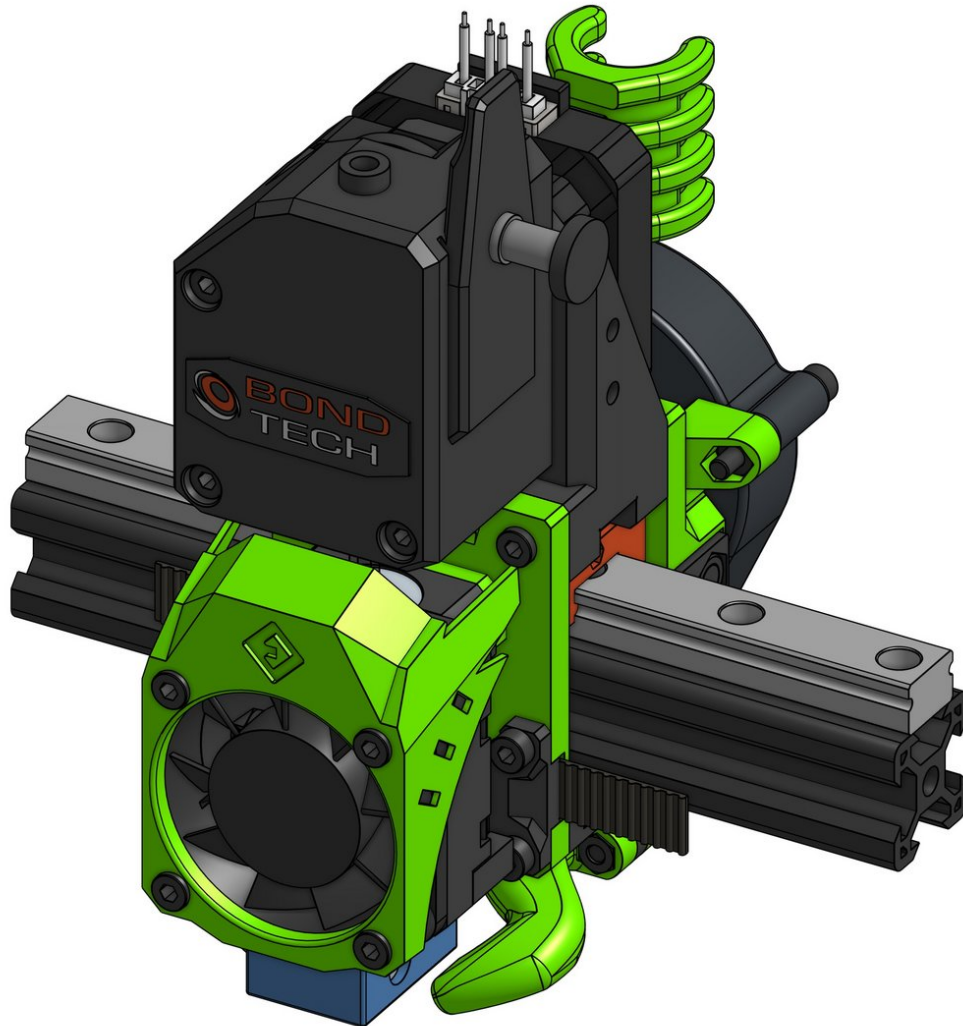


Rat Rig

08. EVA 2 Carriage: BMG + E3D V6

Written By: Paweł Kucmus



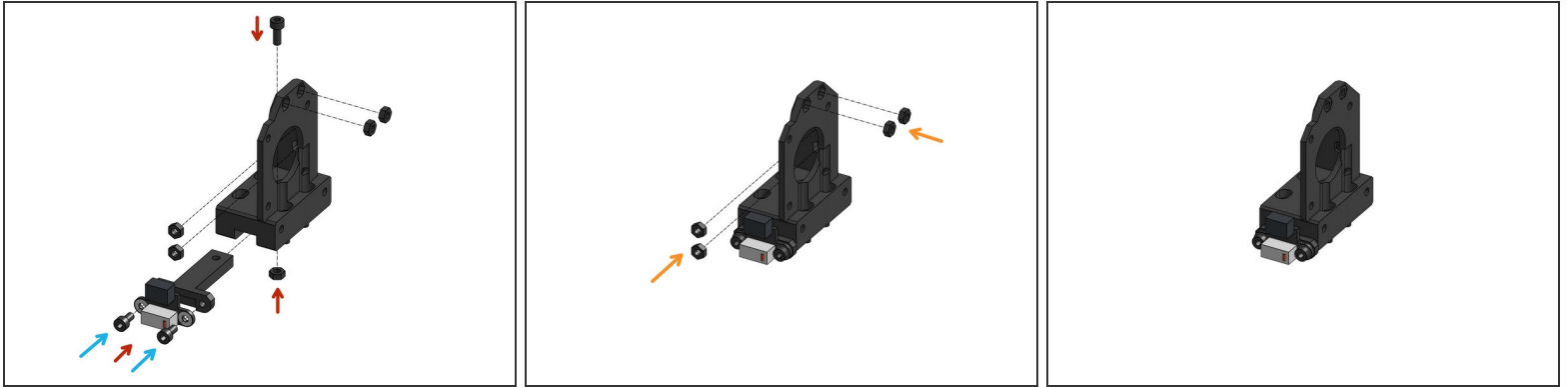
INTRODUCTION

EVA is a modular carriage platform developed by Paweł Kucmus, Rat Rig and the EVA community, that allows you to use your favourite choice of extruder and hot-end on your Rat Rig 3D Printer.

