

COPIS Build Instructions

Images of selected steps



Tapping

3D Prints - M3

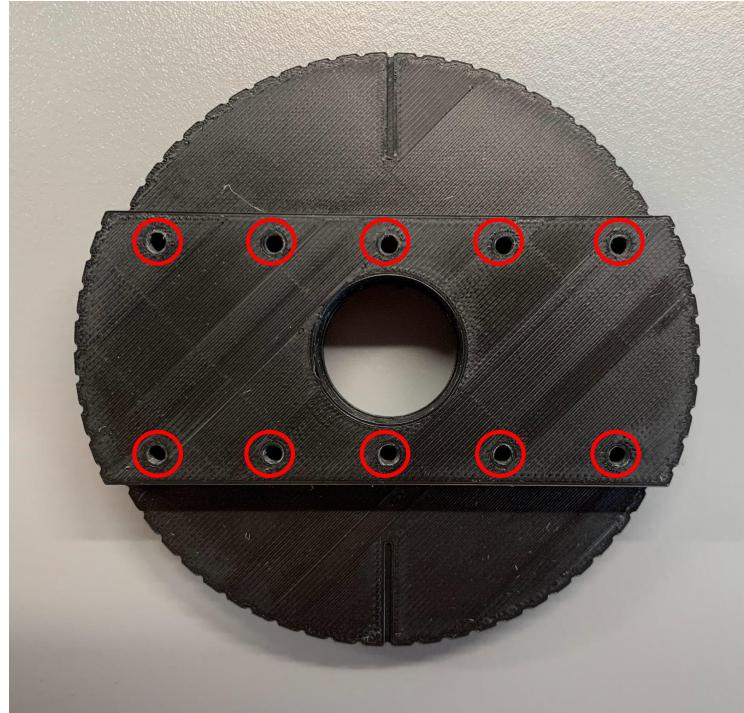


Geared-side Tilt Shoulder Plate (Flat side)



Tap the 6 M3 gear mounting holes on the flat side of the geared-side tilt shoulder plate - 25x180° tap turns

Geared-side Tilt Shoulder Plate (Raised side)



Tap the 10 M3 holes of the raised side of geared-side tilt shoulder plate -
45x180° tap turns

Bearing-side Tilt Shoulder Plate (Raised side)



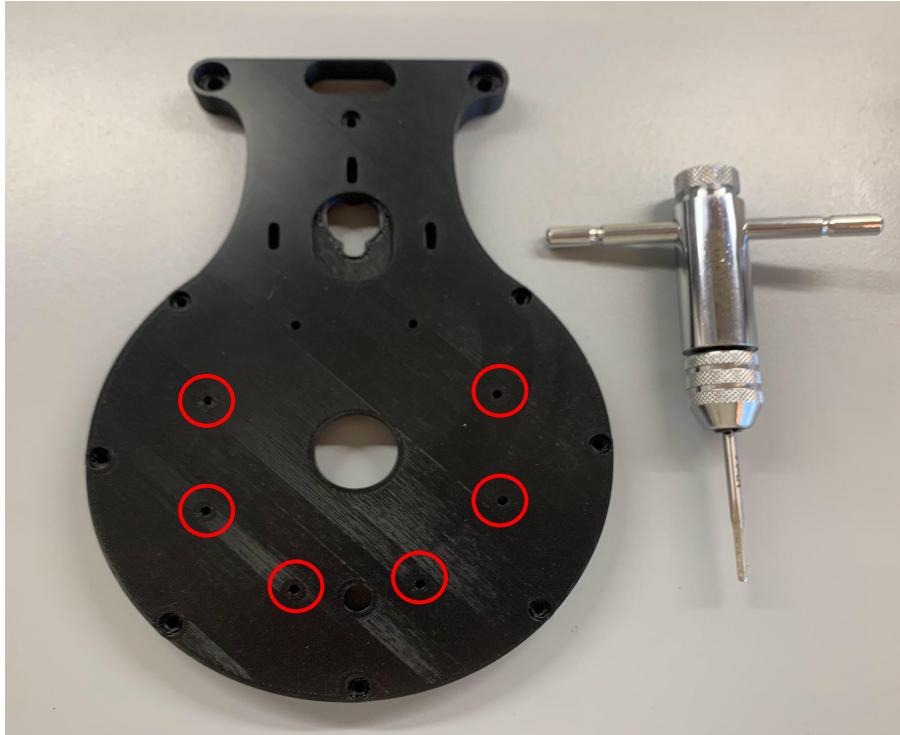
Tap the 10 M3 holes of the raised side of bearing-side tilt shoulder plate -
35x180° tap turns

Inner Tilt Housing



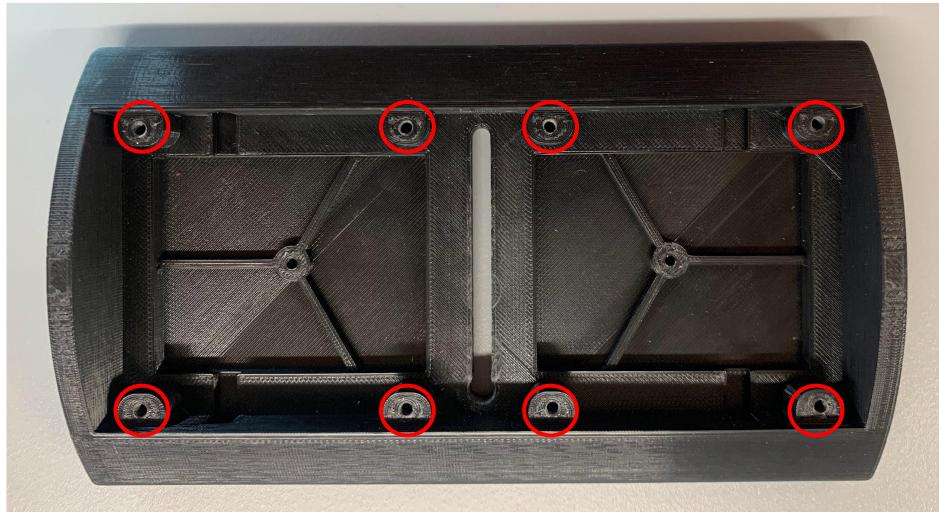
Tap the 8 M3 holes of inner tilt housing - 35x180° tap turns

