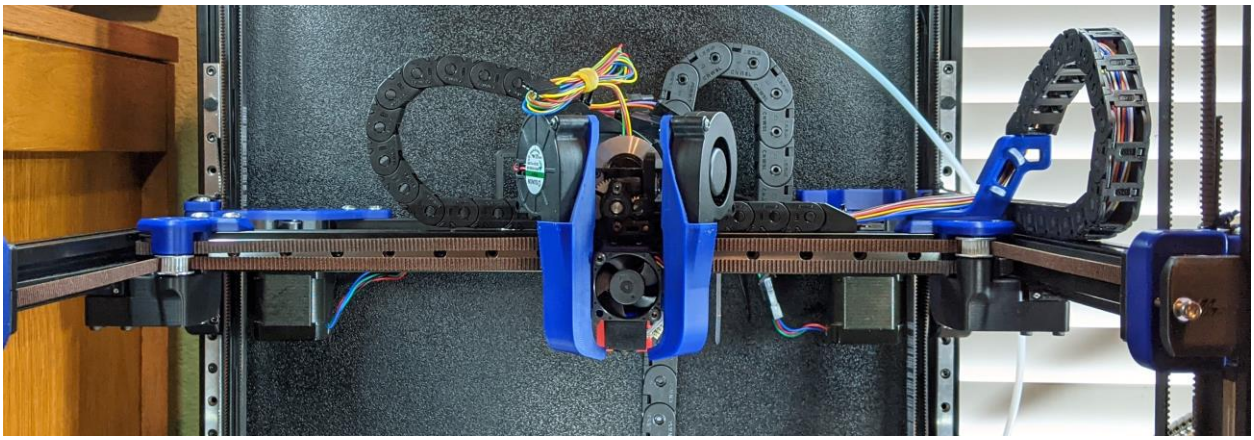
Mantis (Dual 5015 Toolhead) by Long



Features:

- Compatible with MGN12 X-Rail. Dragon Hotend only right now.
- Dual 5015
    - Left to Right airflow balance is no longer an issue
    - Single piece ducts without splitting and fewer bends mean less losses
    - Total airflow is probably ~3x more than Longs fang using the same fan.
- Lighter
    - This entire tool head weighs ~290g including the carriage
    - Spec AB is ~470g. Spec AB with gailieo is ~375g.
- Stiffer
    - Single piece carriage and hotend mounts are significantly stiffer than spec.
- Detachable Bed Probe (magprobe)
    - Decreases weight and allows shrinkage of the carriage.
    - Allows direct probing of the bed surface. Allows usage of any bed surface.
    - Bed with embedded magnets becomes a possibility.
- More balanced
    - Hotend is moved closer the rail +y, and upwards +z
    - Gain in Y and Z travel (~5mm each)
- Decreased length from extruder to hotend
    - Bowden from mini-sherpa to Dragon is only 19mm
- X-endstop relocated to carriage. Easy to transition to umbilical if desired.
    - Y-endstop can still be from the spec endstop pod on the right xy-joint.
- Area around heat block is very open. Ducts give wide berth to block. Duct shouldn't have any issues with melting. Josh Murrah has been printing ABS at 300c without duct melt.