This tutorial covers one of the most popular EVA variants: Bondtech BMG + E3D V6. While many of the steps from the tutorial will be shared by other EVA variants, there may be some differences. This guide will show you the principles and basic EVA modules, so you can easily figure out how to assemble other variants if needed.

For more information on EVA see its [documentation page](#) and make sure to check out the community mods in the [contributions page](#).

Step 1 — Assemble the top part



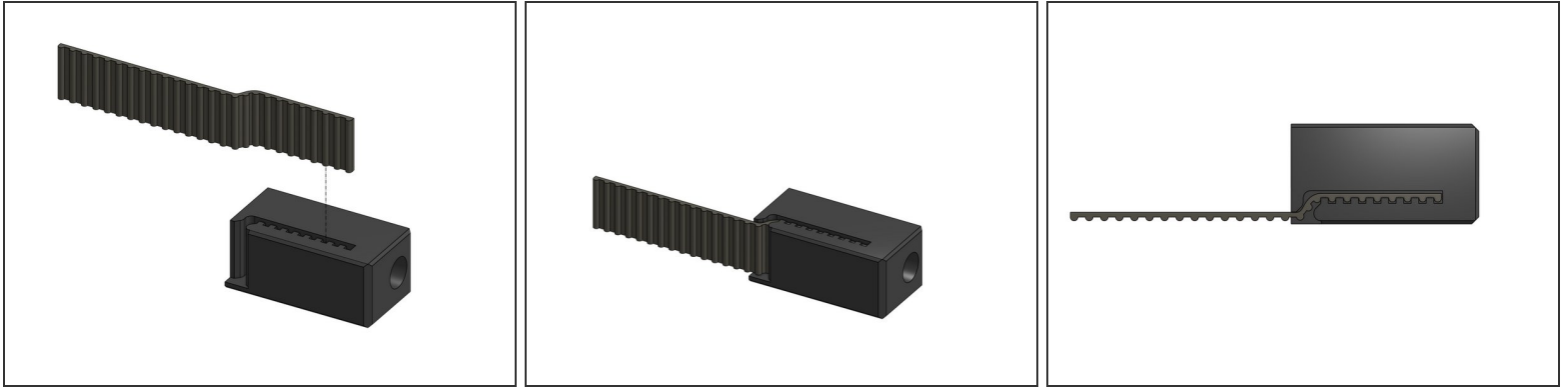
- If you are using a limit switch as an endstop attach it to it's block part, **M3x6mm** screws are used in the case of the "angled" endstop switch
- Attach the chosen endstop block with a **M3x8mm** screw and **M3 nut**
- Back pull the remaining **4x M3 nuts** - those are optional and maybe useful for future features

Step 2 — Attach the top to the MGN carriage



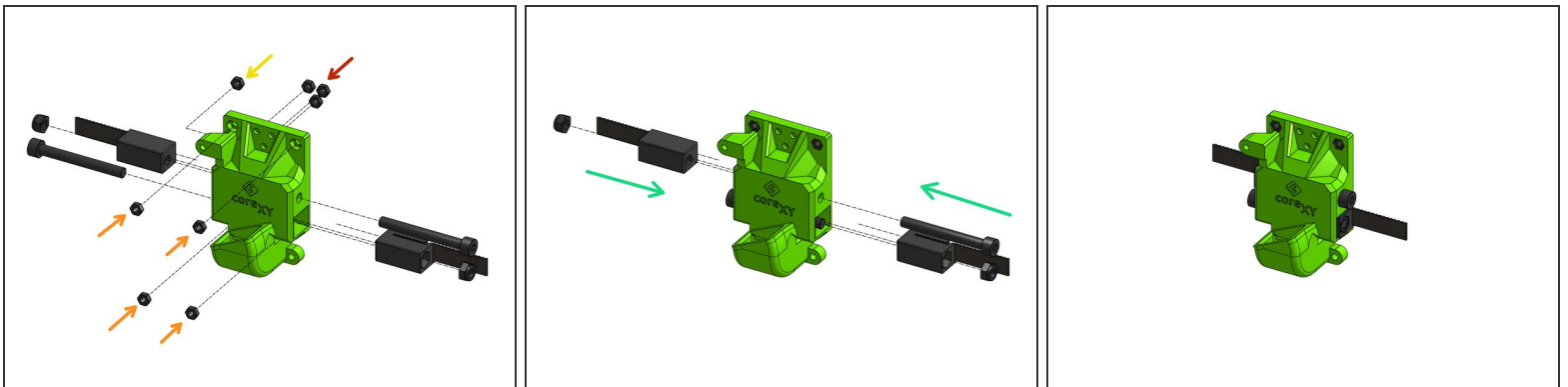
- ① EVA is compatible with MGN12C, MGN12H and MGN15C
- Attach the top part to the carriage with 4x **M3x10mm**