Outer Tilt Housing



Tap at least 6 of the 8 M3 holes of the outer tilt housing for mounting limit sensor and protective cap; preferably the 6 bottom most - 25x180° tap turns

Camera Cradle



Tap 8 M3 holes in the camera cradle - 20x180° tap turns

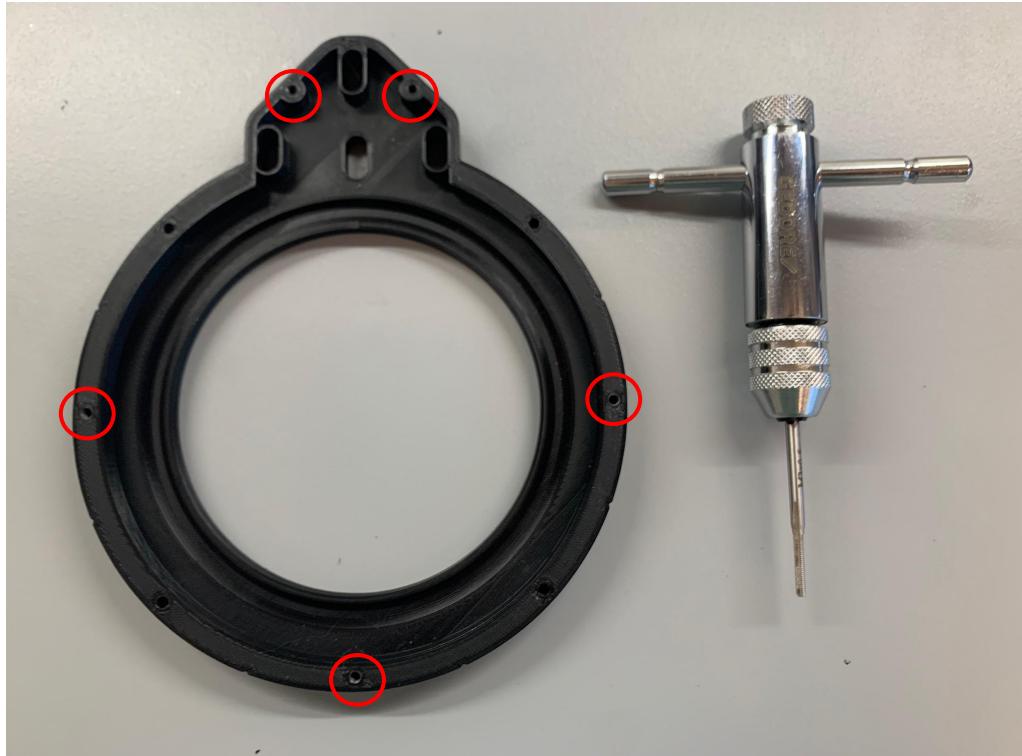
Pan/Tilt

Hanger Arm



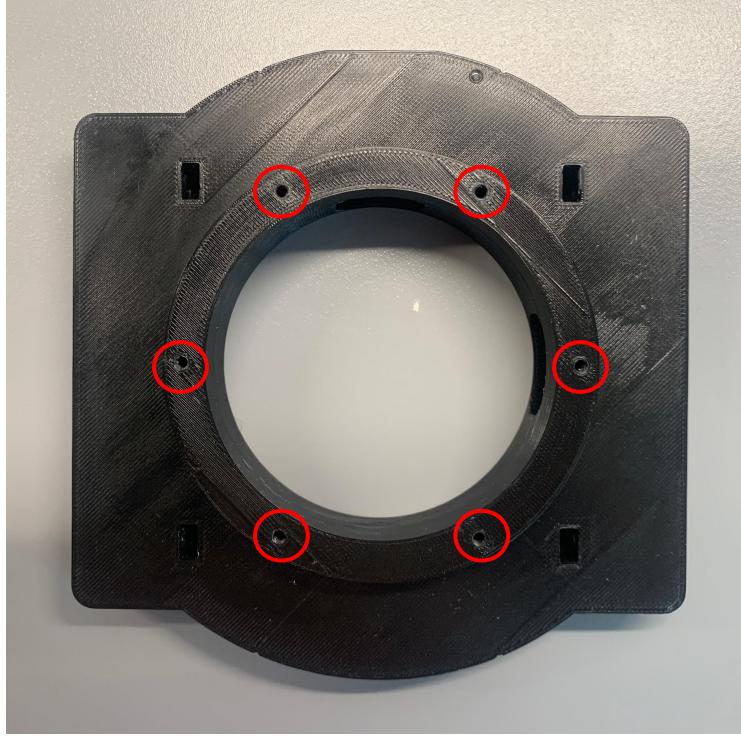
Tap the 3 M3 holes on the outside of the hanger arm head - 30x180° tap turns

Inner Pan Housing



Turn over the inner pan housing and tap the remaining 5 of the 9 M3 holes -
 $35 \times 180^\circ$ tap turns

