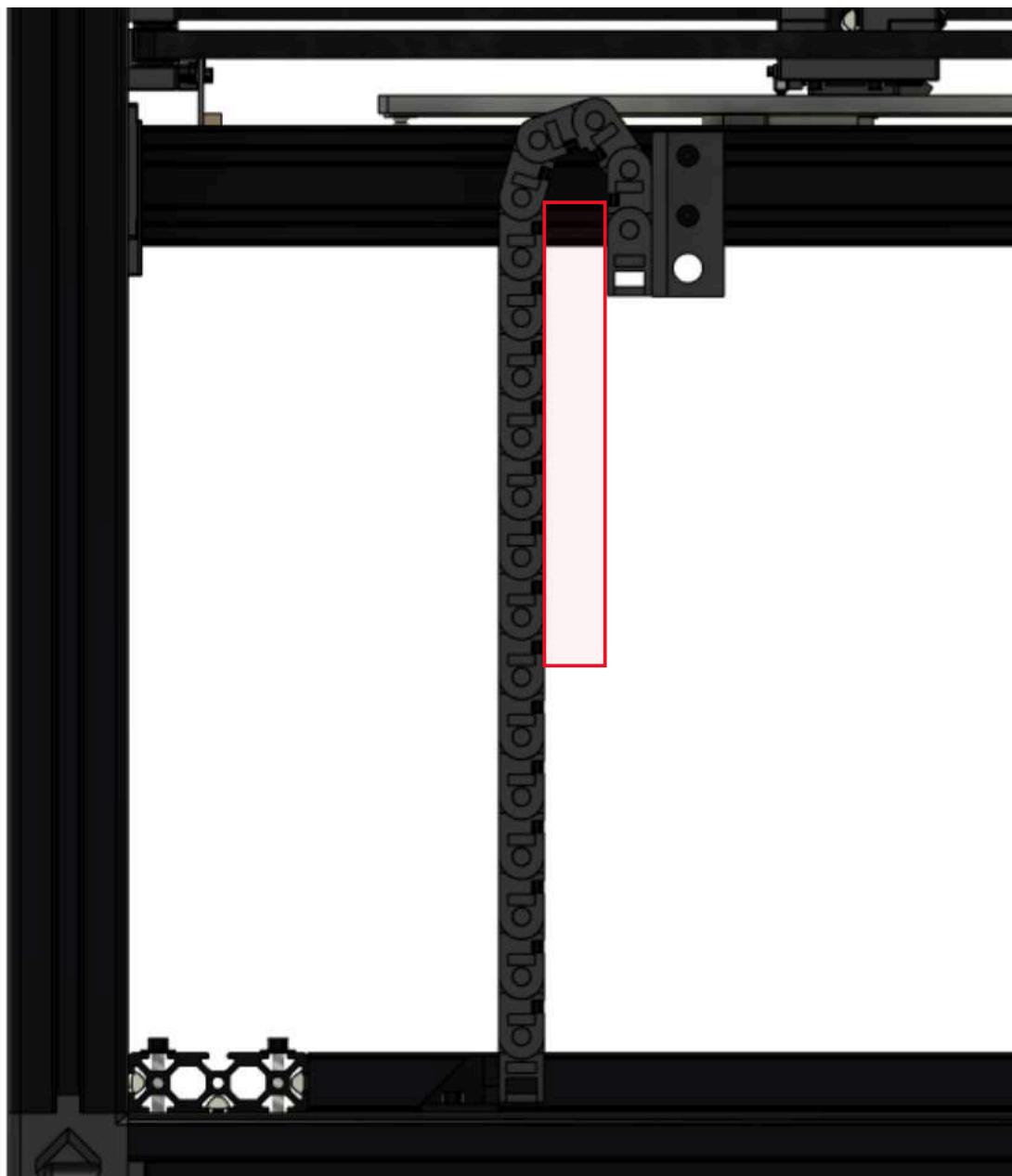
Loosely install the lower chain mount assembly by way of the following:

Install and tighten **(2) M3x6mm FHHS** to mount the loose end of the drag chain to the lower printed mount.

Loosely install **(1) M4x12mm SHCS** to mount the lower mount assembly to the 4040 extrusion using the previously inserted 4040 M4 Trut.

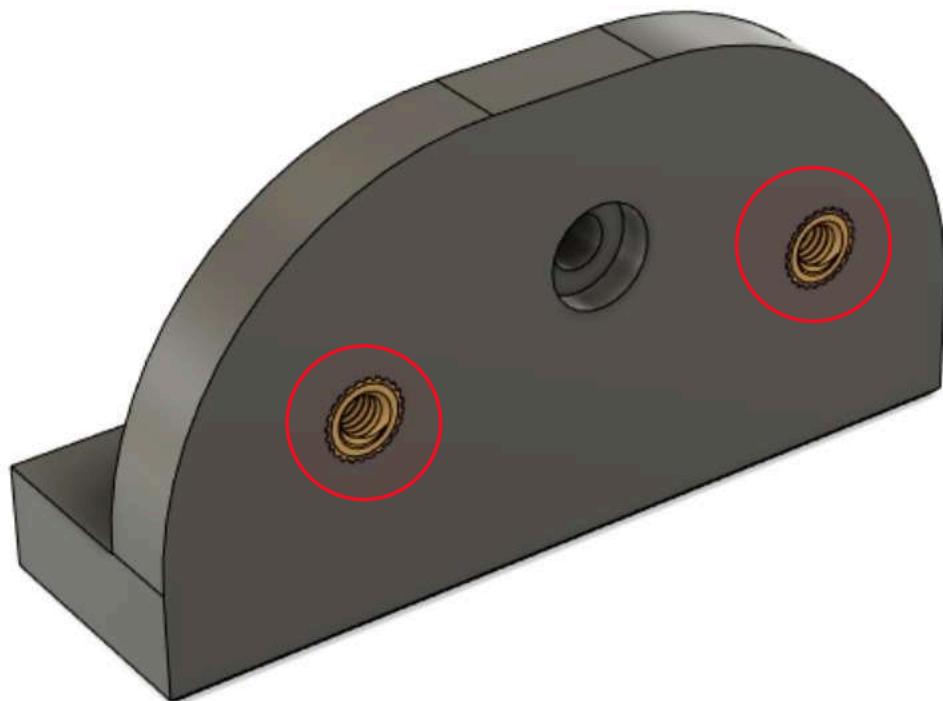


Slide the loosely mounted lower assembly as needed to achieve a parallel path for both vertical portions of the Z drag chain as shown below. Fully tighten in this position.



Step 7a – 2010 Extrusion Wire Ducts

Locate (4) Print_Wire_Duct_Mount_2040 and insert (2) M3 heat set inserts into the shown locations.



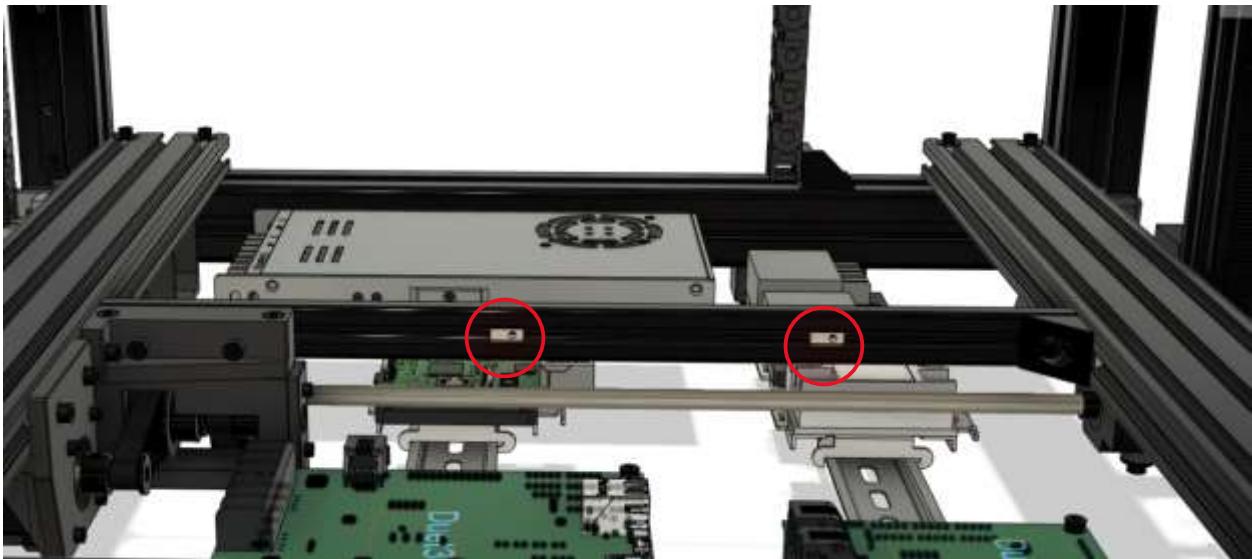
Repeat three additional times – one for each of this type!

Locate (2) Print_Wire_Duct_Mount_2010 and insert (2) M3 heat set inserts into the shown locations.

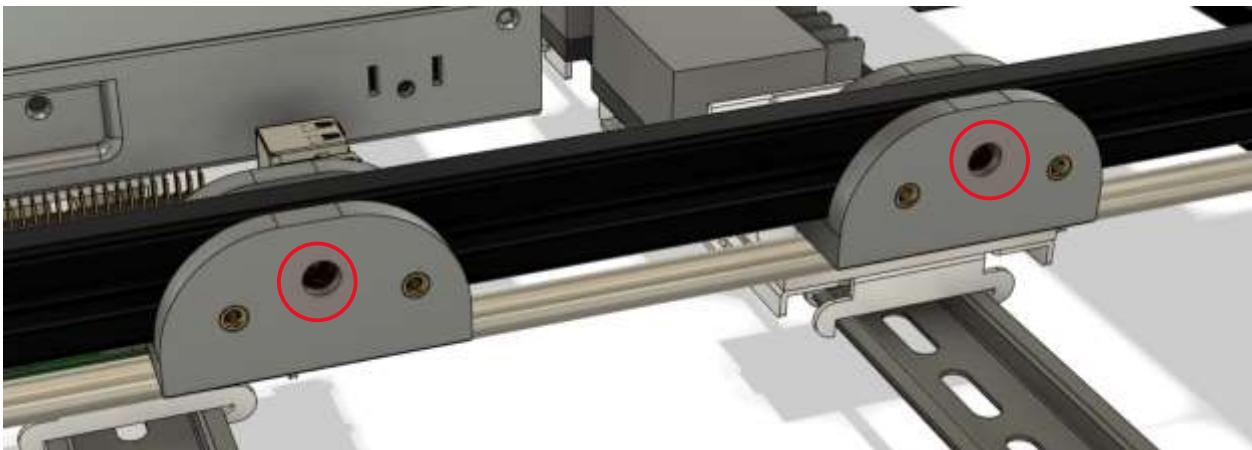


Repeat once more for the other mount of this type.

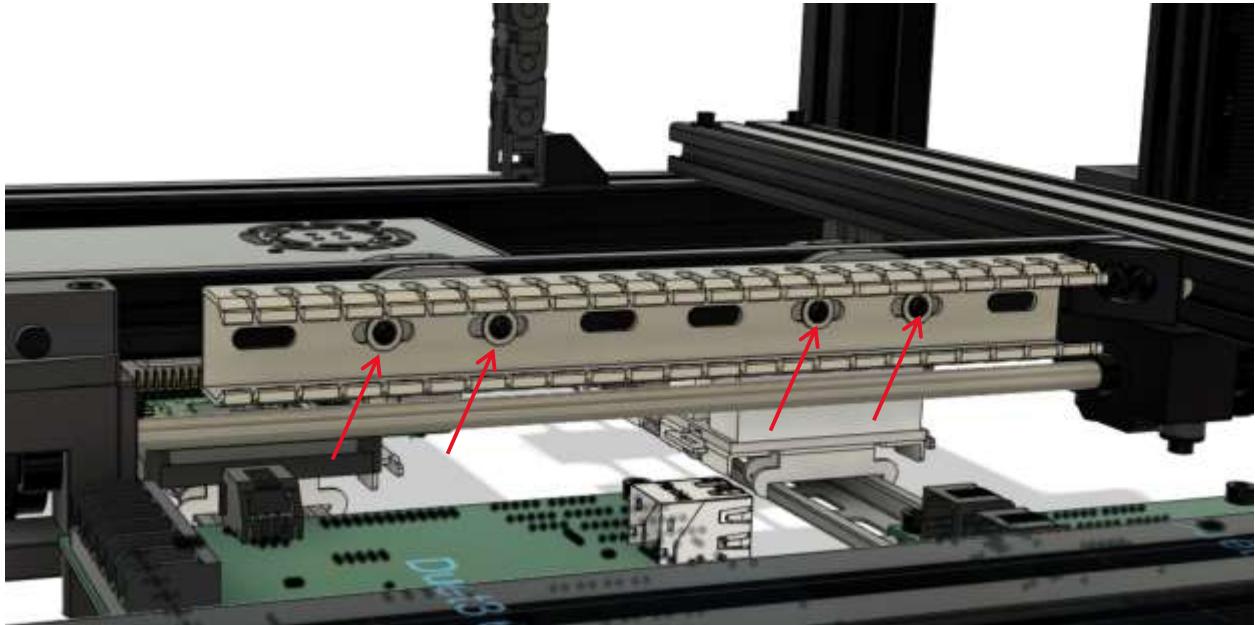
Install (2) 2020 M3 Tnus into the slot of the Z-axis support 2010 extrusion as shown below:



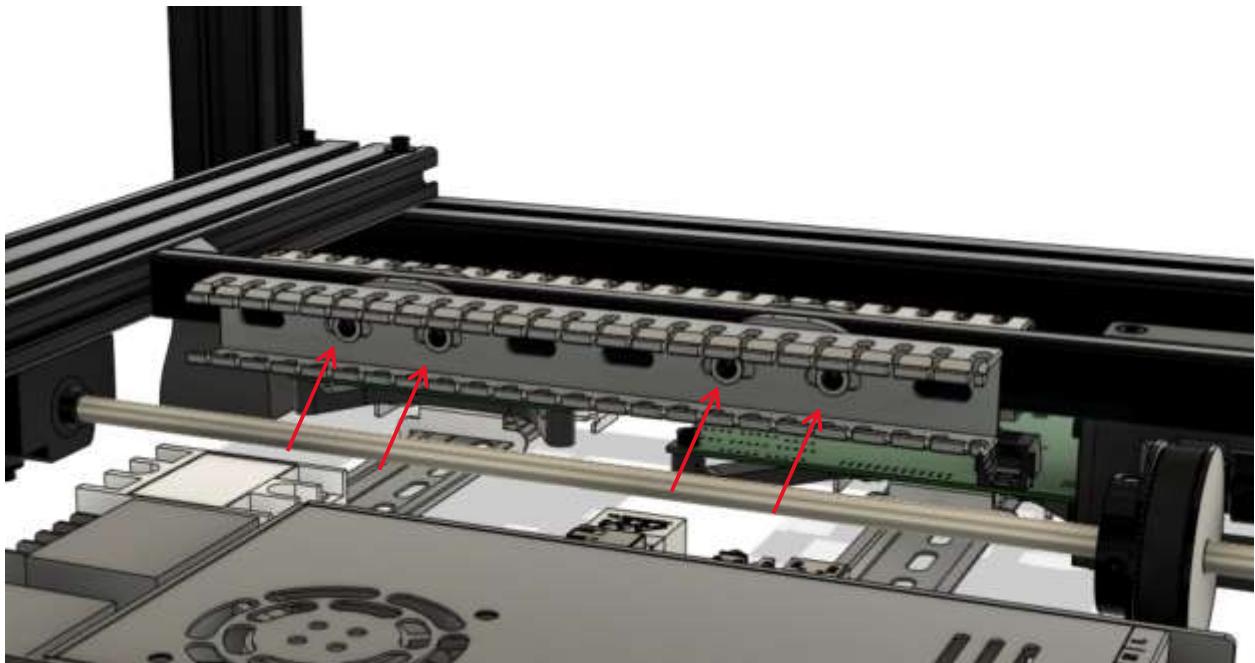
Secure both 2010 bracket assemblies to the 2010 extrusion using the previously inserted 2020 Tnus and (2) M3x8mm BHHS.



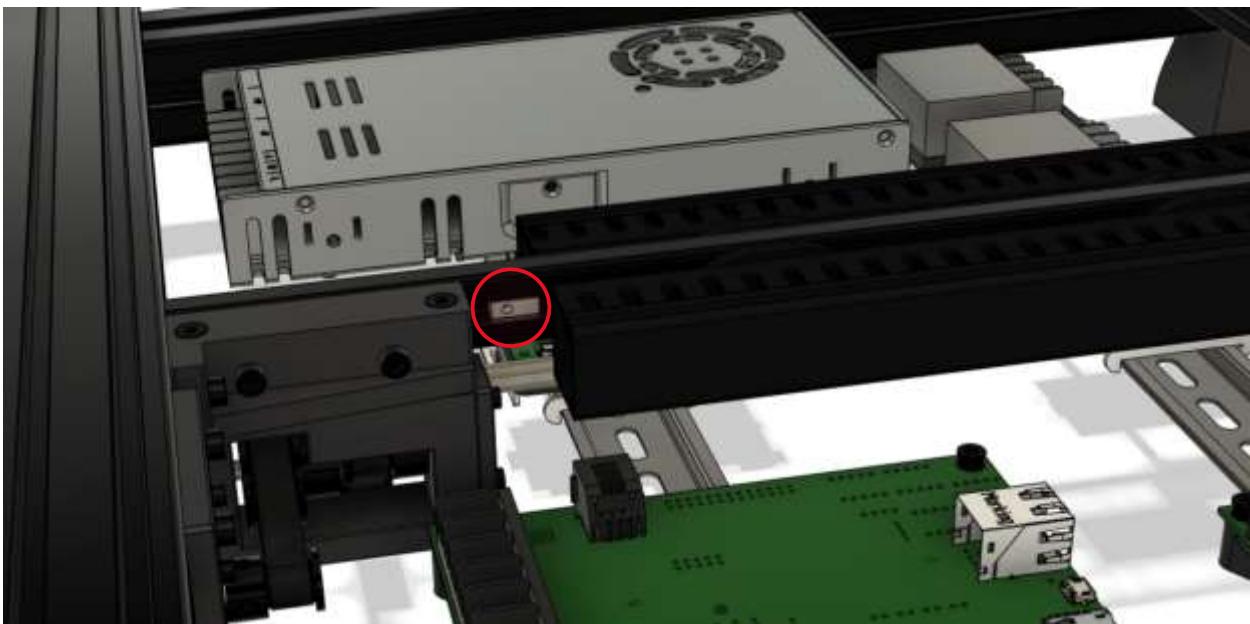
Locate a 230mm length of 25mmx25mm cable duct. Remove the cover and secure the main body to each of the forward-facing surfaces of the 2010 duct mount assemblies. This requires (4) M3 fender washers and (4) M3x6mm BHHS.



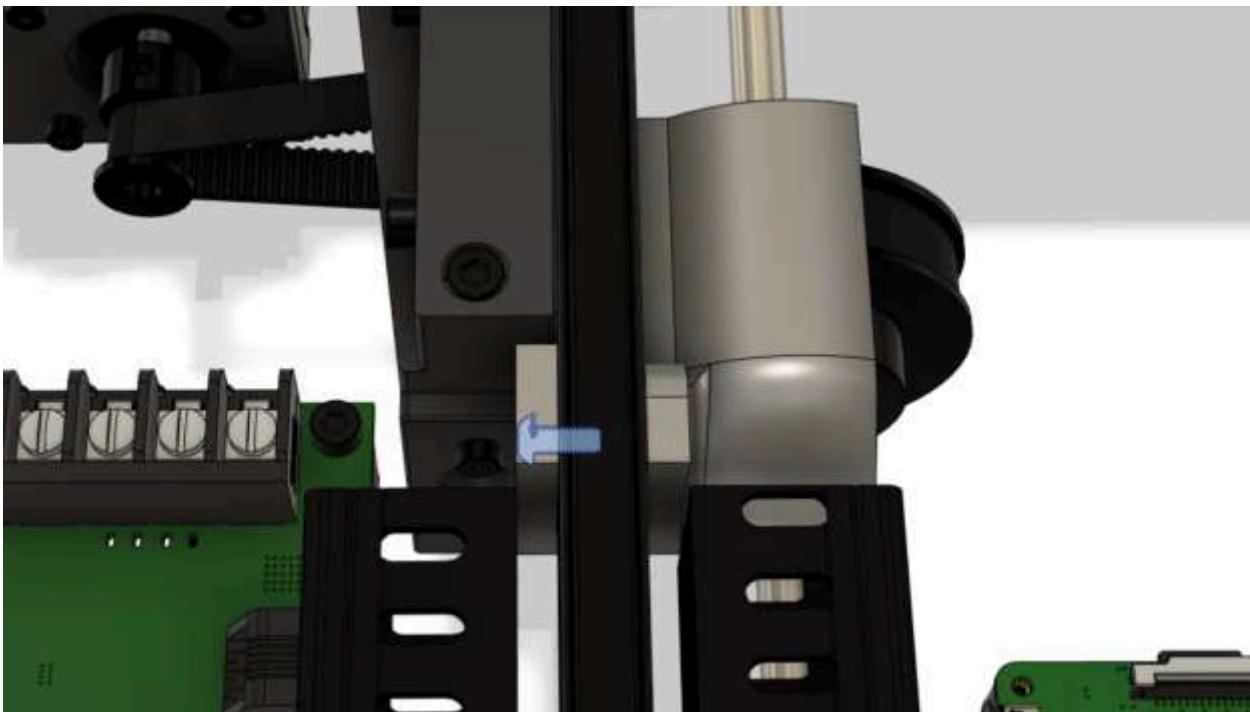
Repeat the above process for the other side of the 2010 extrusion as shown below.



Insert an additional 2020 M3 Trut into the 2010 extrusion in the shown location:

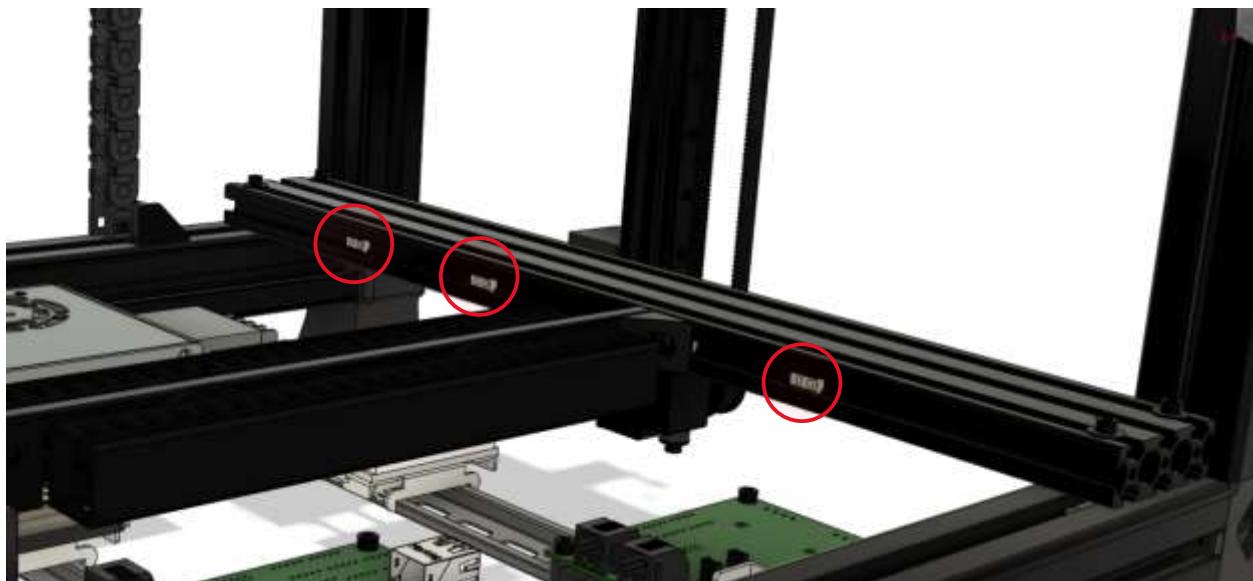


Locate Print_Wire_Duct_Shield and secure to the 2010 extrusion using the previously inserted Trut and (1) M3x8 BHHS as shown below:

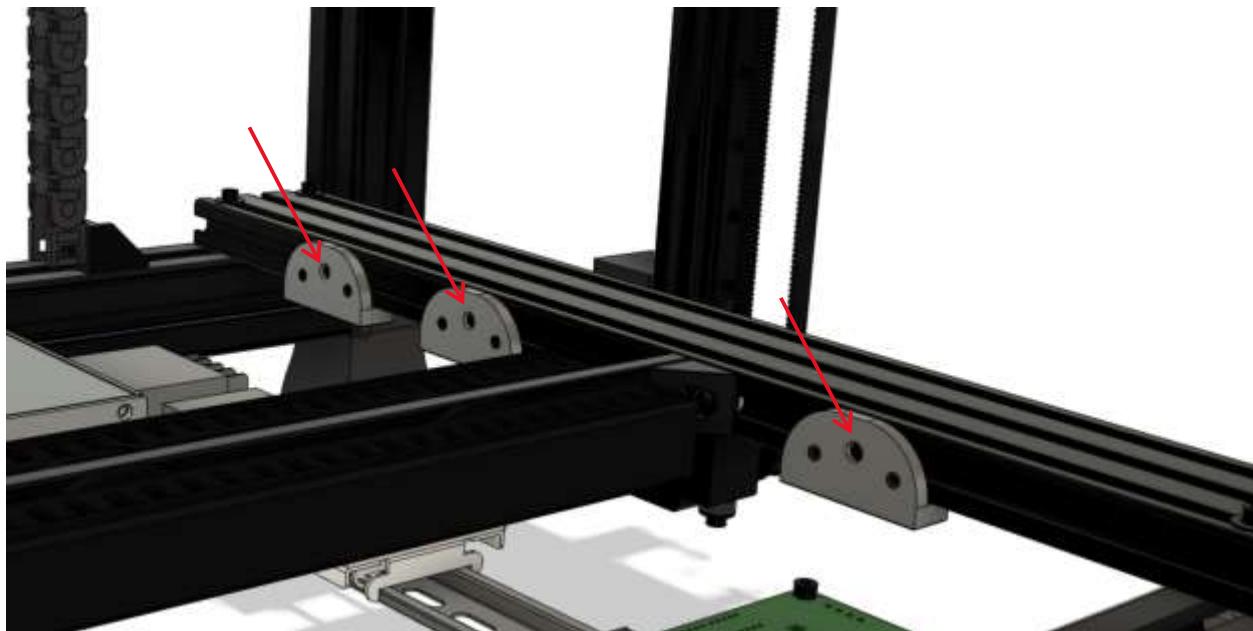


Step 7b – 2060 Extrusion Wire Ducts

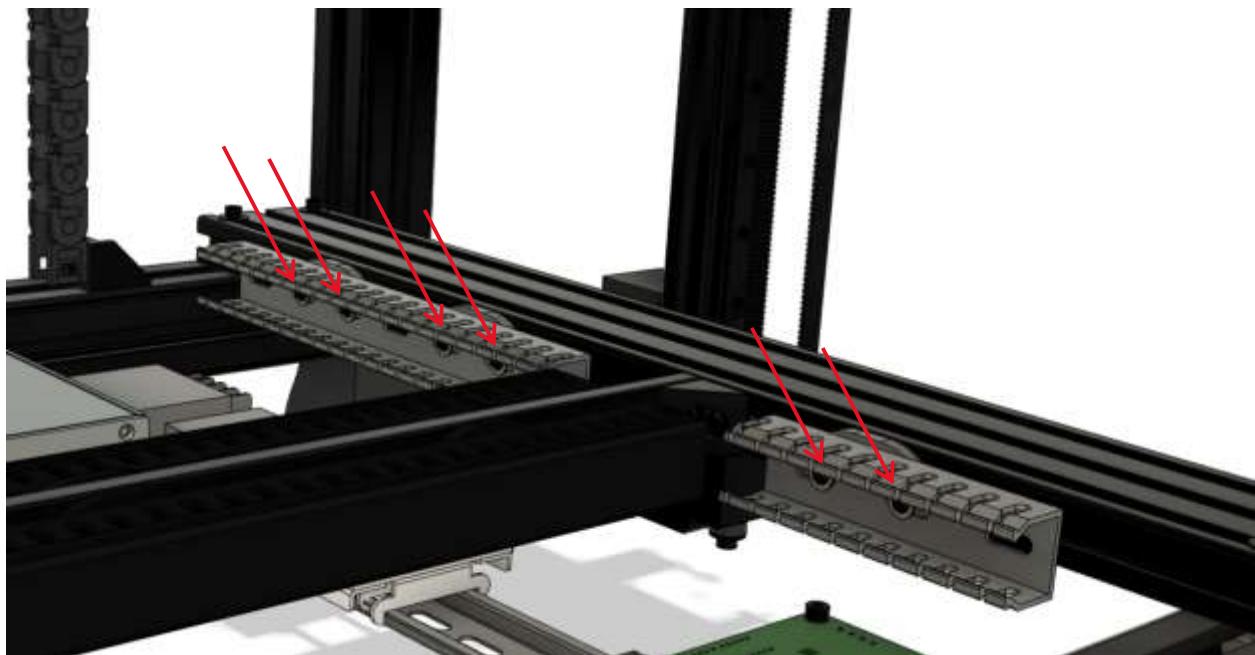
Insert (3) 2020 M3 Tnus into the inside facing slot of the right 2060 extrusion as shown below:



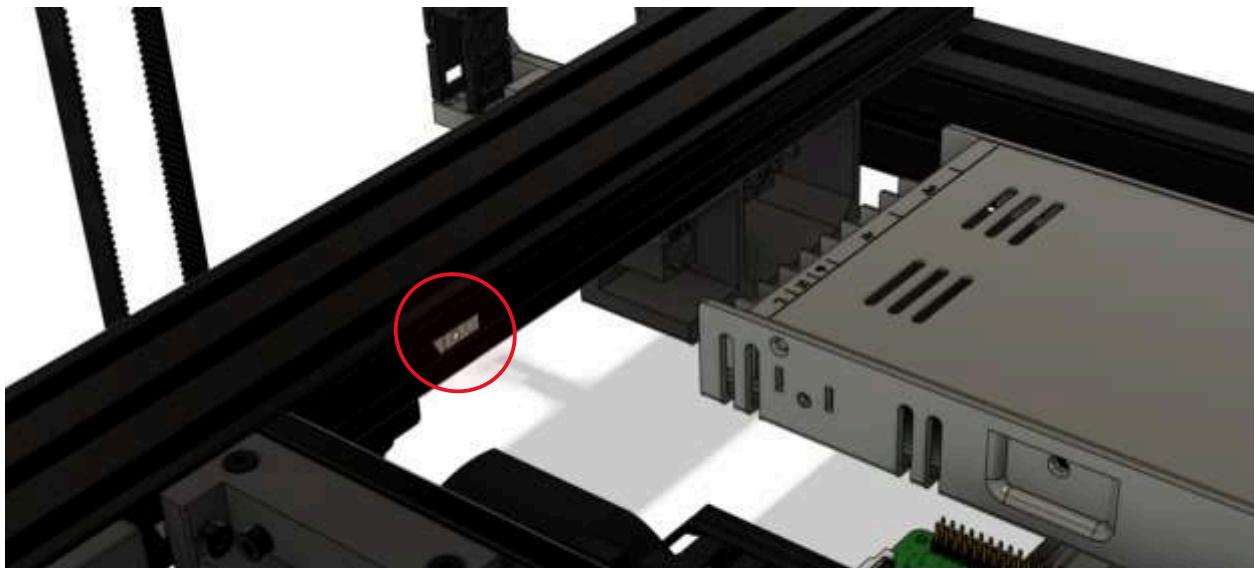
Secure three total 2040 bracket assemblies to the 2060 extrusion using the previously inserted 2020 Tnuts and (3) M3x8mm BHHS.



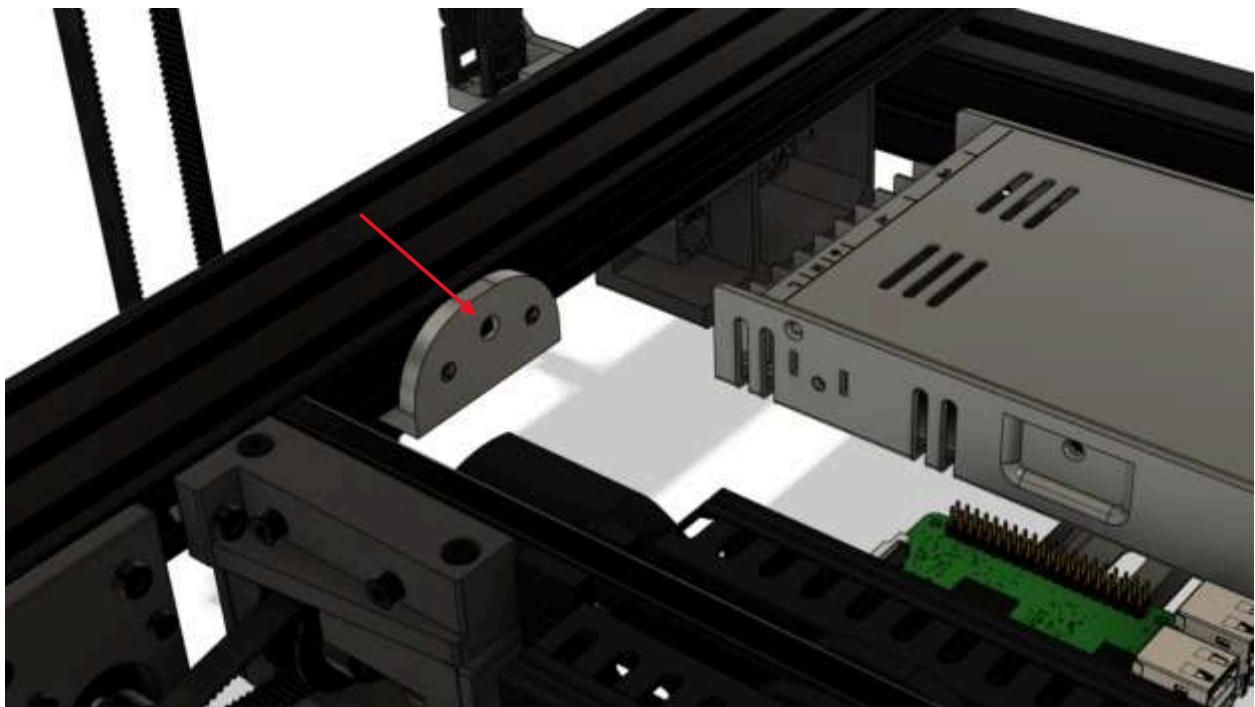
Locate (1) 200mm length and (1) 100mm length of 25mmx25mm cable duct. Remove the cover and secure the main body to each of the forward-facing surfaces of the 2040 duct mount assemblies. This requires (6) M3 fender washers and (6) M3x6mm BHHS. Note that the 200mm duct is installed rearward of the Z axis drive 2010 extrusion.



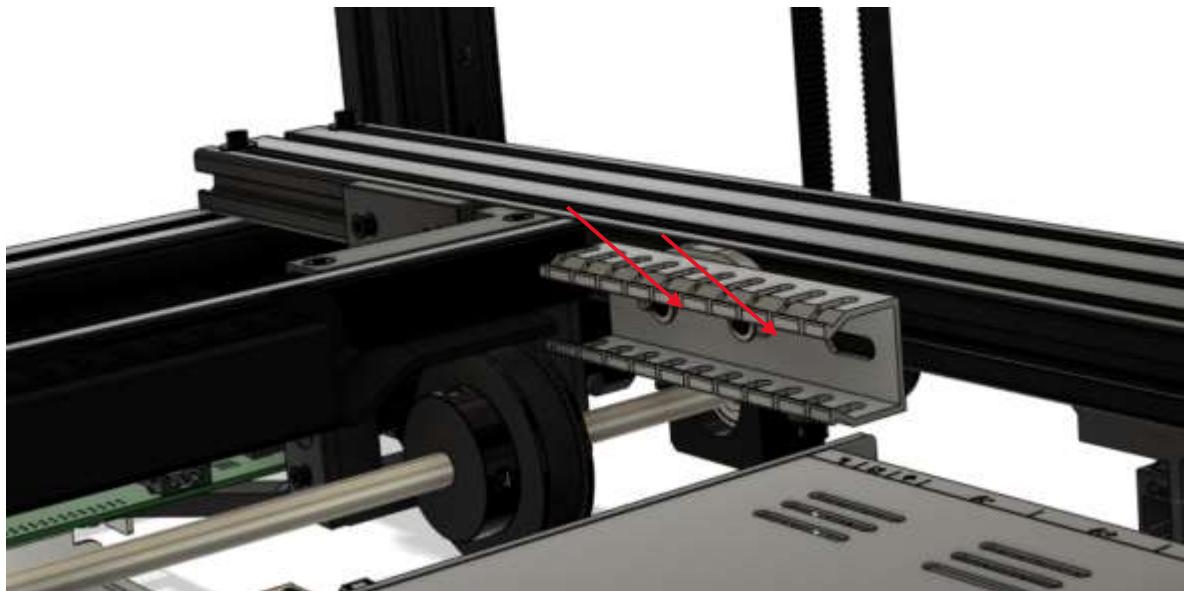
Insert (1) 2020 M3 Tnut into the inside facing slot of the left 2060 extrusion as shown below:



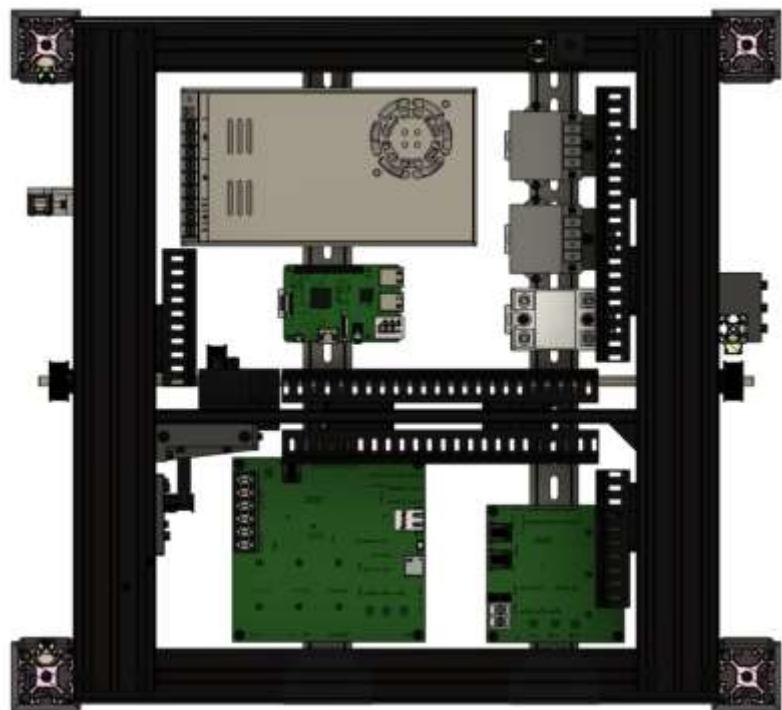
Secure the final 2040 bracket assembly to the 2060 extrusion using the previously inserted 2020 Tnut and (1) M3x8mm BHHS.