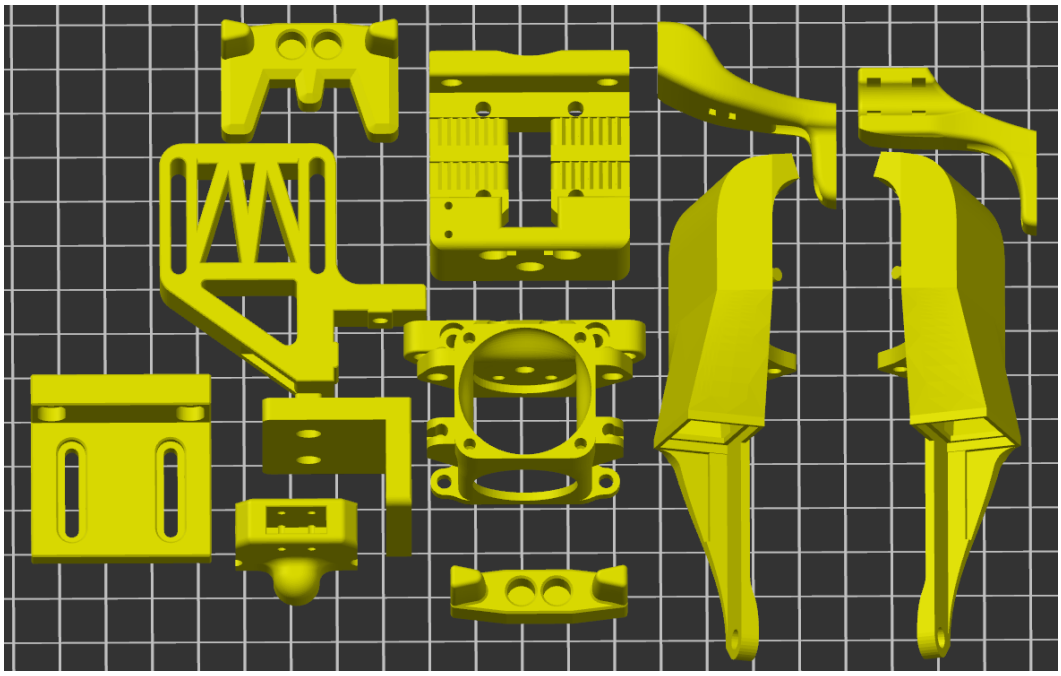
Cons:

- You will lose some space at the front idlers ~10mm in X at each idler.
    - Make sure you change your homing override to home Y first, then X.
- Some parts like the ducts and hotend mount are a bit tricky to print.
- Thumb screw for the mini-sherpa will not fit. Use a buttonhead to save space.
    - I bought 6mm diameter x 0.9mm coil diameter x 10mm length springs for extra clearance.
        - (Replaces stock 6mm x 1mm x 12mm spring)
        - Depending on how much you tighten your screw, the 12mm one will work.

BOM, References, Acknowledgements:

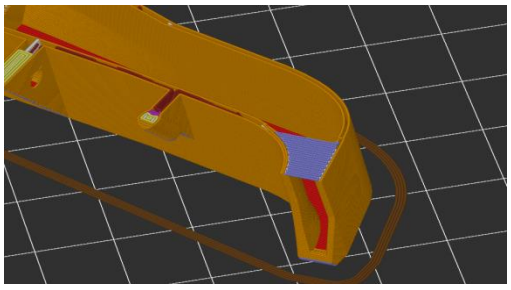
- **Fasteners**
  - m2 x 10 (or m2 x 12) self tapping screws
    - This is a standard Voron part used to attach the Omron microswitches
  - m3x6x4 heatsets
  - m3x20 SHCS x2 (upper screws to attach hotend mount to carriage)
  - Assorted BHCS (all other screws can be button head to save weight)
- **Other**
  - m6x3 magnets x11
  - larger diameter magnet stack (used if soldering directly to the m6x3 magnets) so that magnetic field loss is minimized during soldering)
  - D2F-5 Omron microswitch for magprobe. D2F-5L works too if you just rip the lever off.
- **Fans**
  - 5015 fans x2
    - I recommend Sunon (12v) or Delta (24v) however any 5015s should be fine.
    - Sunon: https://www.digikey.com/short/zrwpw9
    - Delta>Sunon>GDSTime>Winsinn
  - 3010 Hotend Fan
    - I'm using Sunon 3010v1 (12v) currently https://www.digikey.com/short/t5dpqw4w
      - Looks like JoshMurrah has been running this fan at 40% without issue so quieter fans will definitely work.
    - I think the Sunon 3010v2 (12v) will probably work but haven't tested yet https://www.mouser.com/ProductDetail/Sunon/MF30101V2-1000U-A99?qs=EU6FO9ffTwfZ4Kz3LWY0zg%3D%3D
- **Mini-Sherpa**
  - See the Annex guide for its instructions and BOM.
  - https://github.com/Annex-Engineering/Sherpa_Mini-Extruder
  - https://www.youtube.com/watch?v=3WogD5IUwAM
- **Mag Probe**
  - My version is highly inspired by the Annex Mag Probe. ***Credit to ANNEX for their awesome work here***. The mag probe and being able to remove the bulk of the Omron probe is a major factor in what made this tool head possible. Please see their mag probe repository for the original.
  - https://github.com/Annex-Engineering/Annex-Engineering_Other_Printer_Mods/tree/master/All_Printers/Microswitch_Probe
- **JoshMurrah**
  - Just wanted to note him here as he has been extremely helpful in some insane stress testing. His speed benchies have been fun as hell to watch and a motivation for me to keep improving.
- **JosAr**
  - Thank you to JosAr for his work on creating a gantry mounted magprobe dock.