Pan Shoulder



Tap 6 M3 holes in the pan shoulder - 35x180° tap turns

Z Bottom
Plate (Pan
Limit Sensor
M3 hole)



Tap the pan limit sensor M3 hole on the Z bottom plate - 10x180° tap turns

Slip Ring Adapter (Opposite Z screw drive notch side)



Tap the 3 M3 holes on the slip ring adapter, opposite the Z screw drive notch side - 20x180° tap turns

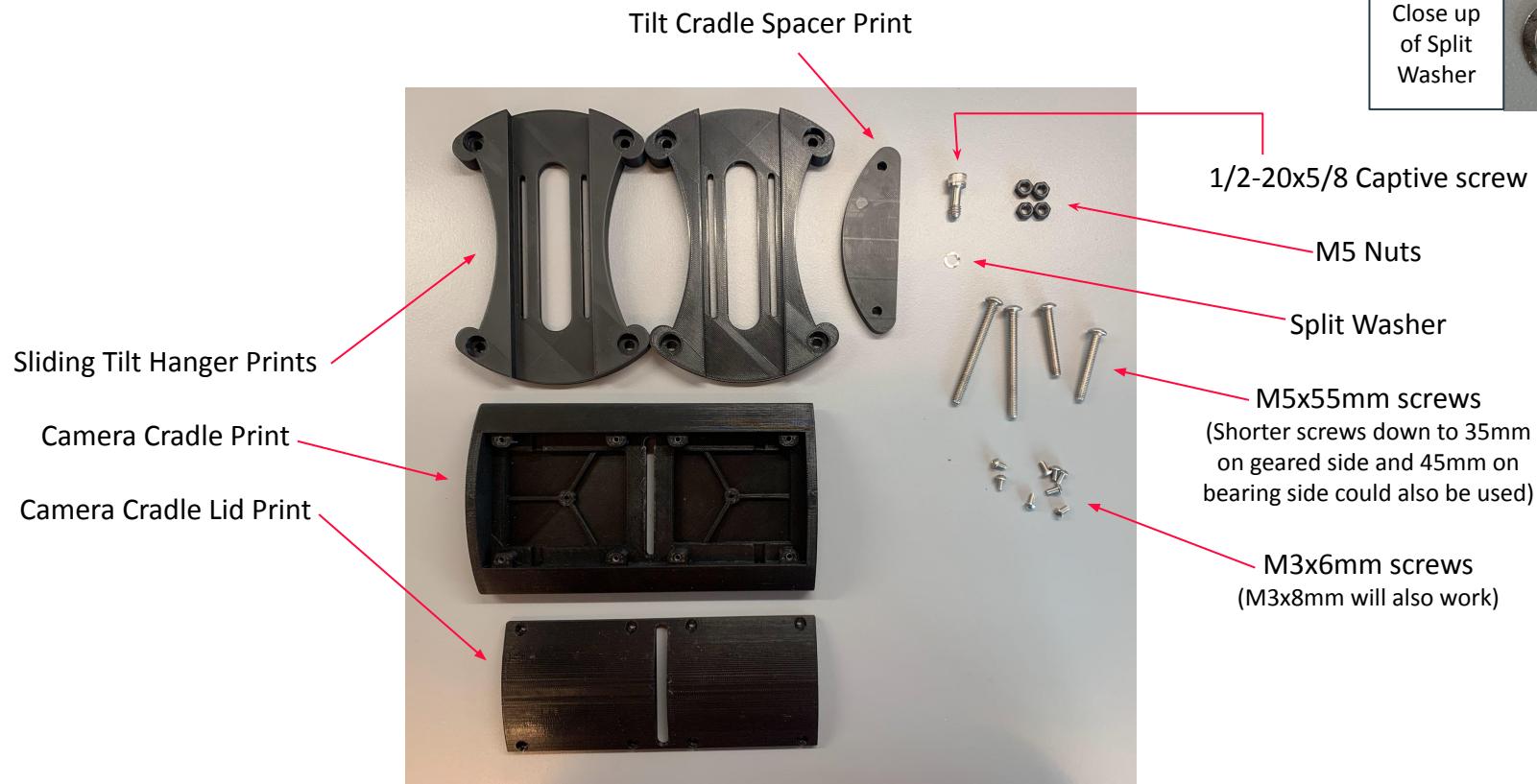


Assemble Tilt Mechanism

(This section is broken into smaller builds necessary to
assemble the entire tilt mechanism)