Locate (1) 100mm length of 25mmx25mm cable duct. Remove the cover and secure the main body to the forward-facing surface of the 2040 duct mount assembly. This requires (2) M3 fender washers and (2) M3x6mm BHHS.

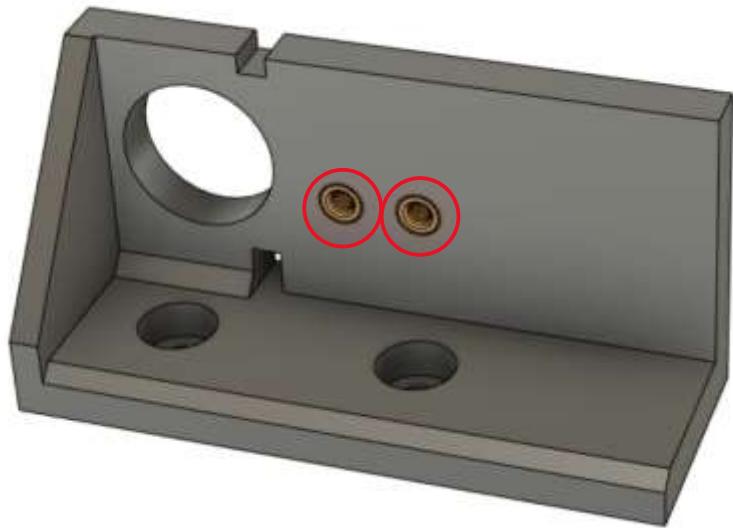


Use the below image to confirm all ducts are in relatively correct locations.

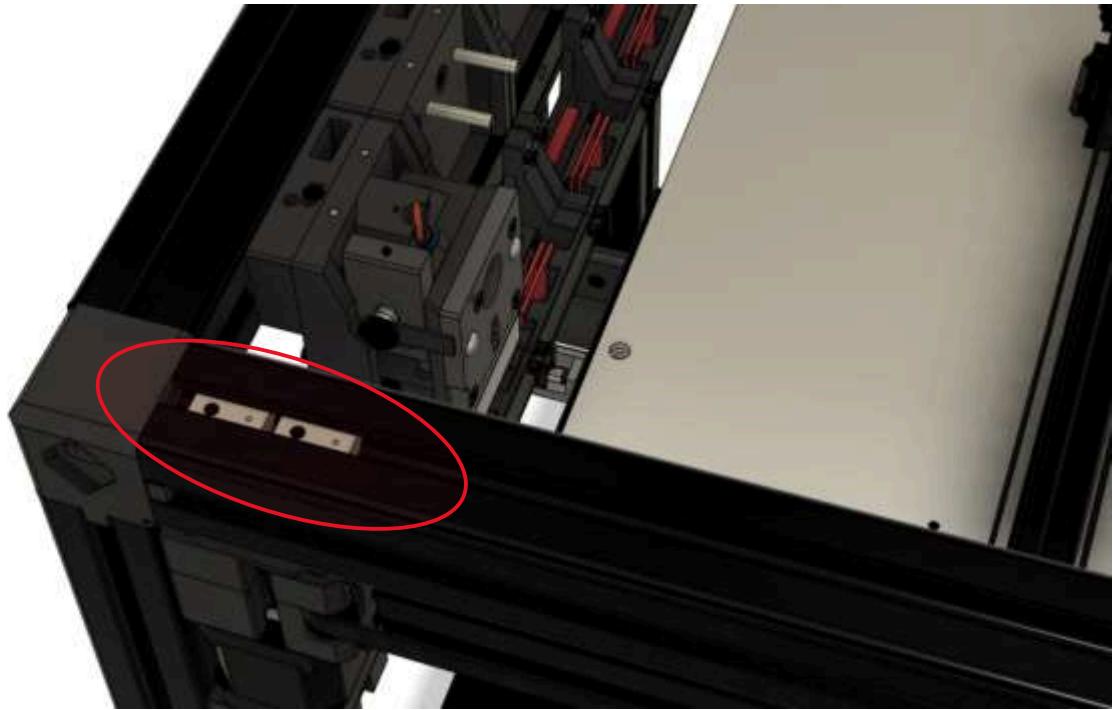


Step 8 – XY Drag Chain

Locate Print_IgusMountFrame and install (2) M3 heat set inserts at the locations shown below:



Insert (2) 4040 M4 Tnutes into the top slot of the upper forward extrusion as shown below:



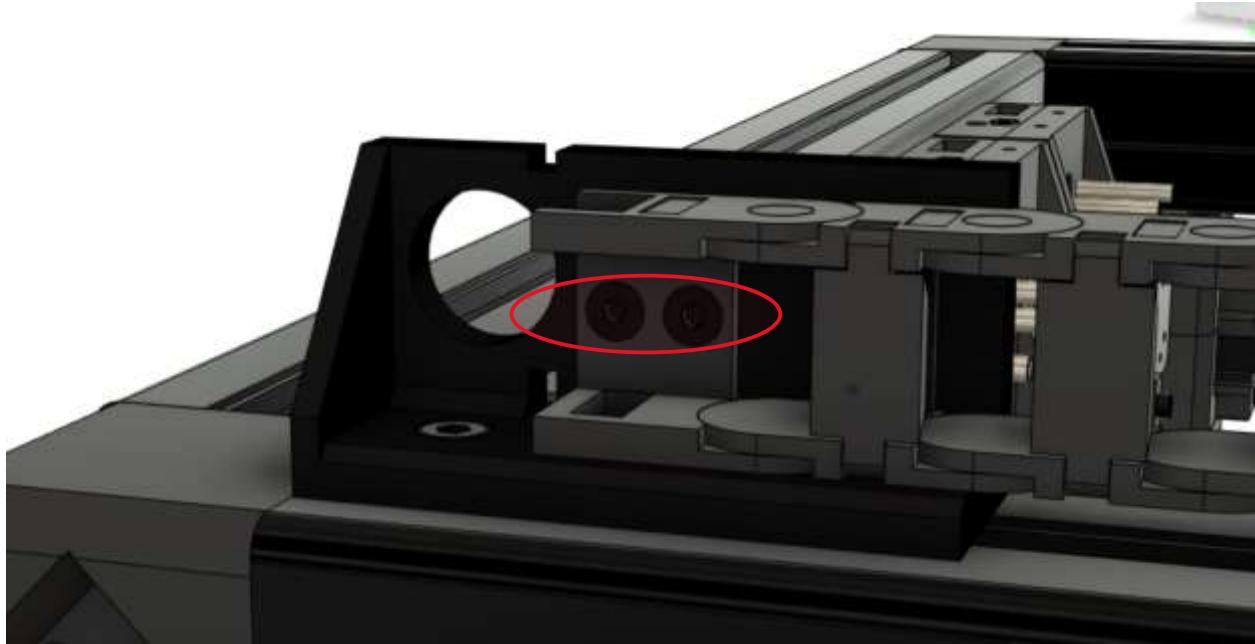
Install and secure the printed part using the previously inserted Tnuts and (2) M4x12mm SHCS. The final installed position should have contact with the edge of the upper corner bracket cover.



Locate the 34 link length of IGUS 10x16x018 drag chain and attach a matching end link set to both sides. Note that if your energy chains include a tie wrap mount protruding from the end of each link, this will need to be removed so that the face of the chain is a flush and flat surface as shown below.



Secure the side of the chain with the “female” end-link to the previously installed frame mount assembly using (2) M3x6mm FHHS.



Secure the other end of the XY chain to the upper left face of the X-Plate using (2) M3x6mm FHHS as shown below.

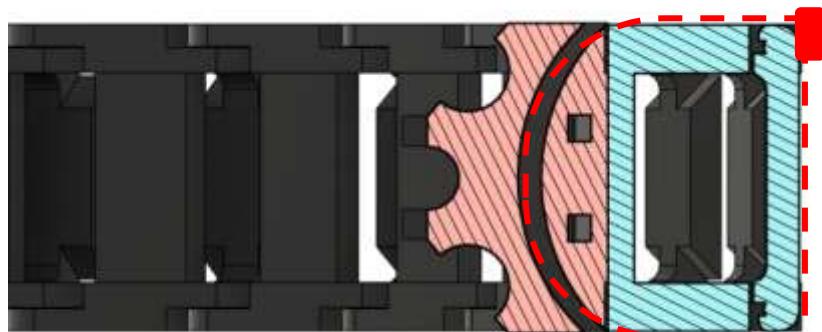


Locate (4) Print_LineHolder_Part1 and (4) Print_LineHolder_Part2.



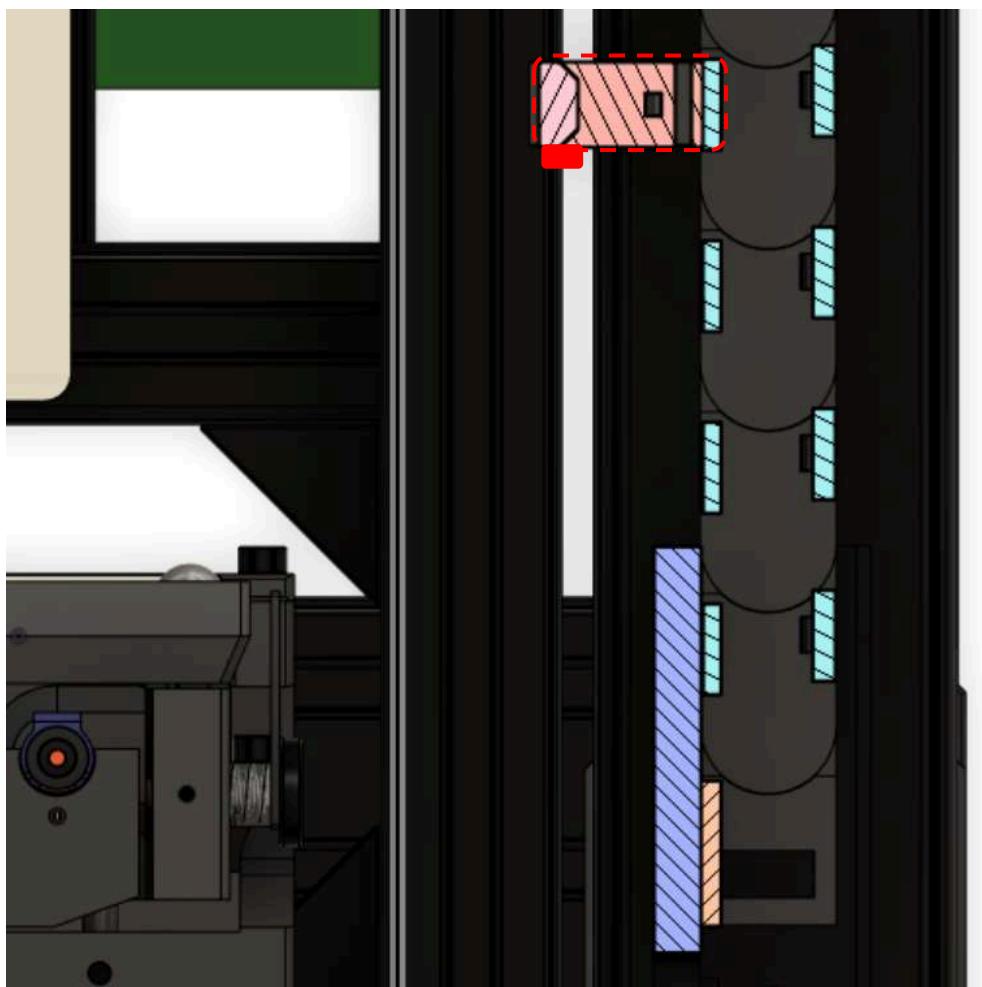
Secure a Part1 printed part to the inside face of the 4th chain link (not including the end link) from the frame mount assembly as shown. This is done with a tie-wrap. It is best to orient the tie-wrap so that the lock meets the outside upper corner of the chain. See the following two images to visualize.