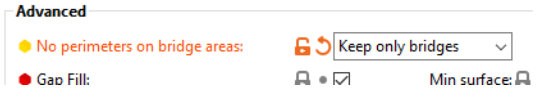
Print Orientation:

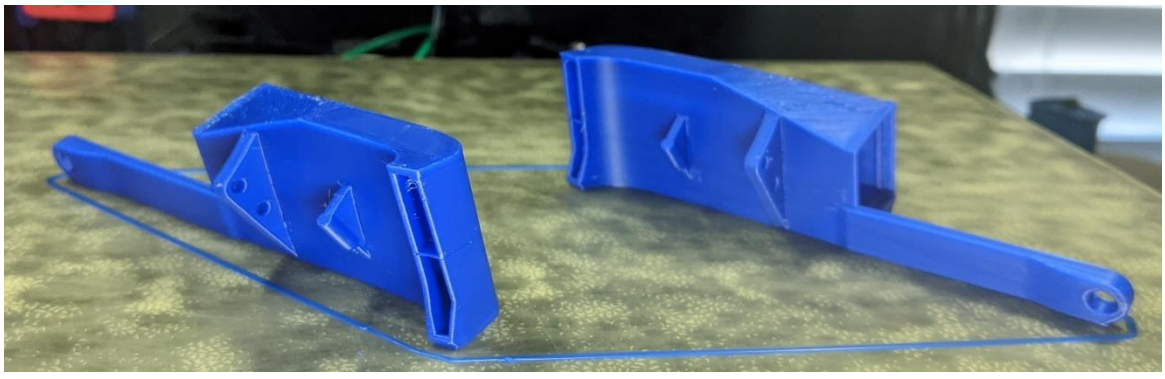


Slicer Tips:

- **Perimeters/Shells**
  - 3-4 Perimeters and low infill is adequate.
  - Josh Murrah is using 3perim/40% on his toolhead used in speedruns.
  - I've been using 4 perimeters/15%
- **Ducts**
  - Check that this outlet divider is sliced in a sane way.
  - In superslicer, I find the "keep only bridges" option under "Perimeters & Shell" works well for the ducts
  - The ducts have some tough overhangs, so orient the part so the over hangs print the best for you. Prioritize good quality for the outlet. The 5015 mount surface will generally be rough, but that's ok.