Assemble Camera Cradle





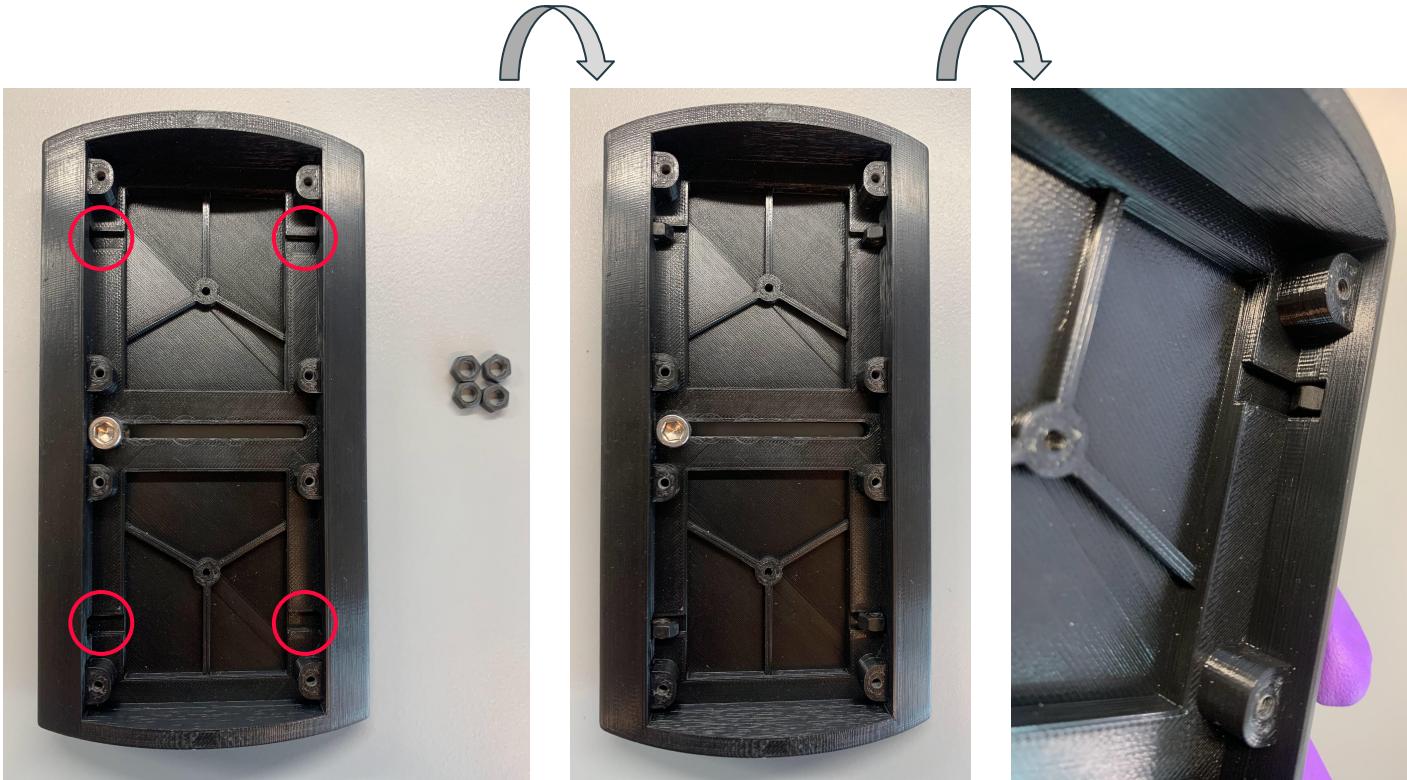


Attach 1/2-20x5/8 captive screw to camera cradle. Thread split washer in the screws' threads to the base of the cradle.



It is recommended to use a long needle nose plier to hold onto the split washer while threading since it is very sharp.

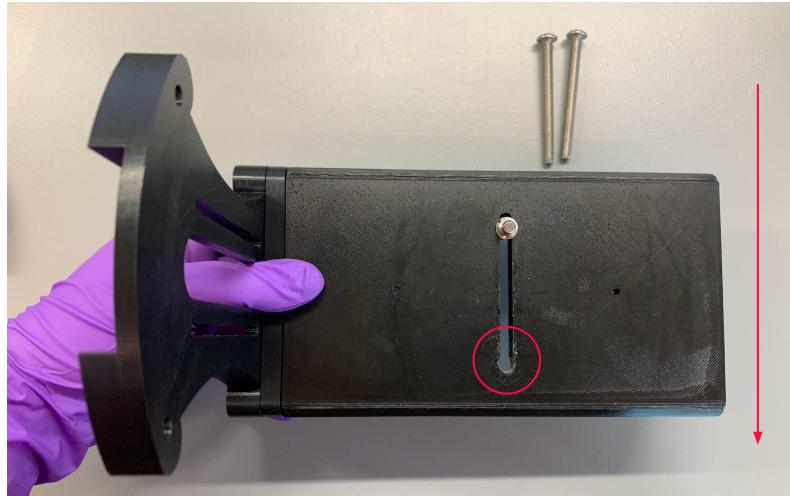
Attach 1/2-20x5/8 captive screw to camera cradle. Thread split washer in the screws' threads to the base of the cradle.



The M5 nuts may fall out when trying to position the spacer and sliding tilt hangers. Do one at a time and make sure they are in when putting in the screws.

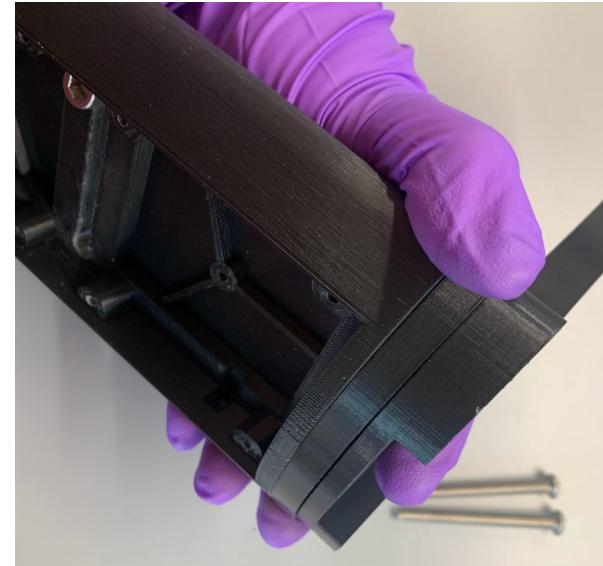
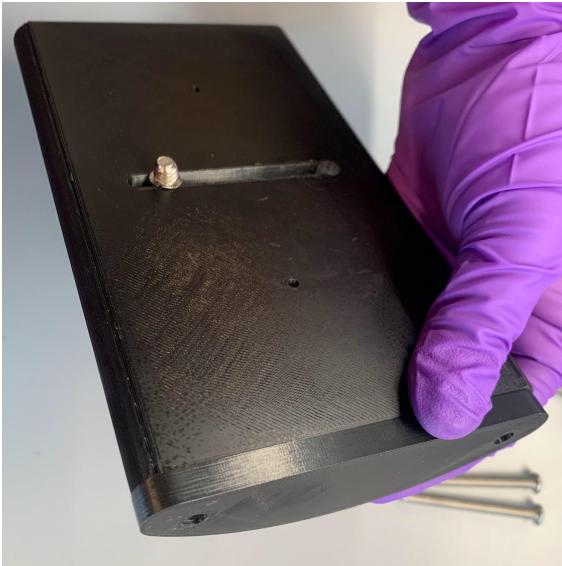
Insert 4 M5 nuts into captive nut traps in the camera cradle.