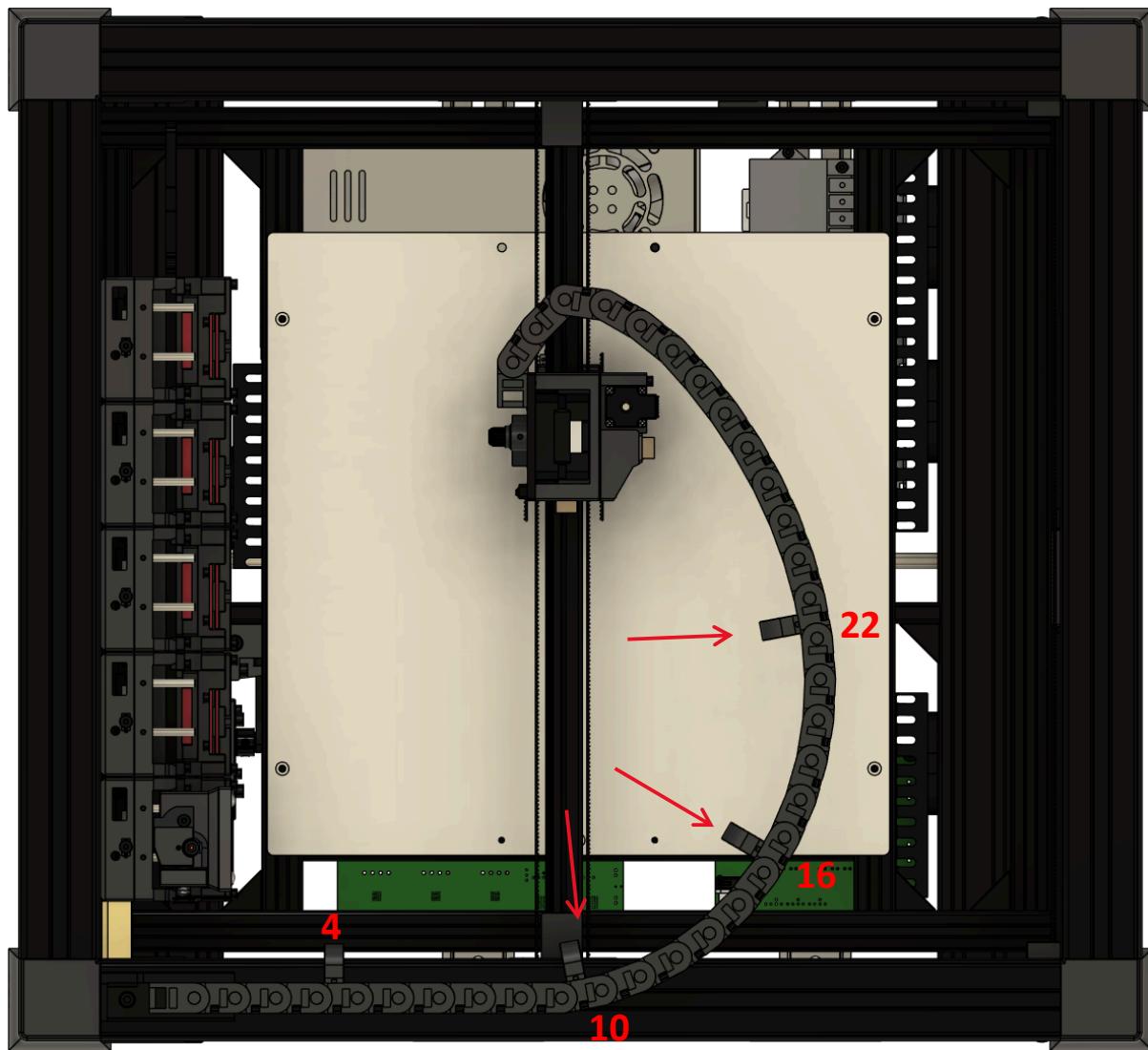


At this time, it is recommended to keep part 2 aside until after the water cooling hoses and/or remote lock cable are in place. The below visuals can be used for reference when it comes time to install them. Each cap is installed with 2 additional tie-wraps in a similar method.



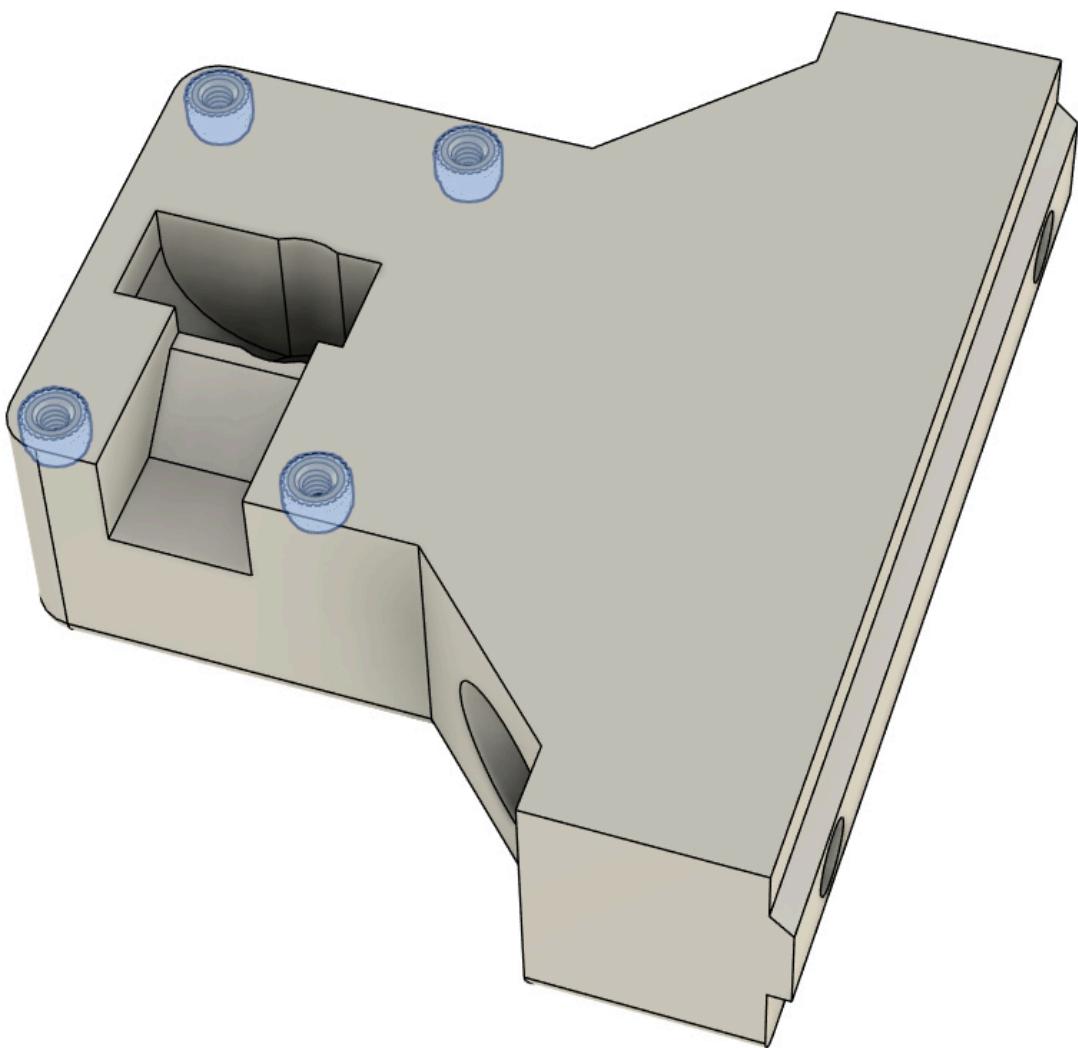


Repeat this step three additional times for the following link numbers as counted from the frame mount (not including end link)

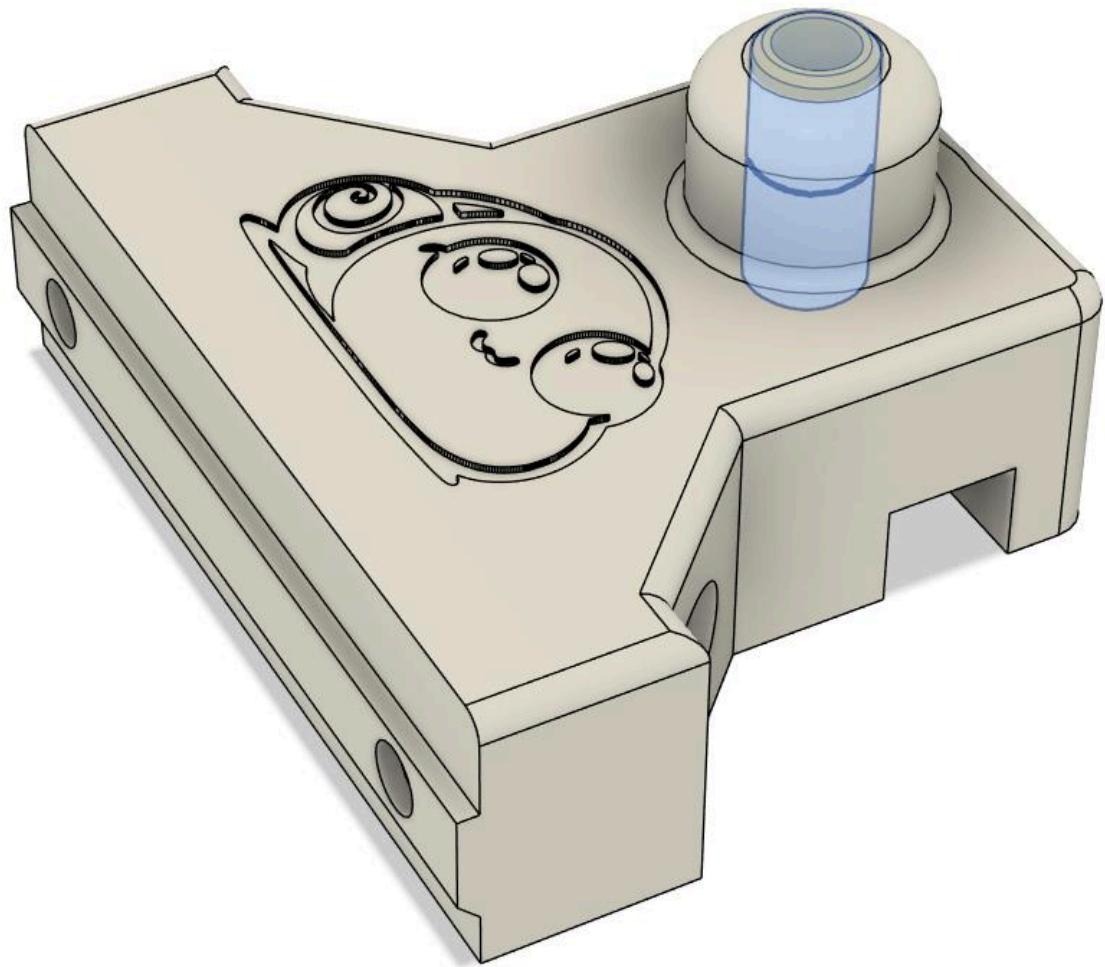


Step 9 – Z Offset Probe

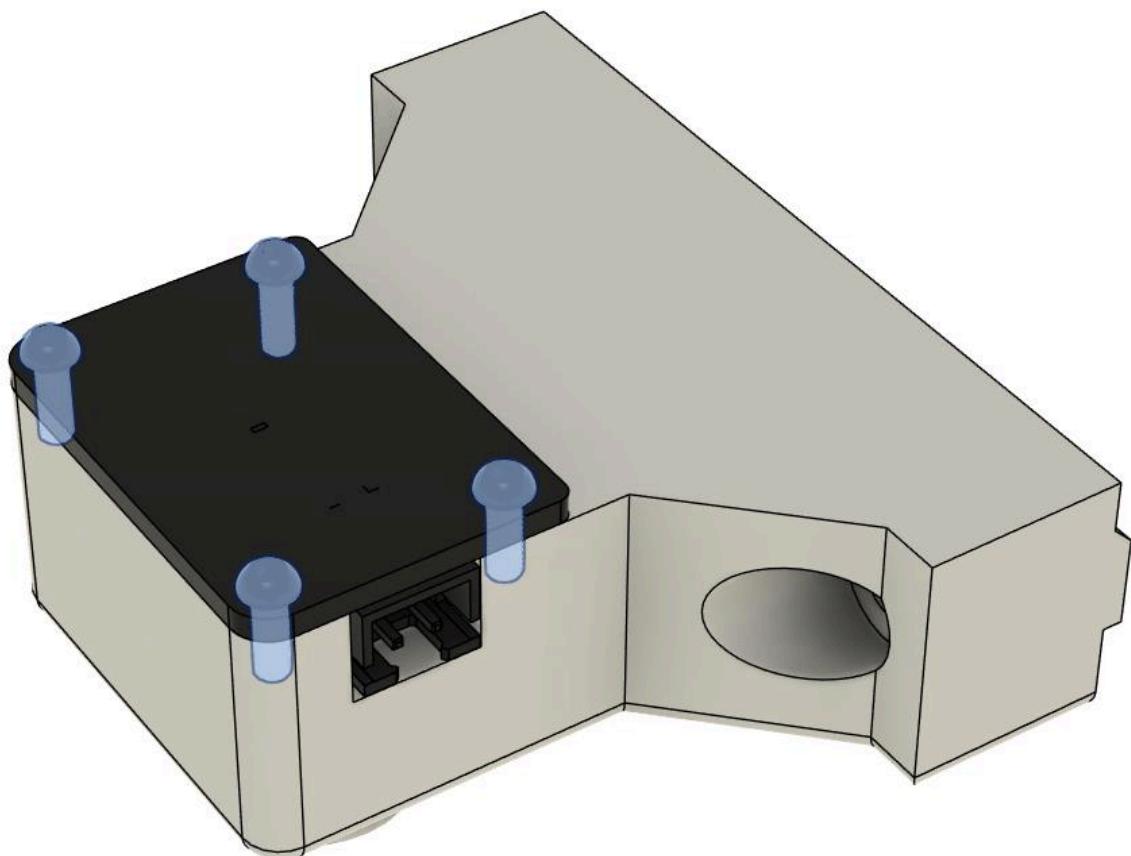
Locate (1) Print_SexBolt_Housing_V2 and orient as shown. Install (4) M2 heat set inserts in the shown locations.