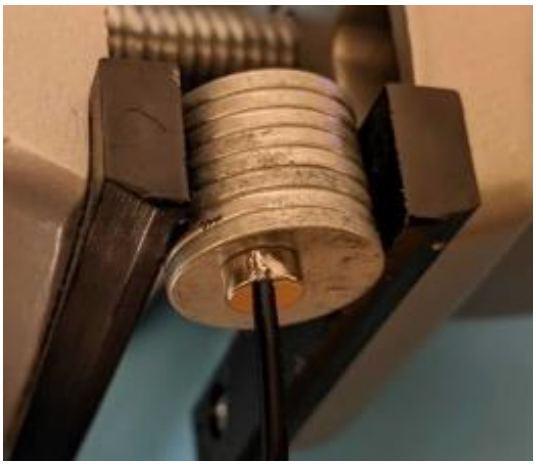




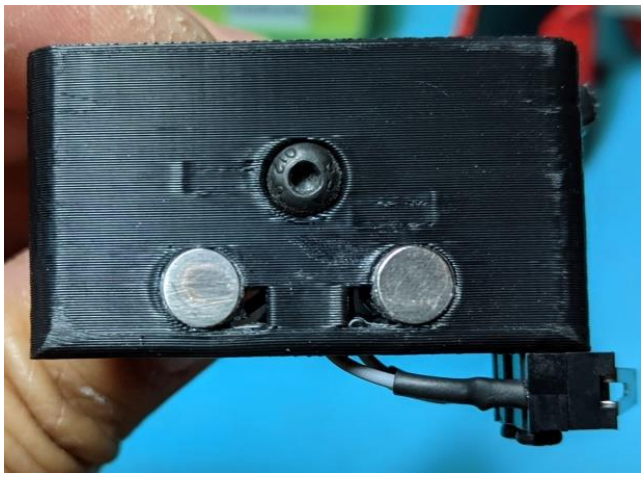


Carriage Assembly:

Magnets



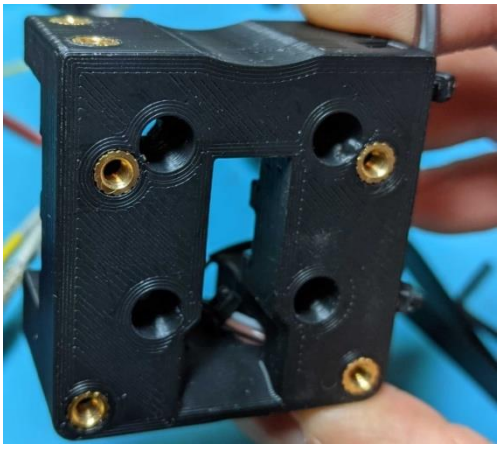
- **Solder Method**
  - Sand the side of 2 m6x3 magnets. Place a magnet on a bigger stack of magnets then solder a piece of wire to the side as shown.
  - If you don't have the magnet on the bigger stack, your magnet will lose some of its magnetic field. It'll probably be ok, but I haven't tried.
  - **Put some superglue into the magnet holes.**
  - Place the second magnet on top of the soldered magnet, then press the two magnets into the hole so the unsoldered magnet is out. The magnets should be "proud" of the carriage.