Use the hole for the captive screw as a reference point. The camera should be facing in the direction of the hole and the widest side of the camera should be on the side with the spacer.

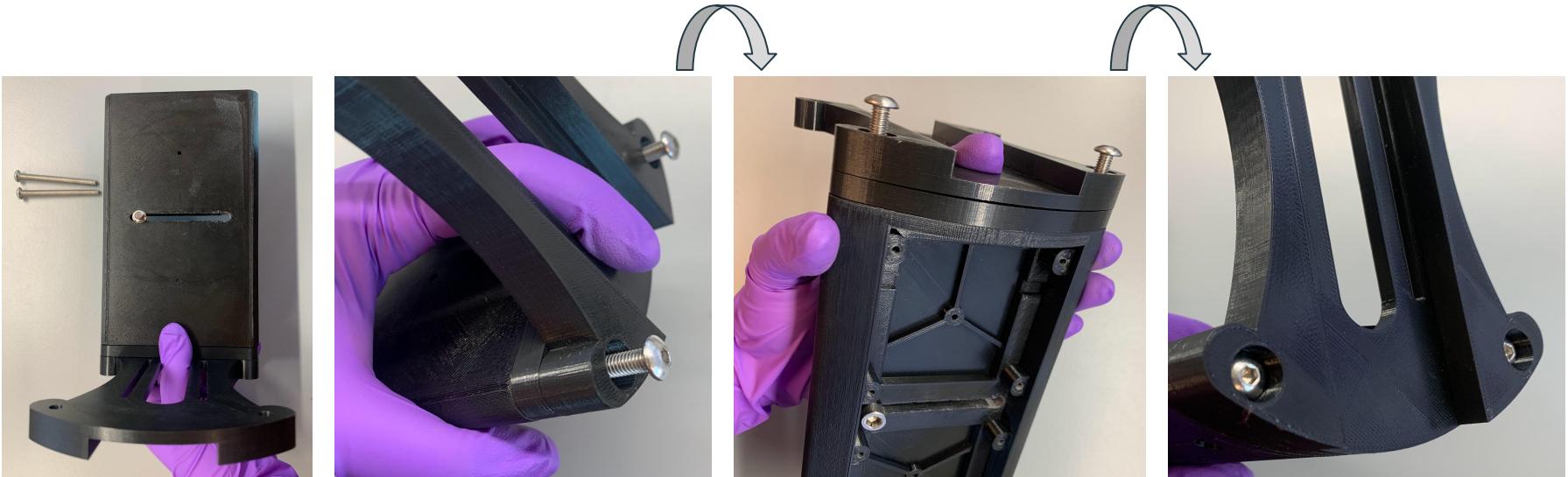


NOTE: This is the assembly for the ideal placement of the camera. If assembled backwards where the camera is facing away from the hole, it should still work as intended.

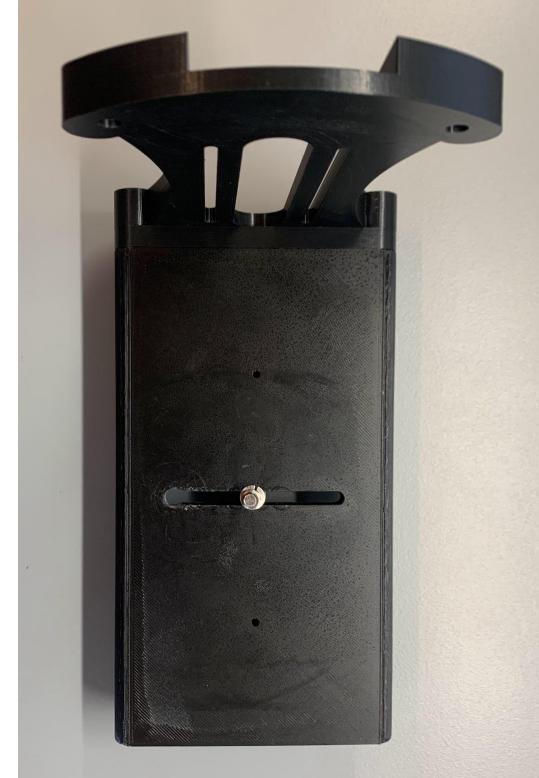
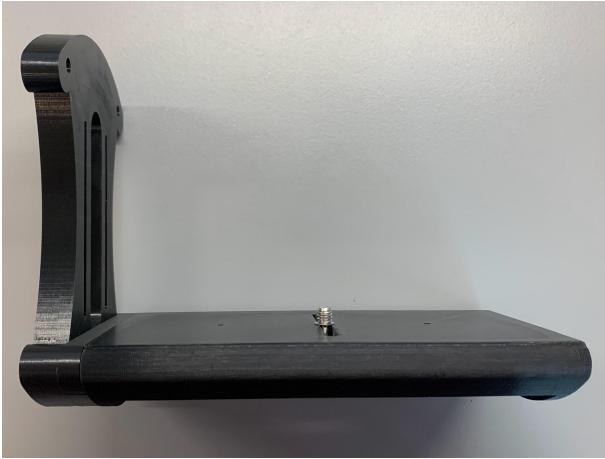
Attach the spacer and one sliding tilt hanger to one side of the cradle using 4 M5x55mm screws (shorter screws down to 45mm on bearing side could also be used).