Step 3 — Attach the belts to the tension blocks



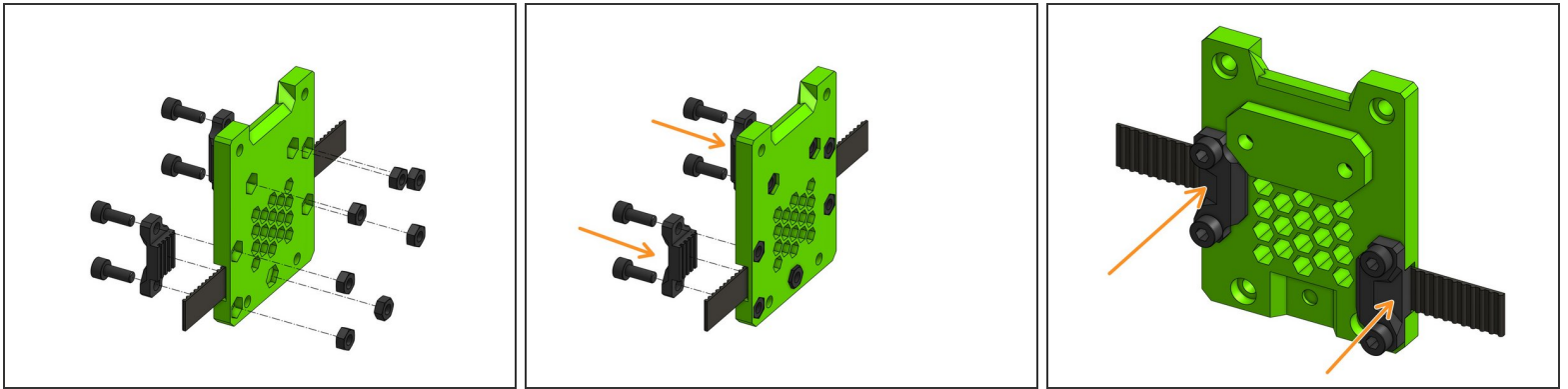
- Slide the belts that are in the back of the X gantry into the tension blocks, repeat for 2 blocks

Step 4 — Assemble the back



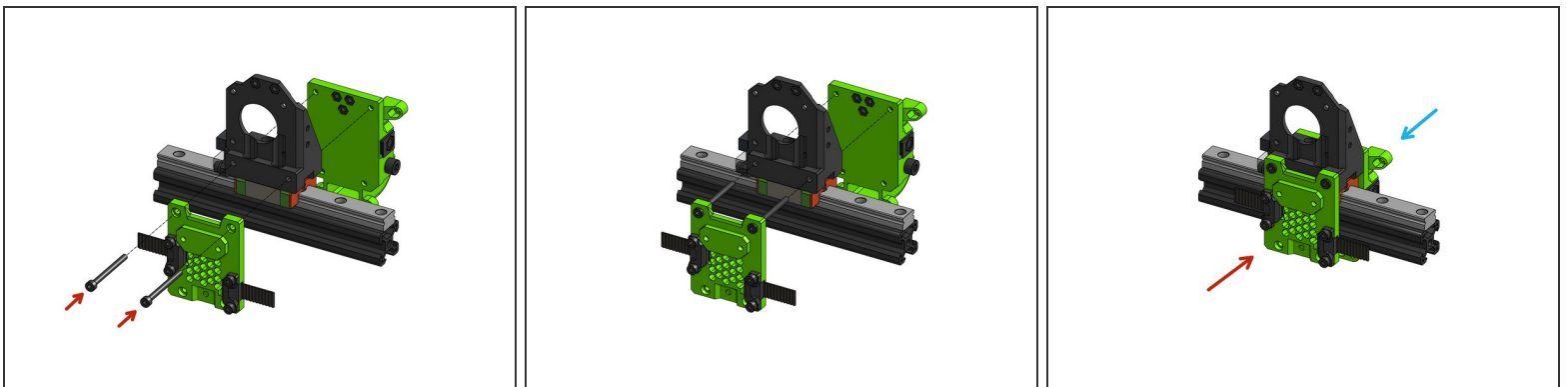
- Back pull all M3 nuts:
 - **3x M3 nuts** for the cable holder
 - **4x M3 nuts** which will hold the back to the rest of the carriage
 - **1x M3 nut** holding the fan
- Assemble the belt tensioners with the **M5 nuts** and pull them in with the **M5x45mm screws**