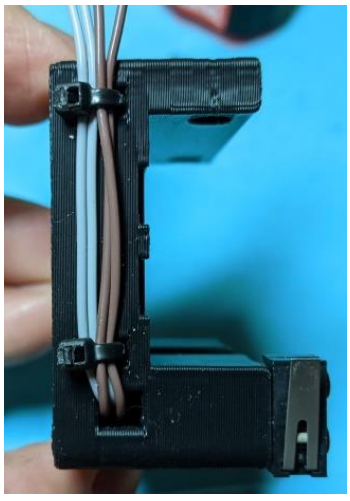


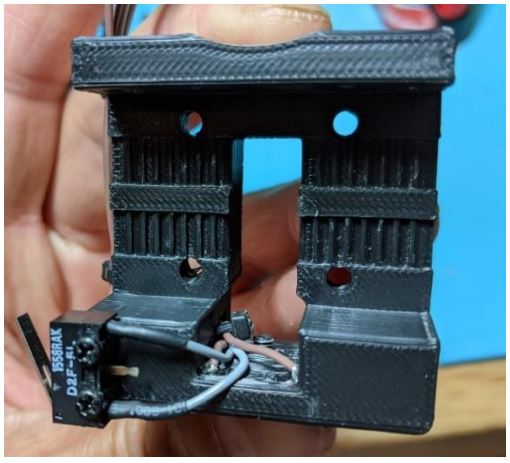
- **Wire Pinch**
  - Josh Murrah was able to attach his magnets by fanning out the wire then compressing the wire between the carriage and magnet and gluing in place. This method appears to be working fine for him.
  - The carriage uses 2 stacks of 2 magnets and a m3x6 button head
- **Misc Notes**
  - Adjust the tilt of your magprobe by screwing in and out the button head screw on the bottom of the carriage
  - Do not forget to put superglue into the holes in the carriage prior to putting in the magnets.

Heatsets

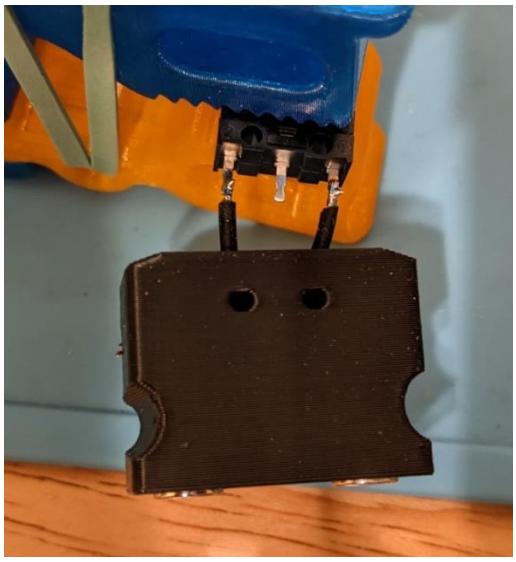
- As shown on front and top. There will be an extra hole on top. This extra hole is in case something else needs to be mounted (power distribution or something) later.