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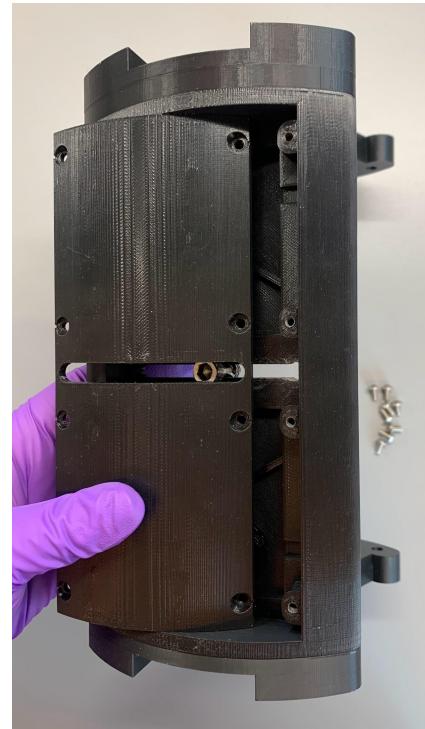
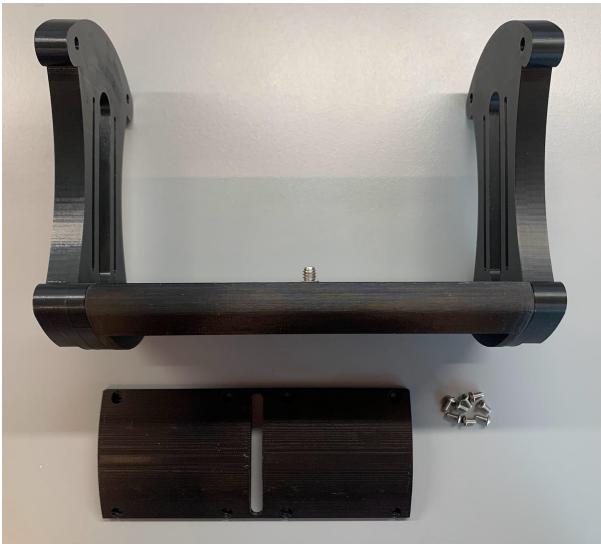
Attach the spacer and one sliding tilt hanger to one side of the cradle using 4 M5x55mm screws (shorter screws down to 45mm on bearing side could also be used).



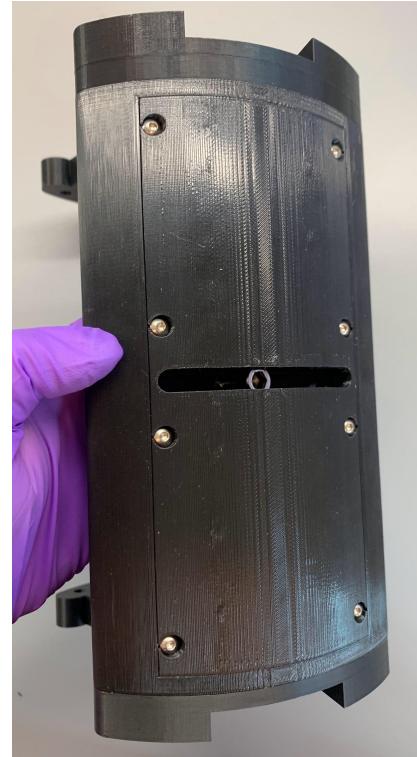
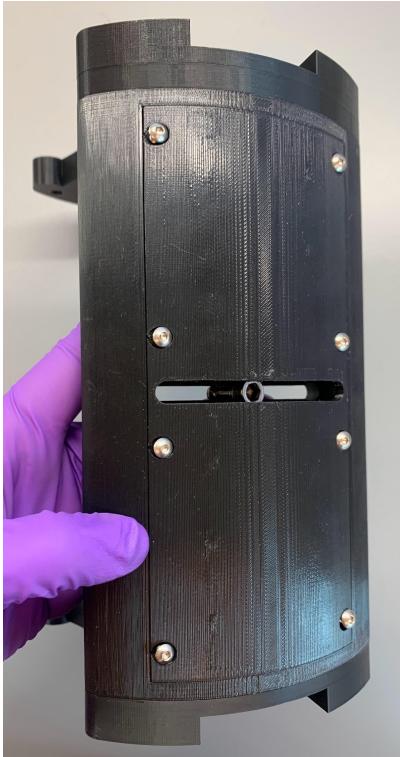
Attach one sliding tilt hanger only to the other side of the cradle using 4 M5x55mm screws (shorter screws down to 35mm on geared side could also be used).



Attach one sliding tilt hanger only to the other side of the cradle using 4 M5x55mm screws (shorter screws down to 35mm on geared side could also be used).



Attach camera cradle lid with 8 M3x6mm screws (M3x8mm will also work).



Attach camera cradle lid with 8 M3x6mm screws (M3x8mm will also work).