Insert (2) 5x7x8mm copper sleeve bearings from the top. There is a seat in the printed housing to prevent them from going too far.



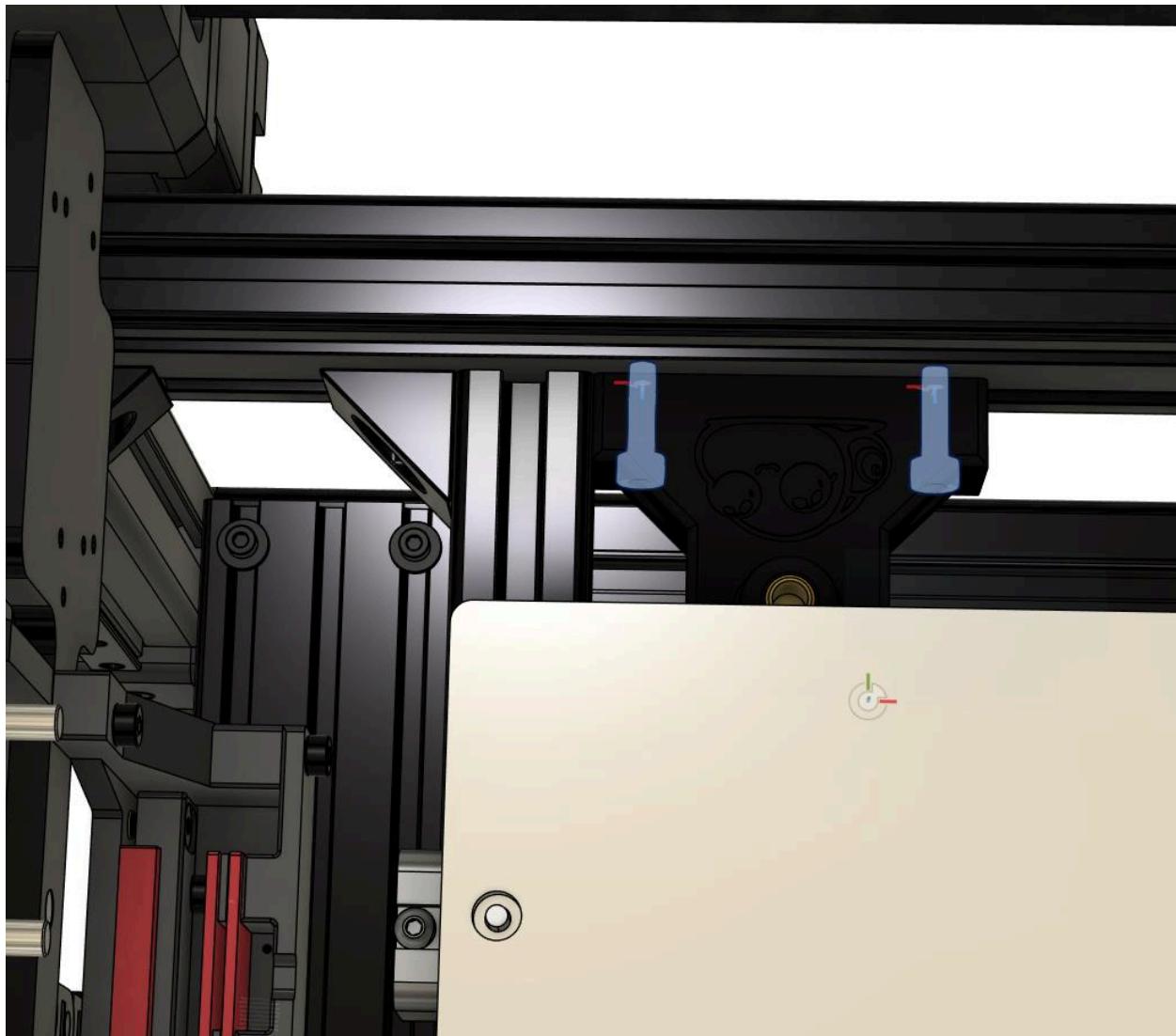
Install the SexBolt PCB and secure using (4) M2x6mm BHHS as shown.



Insert (2) 20 series M4 t-nuts into the rear lower extrusion slot of 2040 bed frame (on the inside of the left-most 2020 rail as shown.



Install Sex Bolt sub assembly and secure using (2) M4x14 SHCS. The installed location of the assembly should be such that the printed part is flush with the 2020 extrusion itself. This position can be adjusted in firmware later if needed.

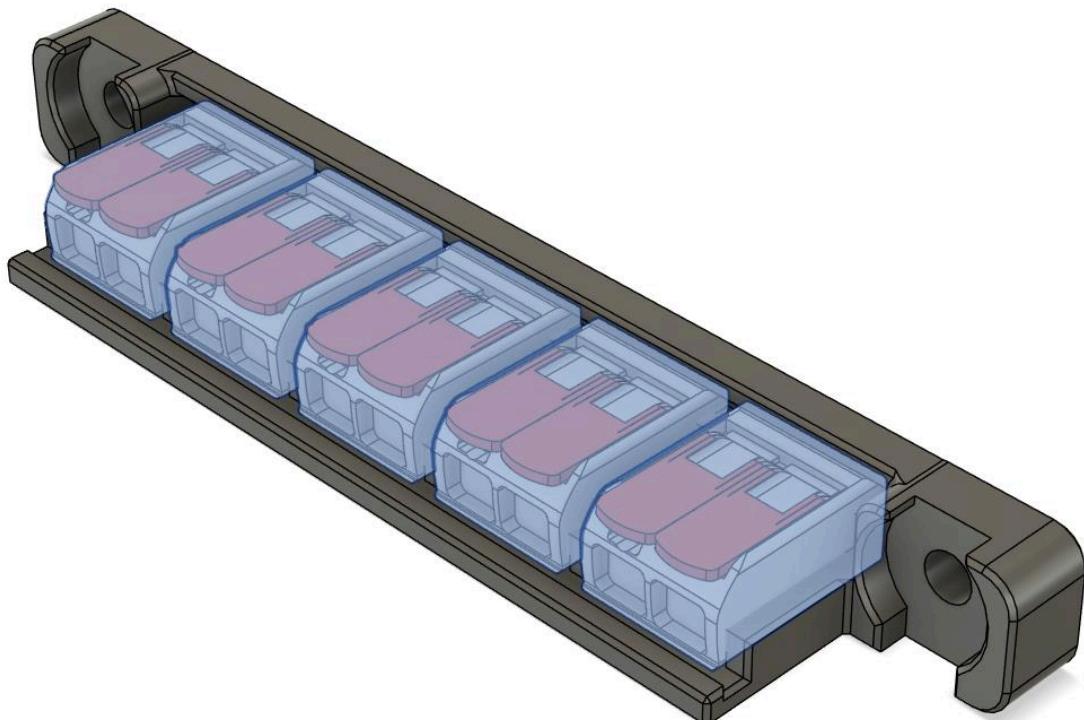


Drop (1) 5x43mm bearing steel shaft down into the part through the sleeve bearings and confirm that a light press audibly activates the micro switch. Note that this shaft is not secured and may fall out if the machine is overturned at any time.