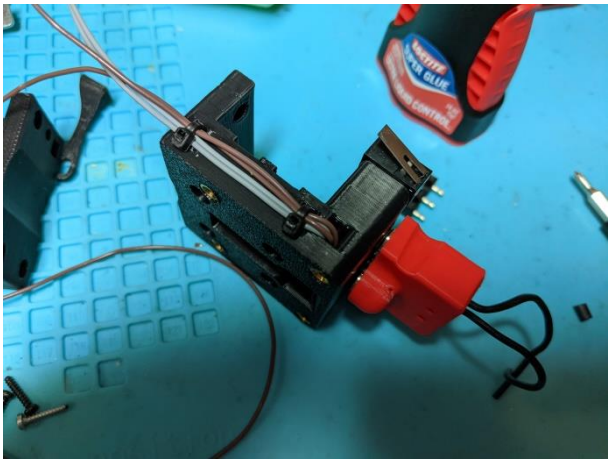


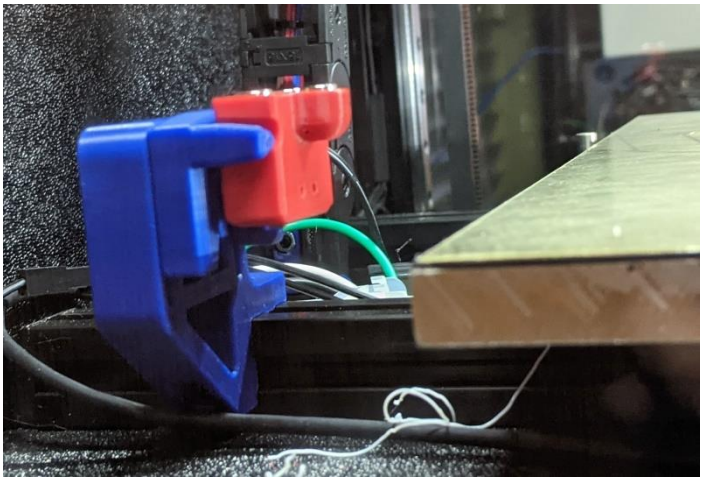


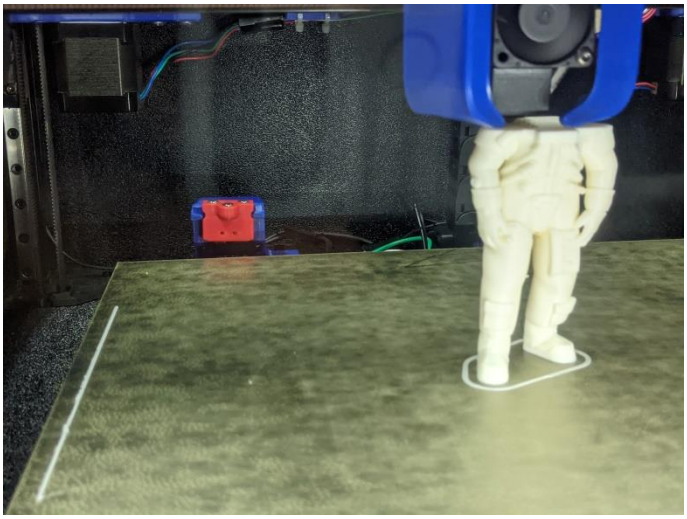
Mag Probe:



- Solder a short length of flexible wire to two m6x3 magnets then press the magnets into the holes.
- Alternatively, fan out the wire and press/glue in the magnets.
- When pressing in the magnets, I used a clamp and a flat surface to try to get the magnets flat.
- Screw in two of the m2x10 or m2x12 self tapping screws (silver ones on the red pictured magprobe below) prior to soldering the microswitch in. Take care not to damage the wires.
- Solder the other ends of the wires to the **outer prongs (NC)** of the D2F-5 microswitch. Note, the image with the black magprobe is an older version.
- Press in the D2F-5 microswitch now and screw in two more m2x10 or m2x12 to secure the microswitch. If there is any play in the microswitch, use some superglue to remove the play.
- Test fit the magprobe to the carriage and adjust the level of the probe using the m3 button head on the bottom of the carriage.
- Insert magnets into dock arms and secure to bed extrusion.
- You don't have to remove your bat85 diode when wiring in the wires to the magnets on the carriage
- Video of docking and undocking. Build your own macros or see annex engineering for their macros.
    - https://youtu.be/hdD8uaDW-pA







Magprobe Config:

- This can be a bit daunting…You can do it though!

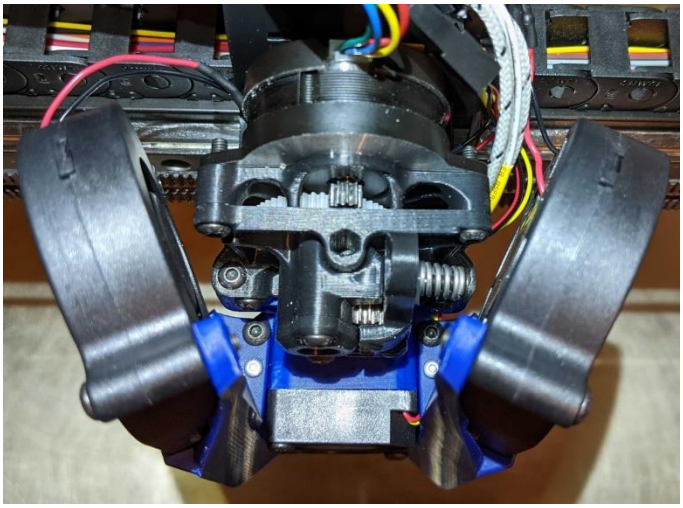
- The general movements for docking and undocking are in Macros_and_Config.txt