Step 5 — Assemble the universal front



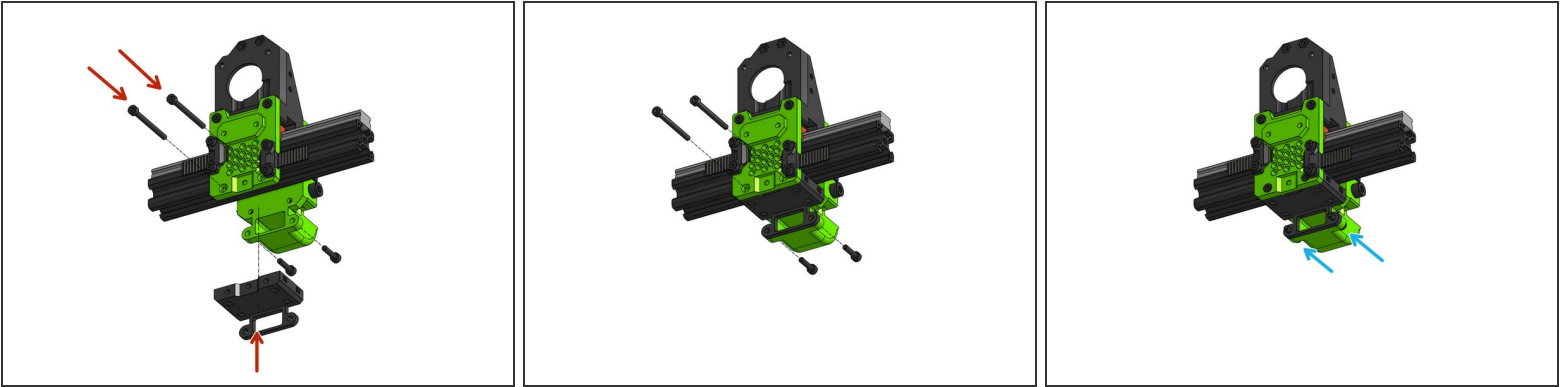
- Back pull all of the **M3 hex nuts** on the back. The bottom-middle nut does not end up flush with the face of the part
- Attach the belt grabbers with **M3x8mm**. The belt does not have to end flush with the groove, it can go over it.

Step 6 — Attach the front and back to the top



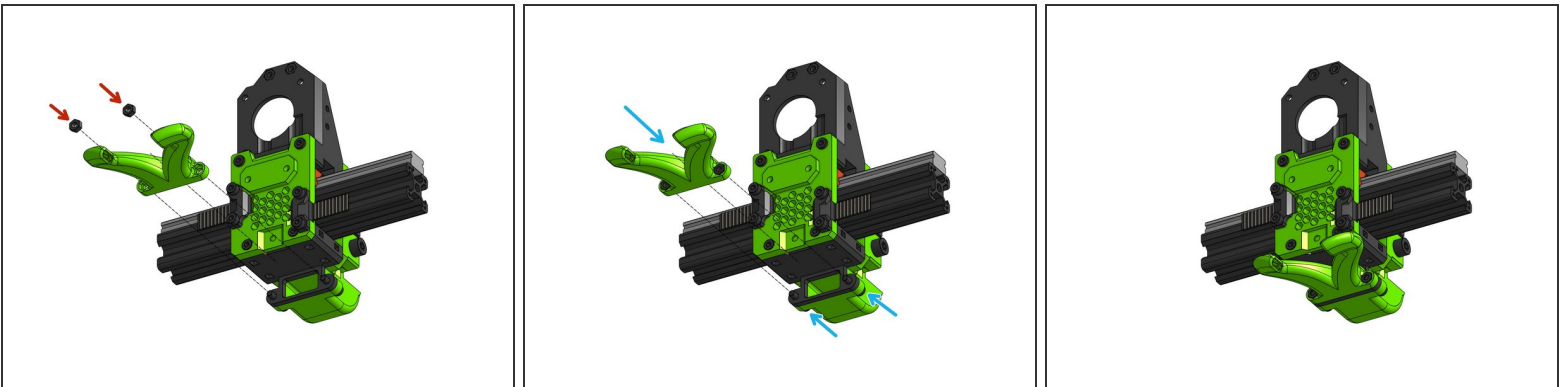
- Fasten the front part to the top part with 2 **M3x35mm screws**.
- Attach the back and tighten firmly.