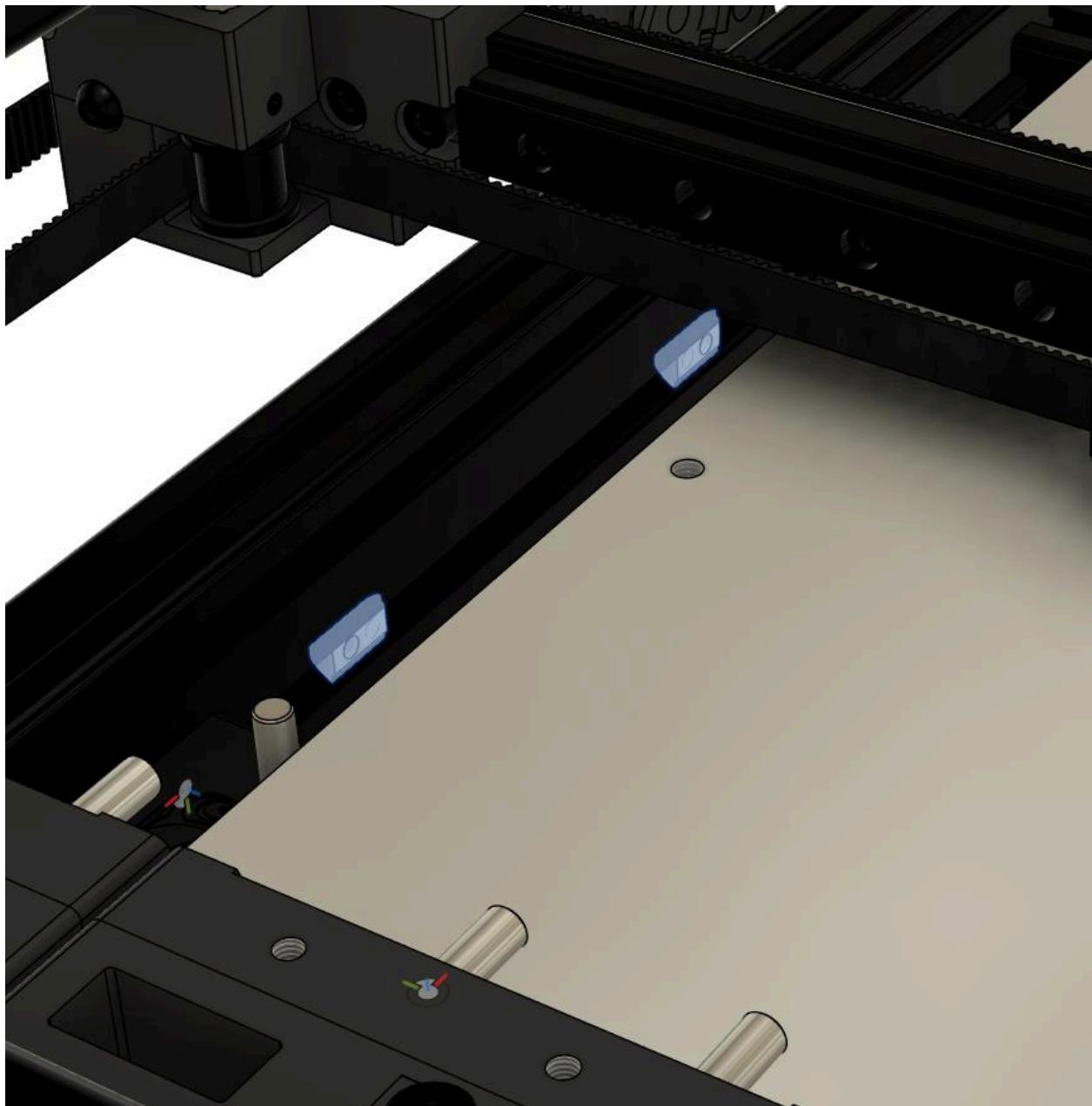


Step 10 – Bed Wiring WAGO Mount

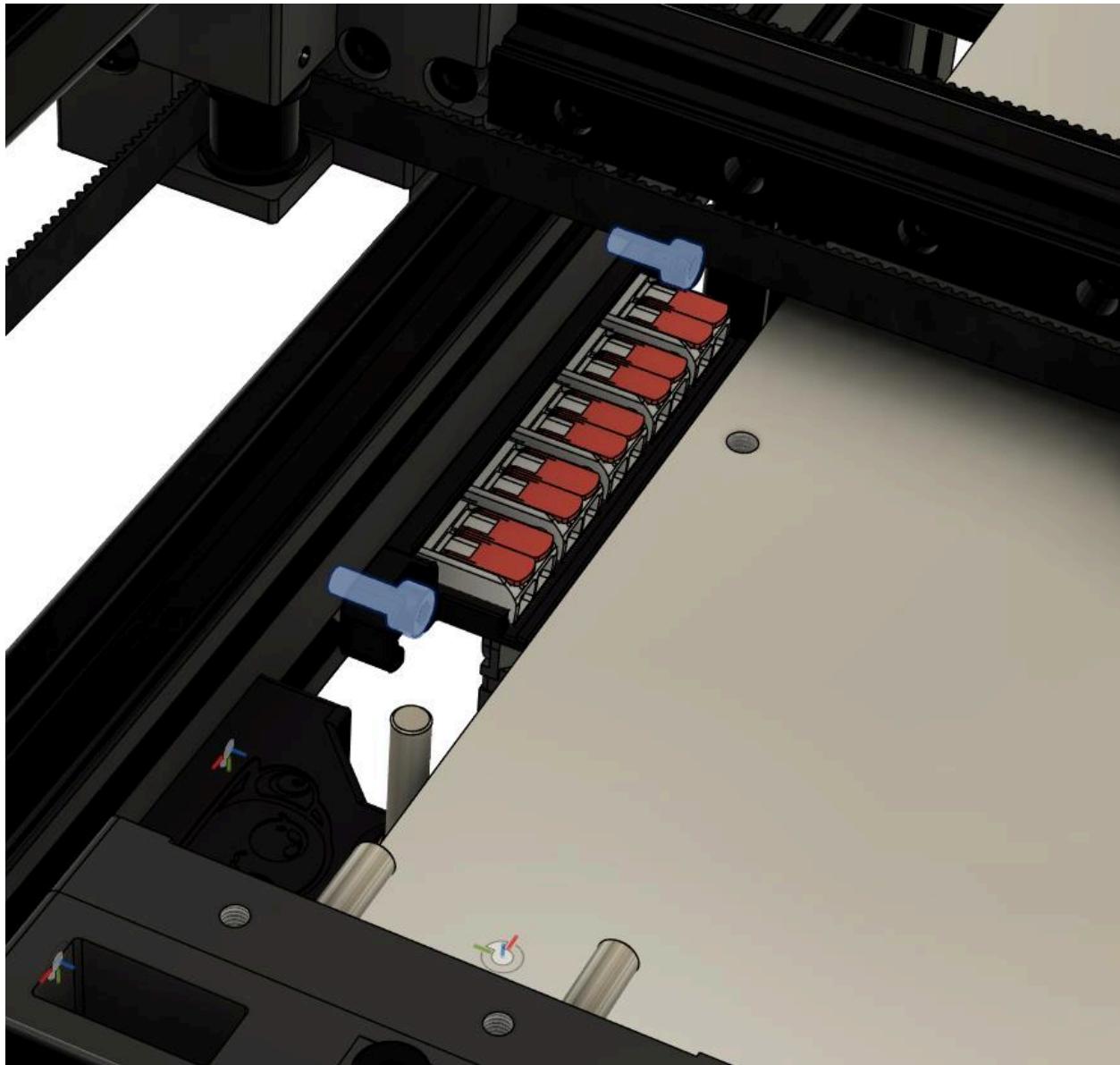
Locate (1) Print_Wago_Mount and insert (5) 2 Pin WAGO blocks as shown below. Note that when installed correctly the WAGO terminals are firmly secure and stay in place when the lever is lifted into the service position.



Insert (2) 20 series M4 T-nuts into the same extrusion slot as Step 9, this time to the right of the previously installed Z Offset Switch assembly.

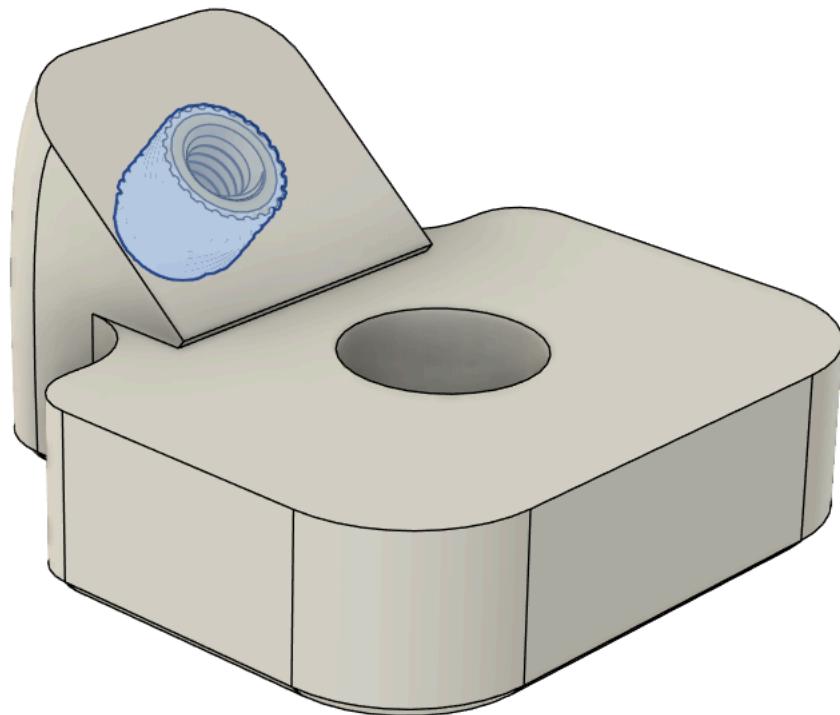


Install and secure the WAGO mount assembly using (2) M4x10mm SHCS. The position of the mount should be roughly centered with the heated bed assembly but is largely non-crucial.



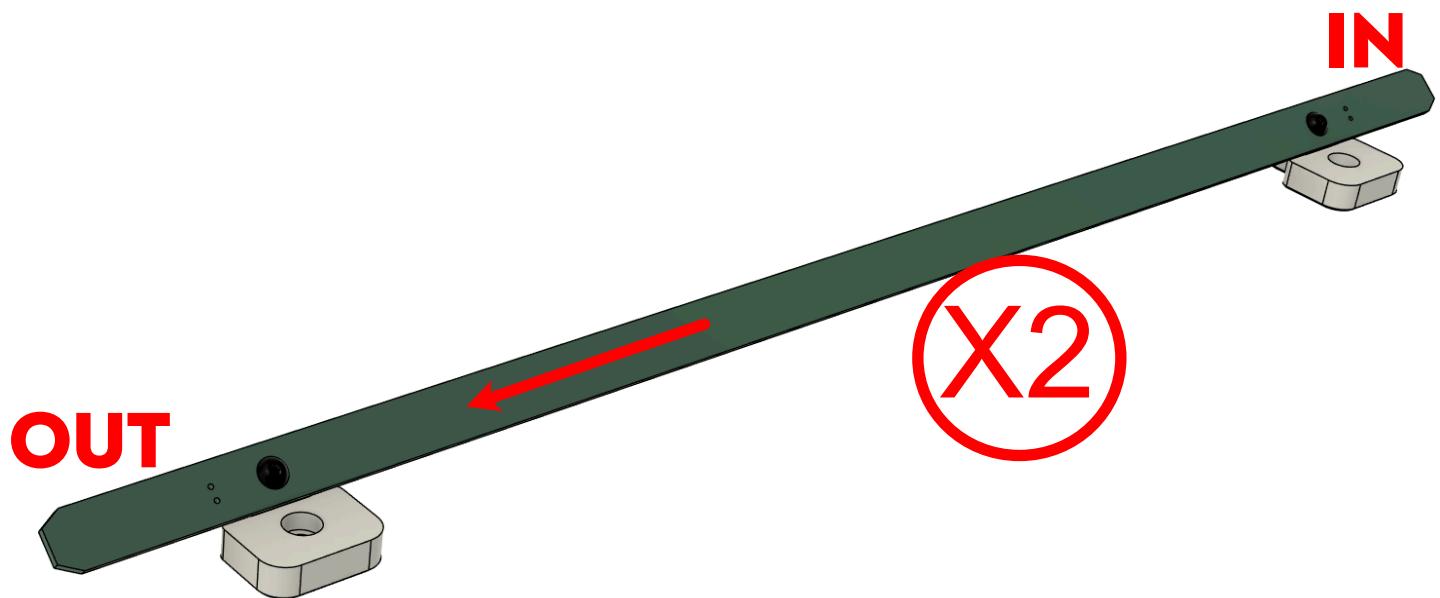
Congratulations! You're almost there!

Locate (4 total) Print_LED_Mount and install an M3 heat set insert into the shown location of all four parts.

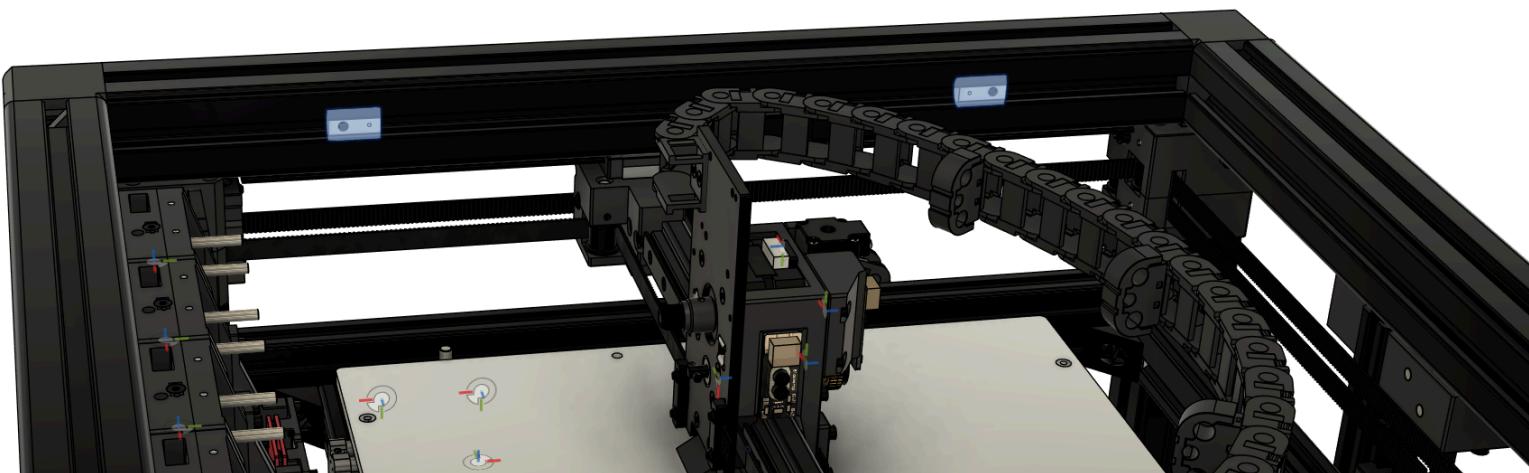


Locate 2) Daylight_XXL LED Light bar PCBs and secure at each end to the previously prepared printed parts as shown below using (4) M3x6mm BHHS. When finished you will have 2 total light bar assemblies.

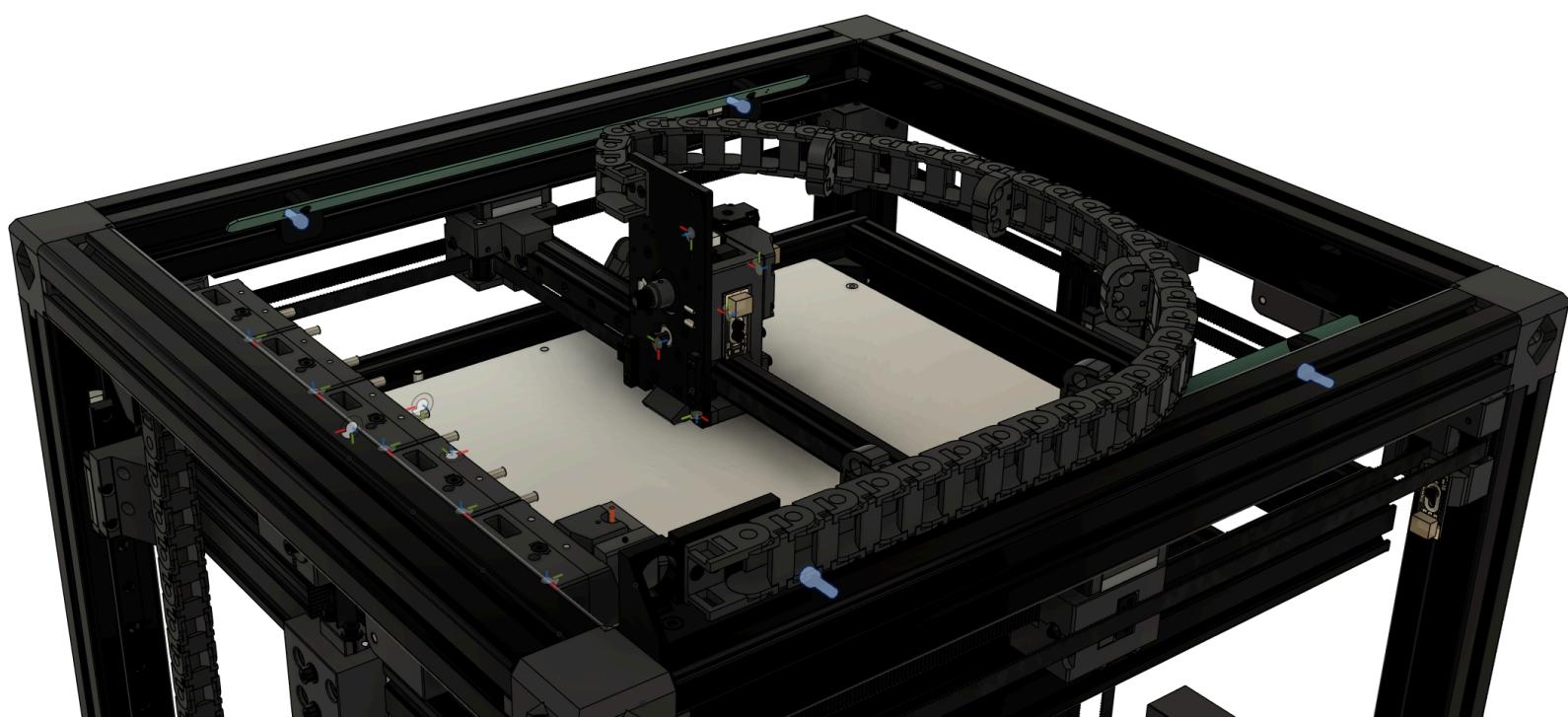
Note: The current should flow in the direction indicated below. Be sure that each stick is mounted this way!