Complete Camera Cradle for the Tilt Mechanism of one camera gantry

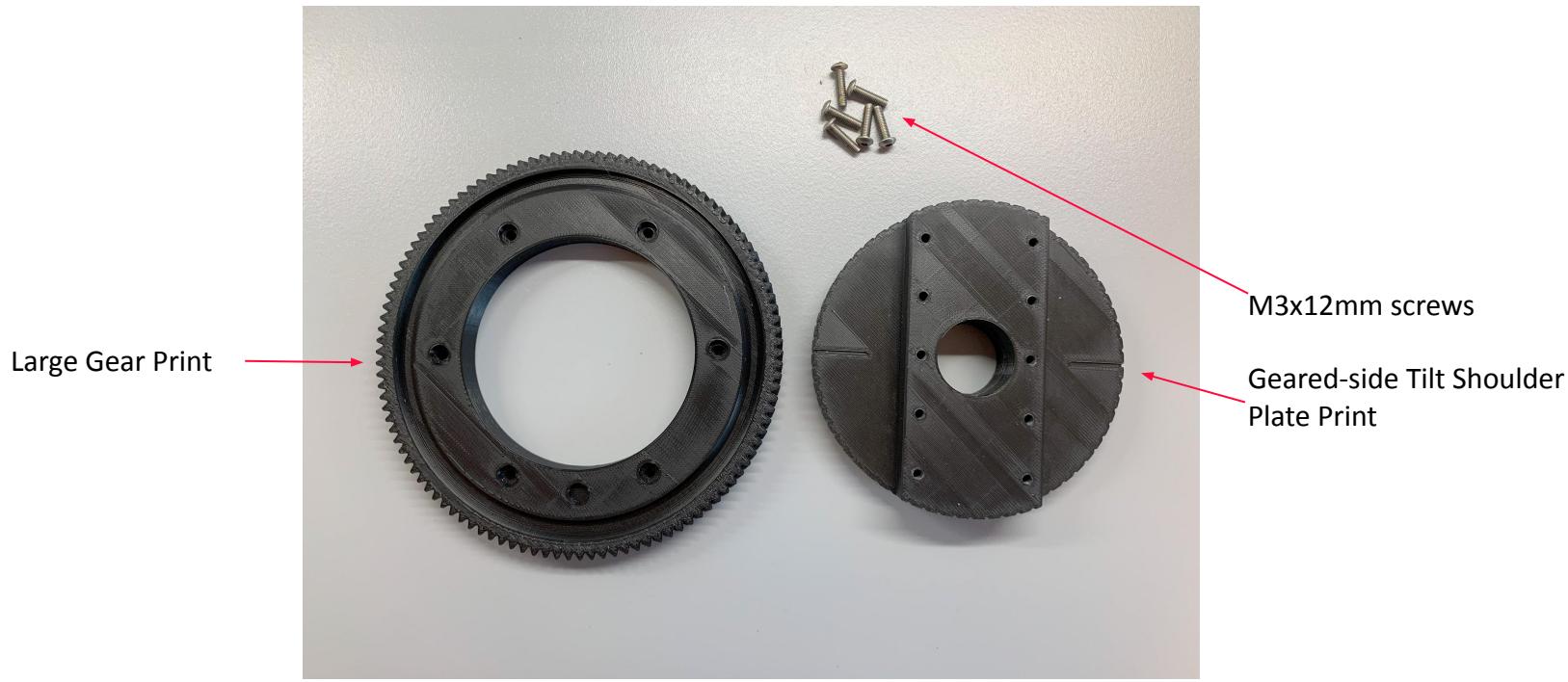


Assemble Tilt Mechanism

(This section is broken into smaller builds necessary to
assemble the entire tilt mechanism)

Assemble Tilt Housing

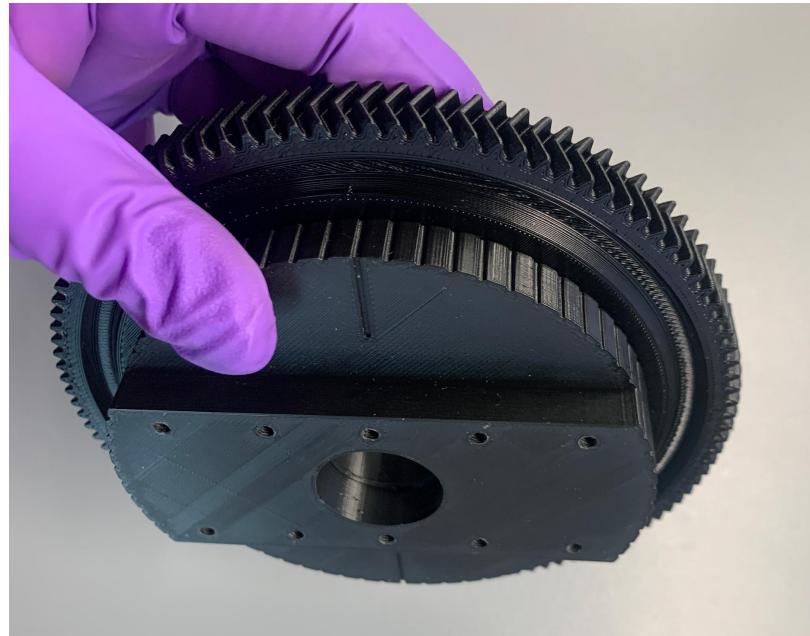




Attach geared-side tilt shoulder plate to large gear with 6 M3x12mm screws. Position the large gear so that the side with the magnet hole is on the bottom and faced down. Place the geared-side tilt shoulder plate on top with the raised side vertical and faced up.