Step 7 — Attach the bottom part



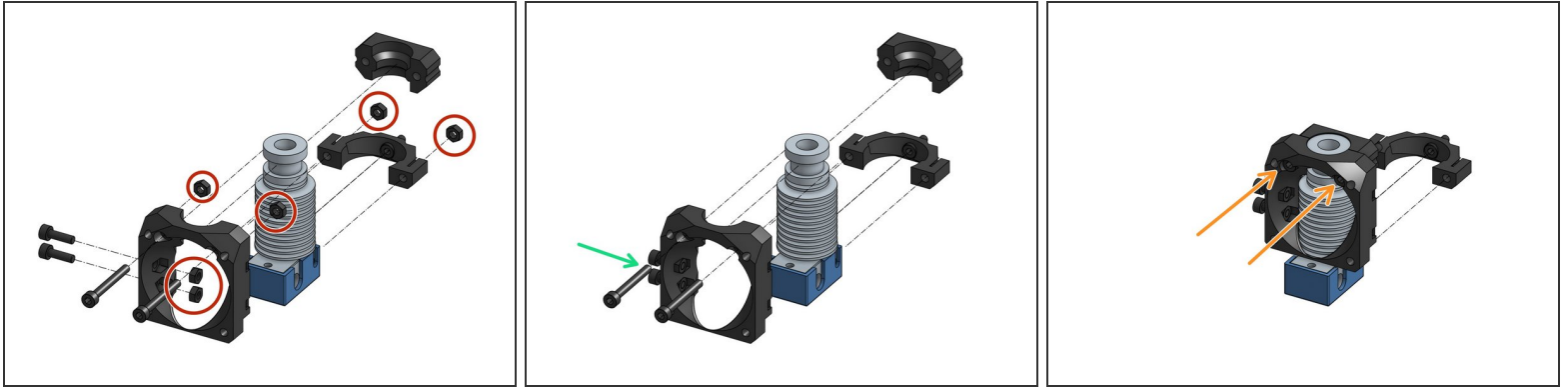
- Align the bottom part and fasten the front and back parts together through the bottom part with **M3x35mm screws**
- Fasten the M3x12mm screws from the back, which will hold a fan duct.

Step 8



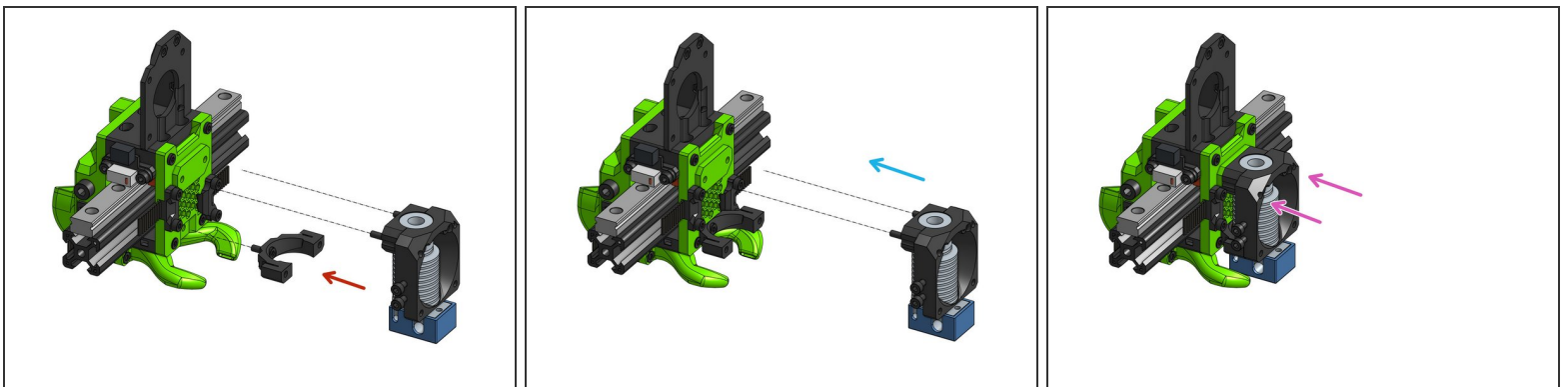
- Push the two **M3 hex nuts** into the fan duct
- Attach the fan duct to the bottom part with the **M3x12mm screws**

Step 9 — Assemble the E3D V6 face



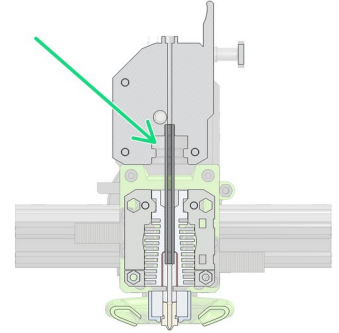
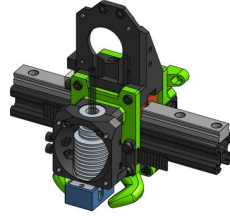
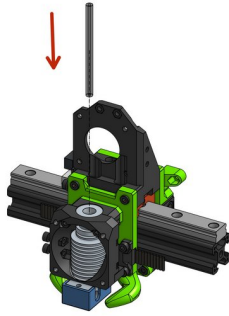
- Push the 6 **M3 hex nuts** into the plastic parts
- Attach the **M3x10mm** screws on the side. Leave them loose for now, they will be used to mount a bed probe.
- Align the face and clamp parts over the groove mount of the V6 and fasten them together with **M3x25mm screws**.