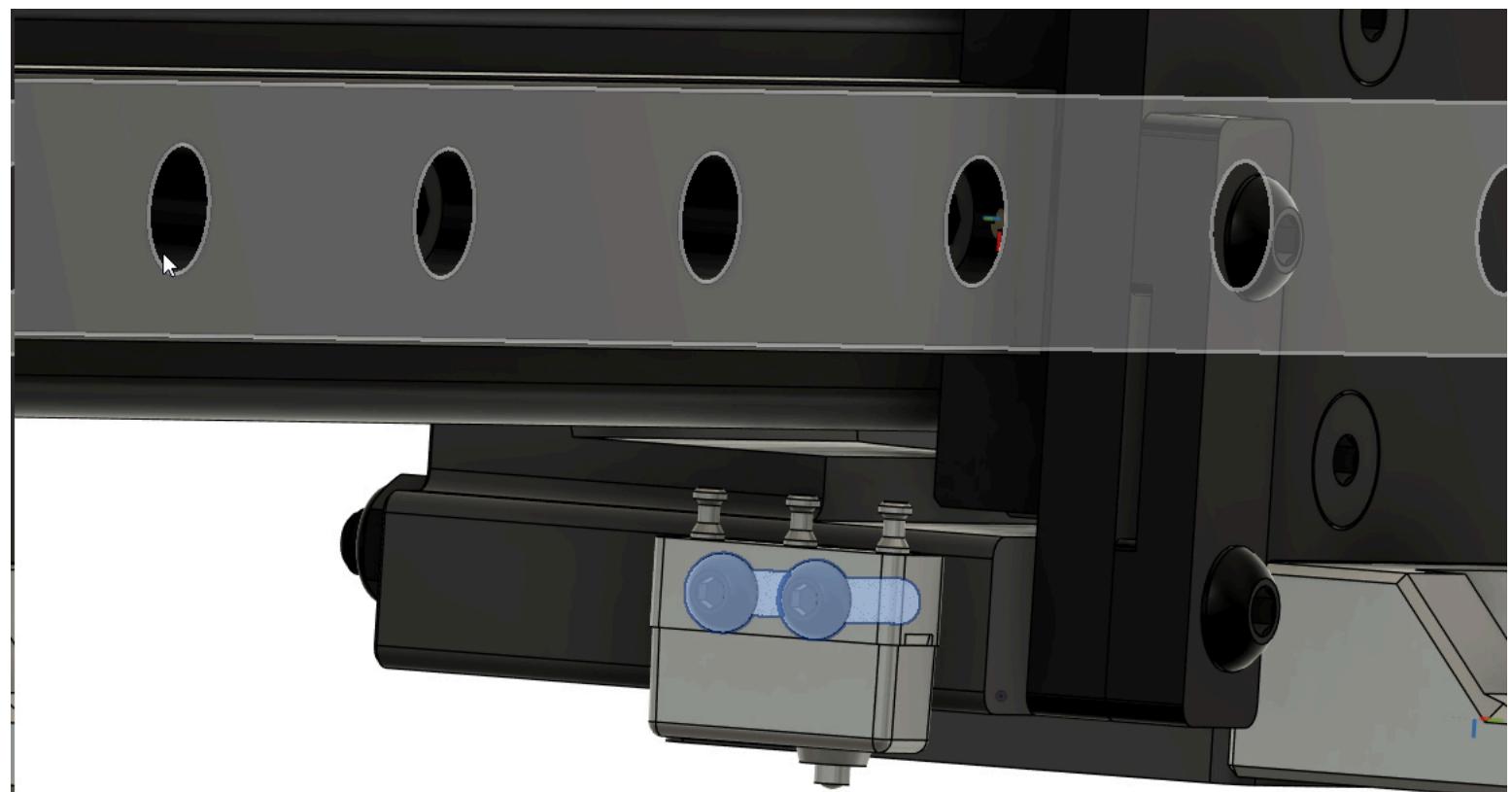
Insert (2) 40 Series M4 T-nuts into each of the inside extrusion extrusion slots of the top most part of the frame. Use (4) total T-nuts to populate the front and rear extrusions.



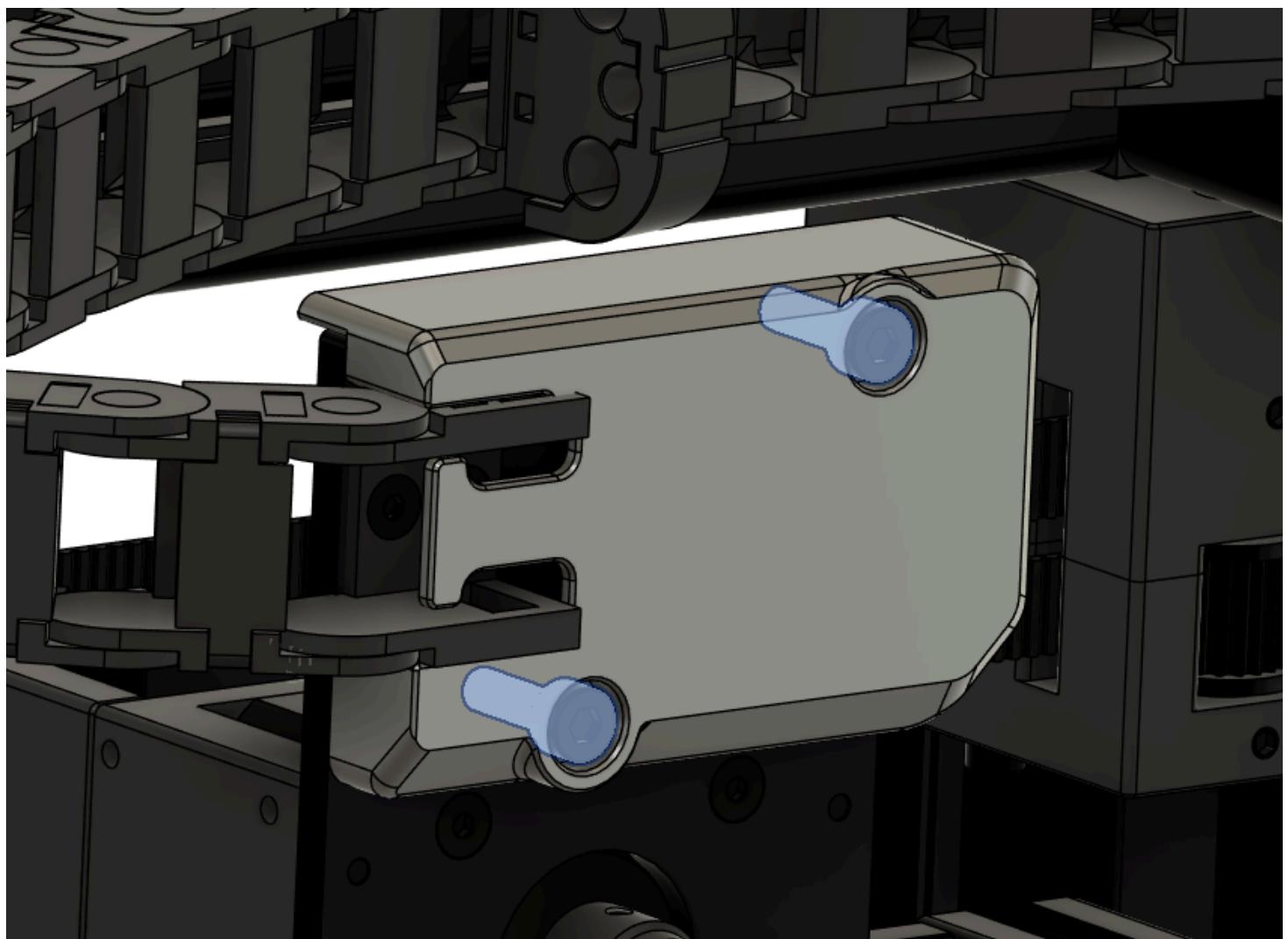
Install both LED Light Bar assemblies using (4) total M4x12mm SHCS at all mounting point locations.
The LED Bars should be roughly centered within it's length of extrusion.



Locate and install the Honeywell Z Probe/Switch as shown below using (2) M2x8mmBHHS.

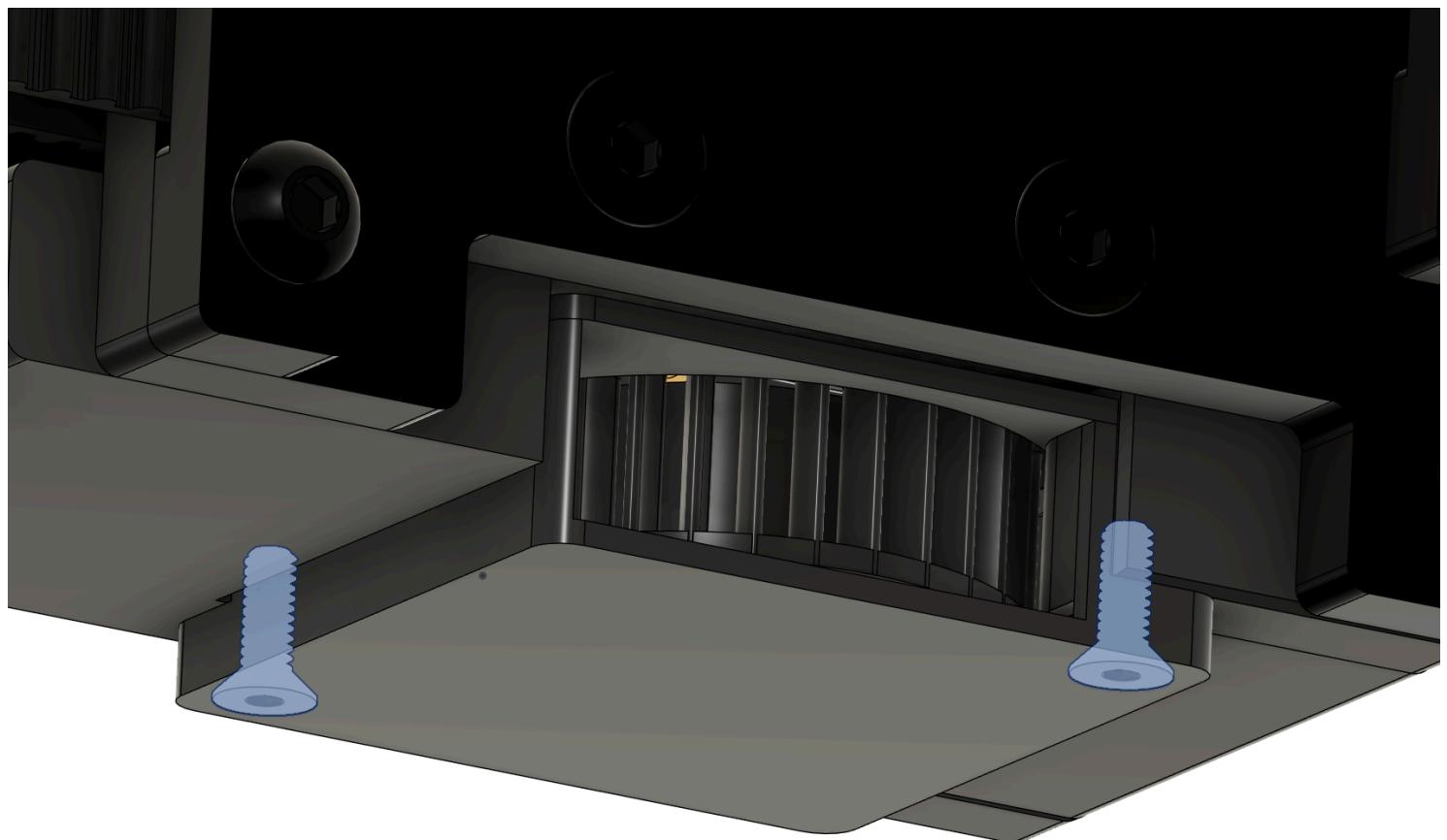


Locate and install Print_ToolHead_Wire_Cover as shown below using (2) M4x12mm SHCS.



Locate and install the 3010 Blower fan as shown using (2) M2x6mm FHHS.

NOTE: It is recommended to chamfer or otherwise open up the mounting holes on the 3010 fan to allow the FHHS mounting screws to sit closer to flush with the face of the fan. This will maximize clearance from the print head to currently printing parts.



Congrats! You're almost there!