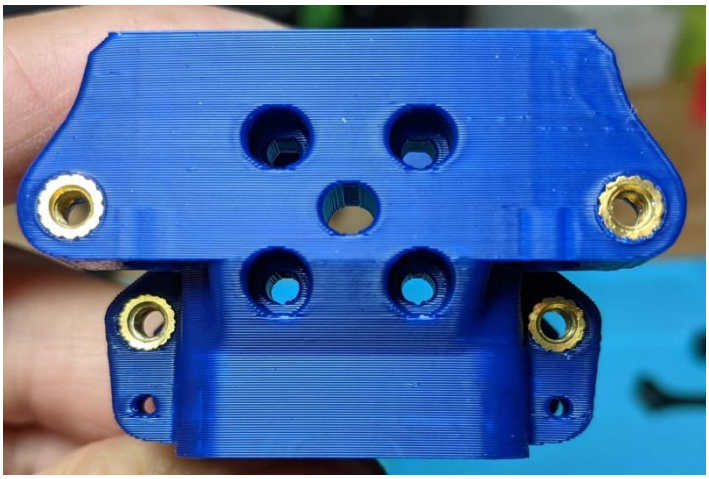
```
#   Get Probe
[gcode_macro Get_Probe]
gcode:
    G0 X46.3 Y305 Z20 F12000        #Spot above where the carriage magnets line up with the magprobe magnets
                                    #   (with magprobe in the dock)
    G0 X46.3 Y305 Z2 F3600          #move -Z where all the magnets pairs first fully grab onto each other
    G0 X46.3 Y290 Z2 F1800          #Move -Y so the probe is fully clear of the the arms of the dock
    G0 X46.3 Y290 Z20 F3600         #move +Z so any move from here clears the buildplate.

#   Dock Probe
[gcode_macro Dock_Probe]
gcode:
    G0 X46.3 Y290 z10 F12000        #Above +Z and forward -Y of where magprobe side cutouts line up with dock arms
                                    #   (allows build plate clearance for next downward move to line up magprobe to arms)
    G0 X46.3 Y290 Z2 F3600          #Location where the side cutouts of the magprobe line up with the front of dock arms
    G0 X46.3 Y305 Z2 F3600          #move the magprobe +Y into the dock, engaging the arms
    G0 X80 Y305 Z10 F1800           #move +X and +Z to disengage the magprobe from the carriage
    G0 X80 Y290 Z20 F3600           #Move +Z and -Y to a safe spot where further moves won't collide with dock
```

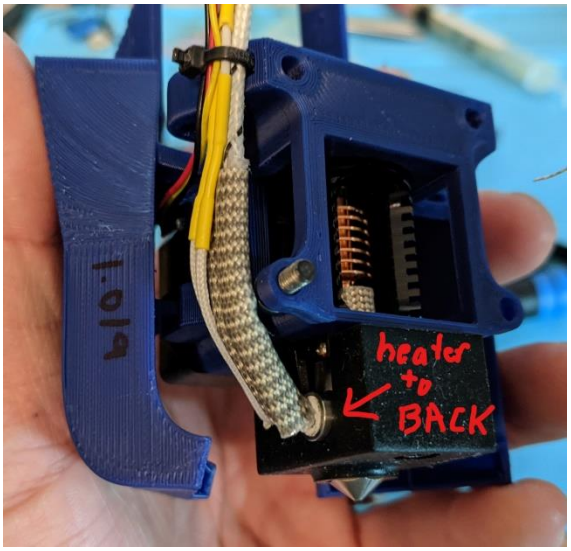
- **For smart macros**
    - See the annex repo for their magprobe at:
        - https://github.com/Annex-Engineering/Annex-Engineering_Other_Printer_Mods/tree/master/All_Printers/Microswitch_Probe
    - Or the Klicky probe repo at:
        - https://github.com/jlas1/Klicky-Probe