Step 10 — Attach the face to the front



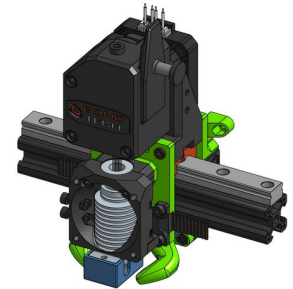
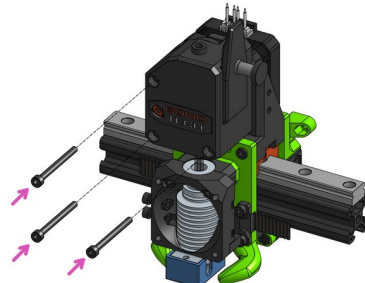
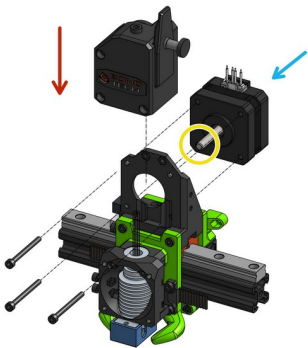
- Attach the bottom support part to the front part with a **M3x8mm screw**
- Attach the V6 face assembly
- Fasten the face with the **M3x25mm** screws that are already in the face part

Step 11 — PTFE Tube



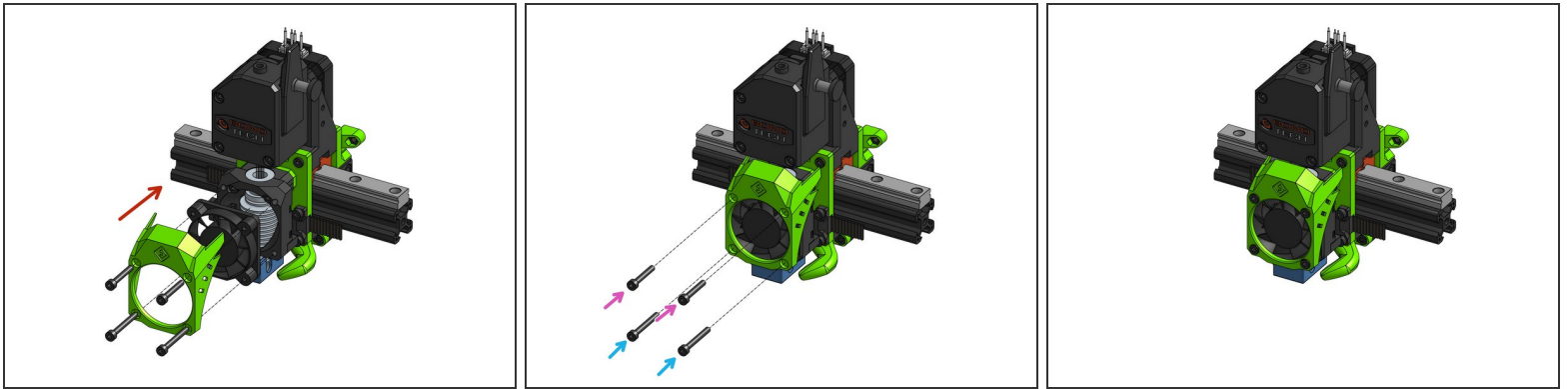
- Insert a 62mm PTFE tube into the V6 hotend
- Once the BMG is added to the carriage, this is where the tube will fit.

Step 12 — Assemble the extruder



- Slide the BMG on top of the PTFE tube
- Attach the **brass gear** from the BMG package (not depicted) to the motor shaft
- Slide the NEMA17 motor into the tom mount and the BMG
- Fasten the BMG to the motor with **M3x35mm screws**

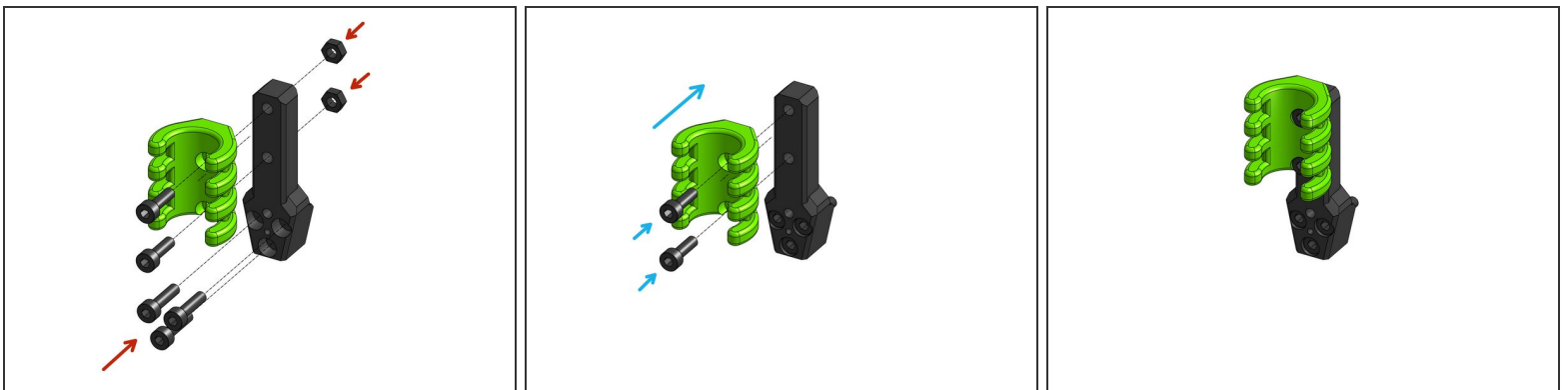
Step 13 — Attach the hot-end fan



i This step assumes a 4010 (40mm x 10mm fan) for a 4020 fan you need screws that are 10mm longer

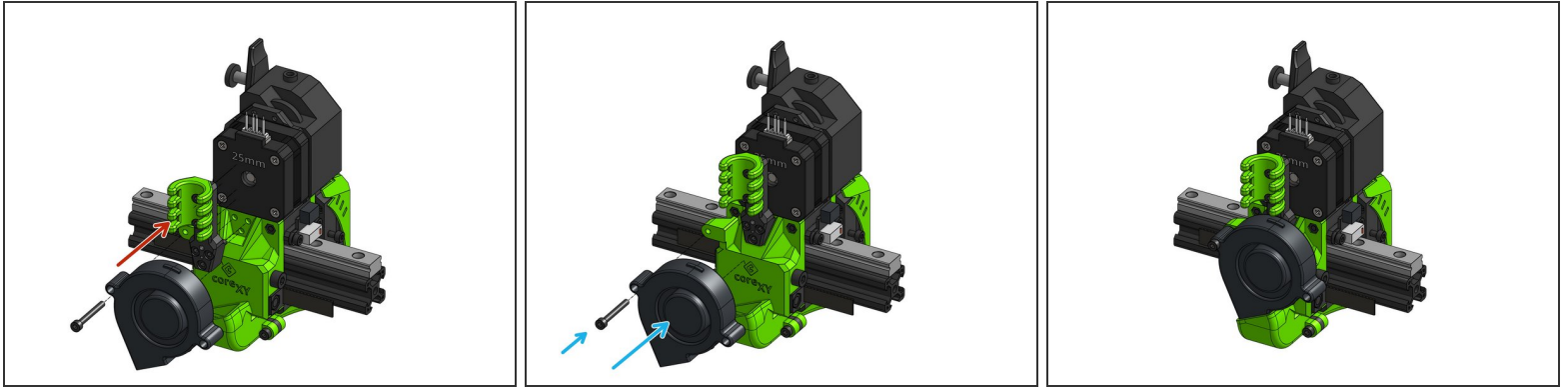
- Attach the fan and (optionally) the shroud to the face part with:
 - 2x **M3x25mm screws**
 - 2x **M3x20mm screws**

Step 14 — Cable holder



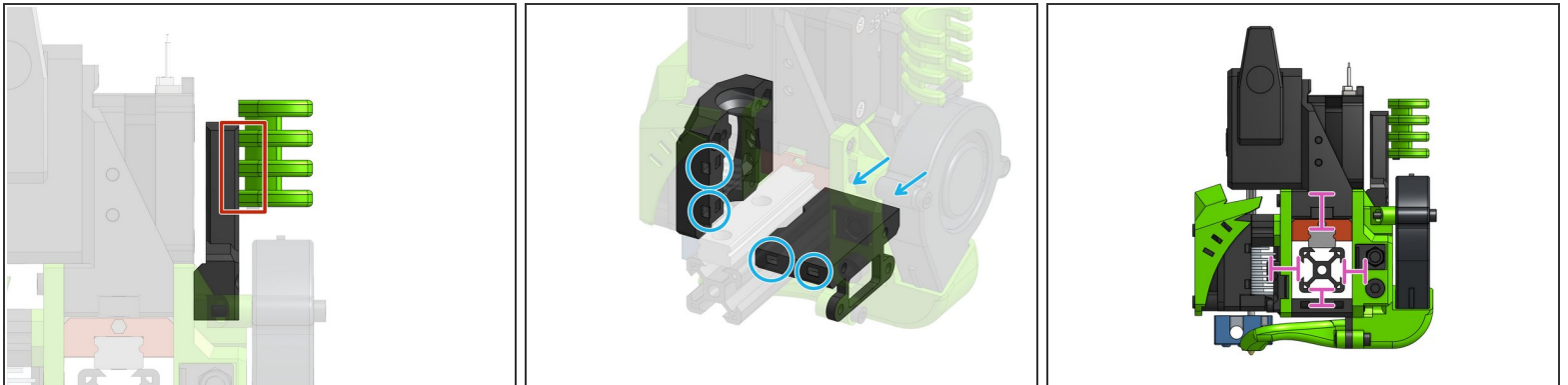
- Attach the 2 **M3 hex nuts** and 3 **M3x12mm screws**
- Attach the cable holder with 2 **M3x10mm screws**