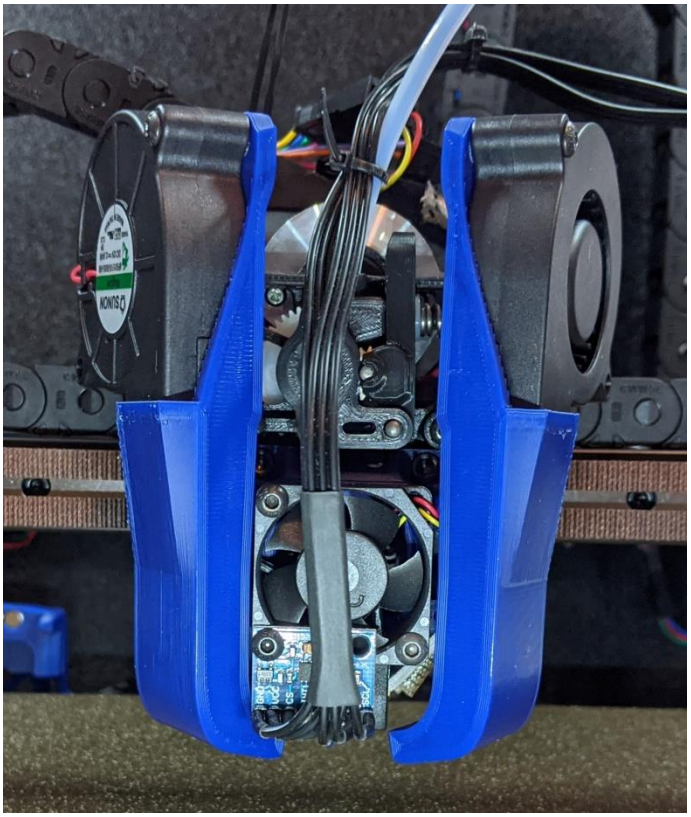
Final Assembly:

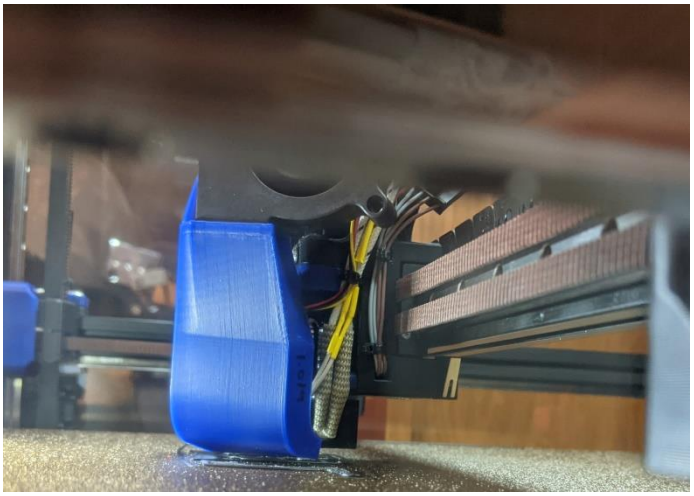
- Use button heads for everything if possible.
- ****note the heater cartridge location****











Firmware Settings:

- With my Sunon I have been able to pwm down to 7% using these settings
    - kick_start_time: 0.5
      off_below: 0.05
      cycle_time: 0.008

Slicer settings:

- This is currently what I've been using for ABS as far as cooling with my Sunon 5015s. Not sure where I'll end up here, but it's a starting point.
- Don't be afraid to pump the fan up with ABS, especially for overhangs and short layer times. The higher fan percent will increase your chamber temps and offset the higher fan usage. I often see 55c+ chamber temps in my uninsulated Voron 300. If I'm printing a single ABS part with short layer times I'll often use 50%+ fan for the whole part. I haven't had issues with layer splitting when I do this.