Step 15



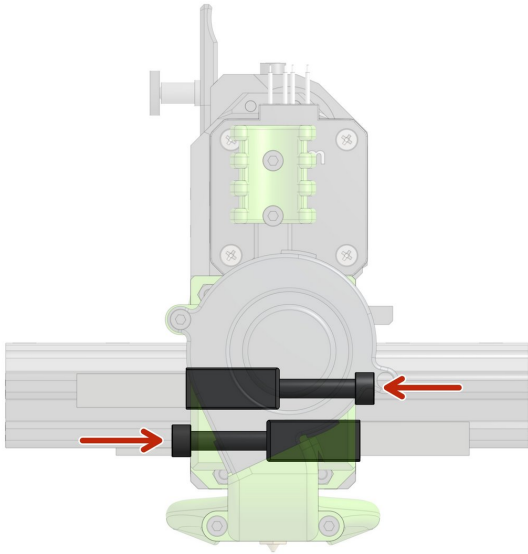
- Attach the cable holder with the 3 screws that are already in it
- Attach the 5015 layer fan and fasten it with a **M3x25mm screw**

Step 16 — Cable management tips



- Use zip ties to hold to the whole wire loom - this acts as a strain relief and prevents connectors from being pulled while printing. Use at least 2 zip ties to grab the loom in multiple points
- You can use the designated slots for zip tying the heater and thermistor wires
- Make sure all your wires stay away from the rail, as this could lead to damage.

Step 17 — Tension the belts

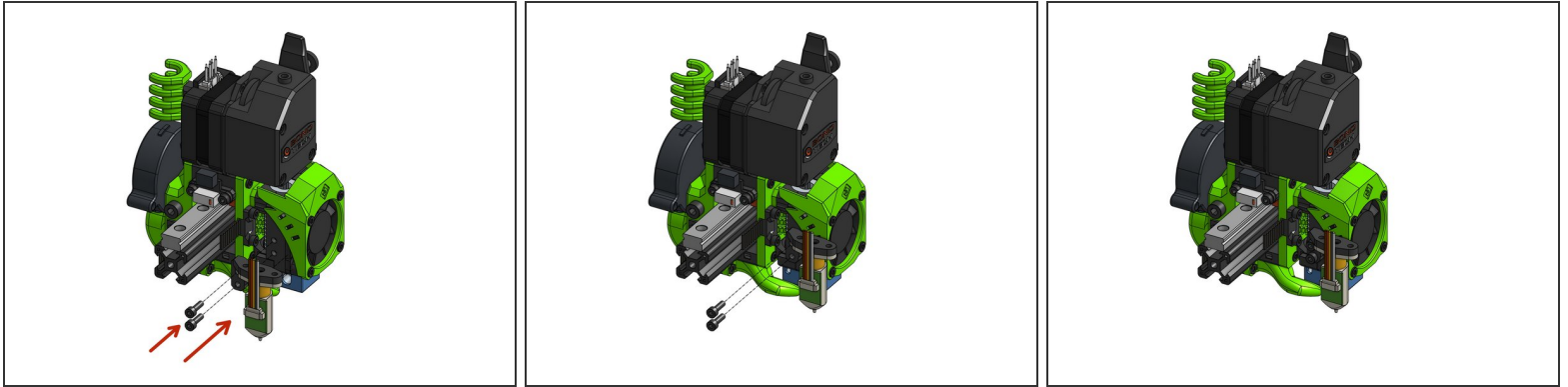


- Use the M5x45mm screws to tighten the XY belts

⚠ It's essential that the X gantry remains square after tensioning!

- Make sure you keep tensioning until you get rid of all belt slack, and stop tensioning as soon as there's none.
- If you have difficulties assessing if both belts are equally tensioned, measuring the vibration frequency of each belt and adjusting tension until frequencies match may be a helpful tool.
- If the belts are too loose you might see some defects like ringing in the print surface. Ringing can be caused by acceleration and jerk settings too, so adjusting belt tension alone isn't likely to solve a ringing problem.
- You can find a comprehensive article on CoreXY belt tensioning [here](#).

Step 18 — Attach a bed probe



- For BL-Touch, use the screws included in the packaging to attach the probe to the printed mount.
- Fasten the probe to the face of the carriage with the two **M3x10mm screws** that are already in the assembly.