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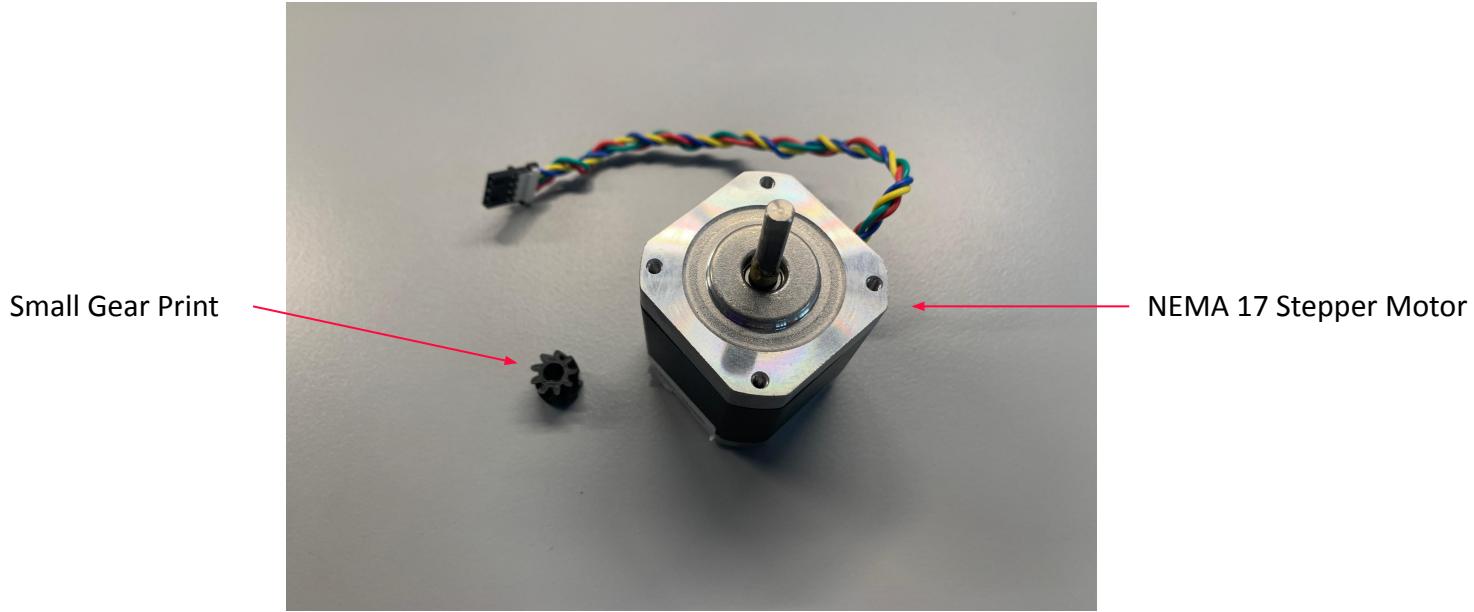
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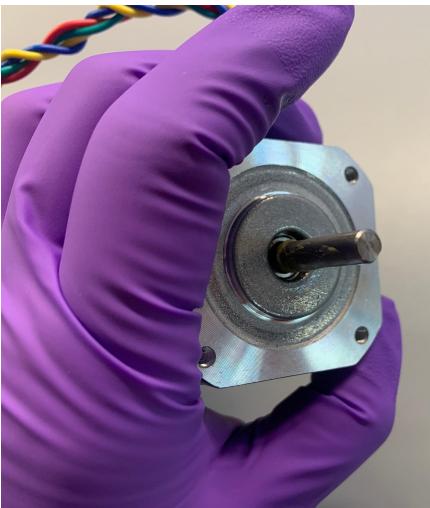
x1



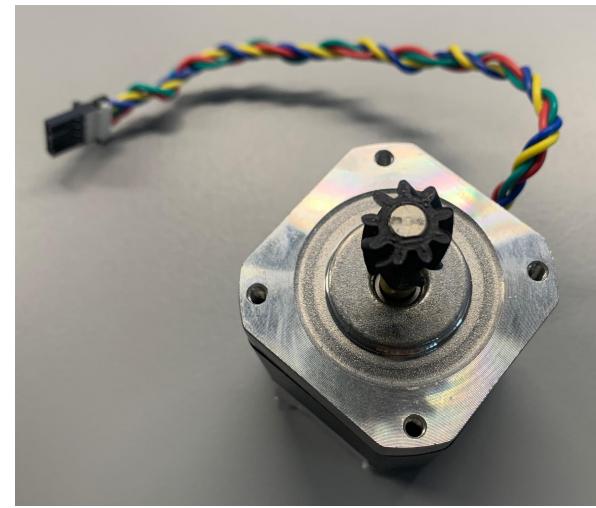
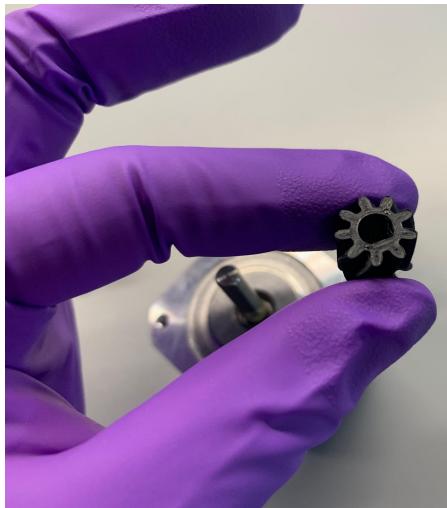
Insert radial magnet 0.236"DIA X 0.098"H CYL into large gear (use a bit of double sided tape if it is not snug).



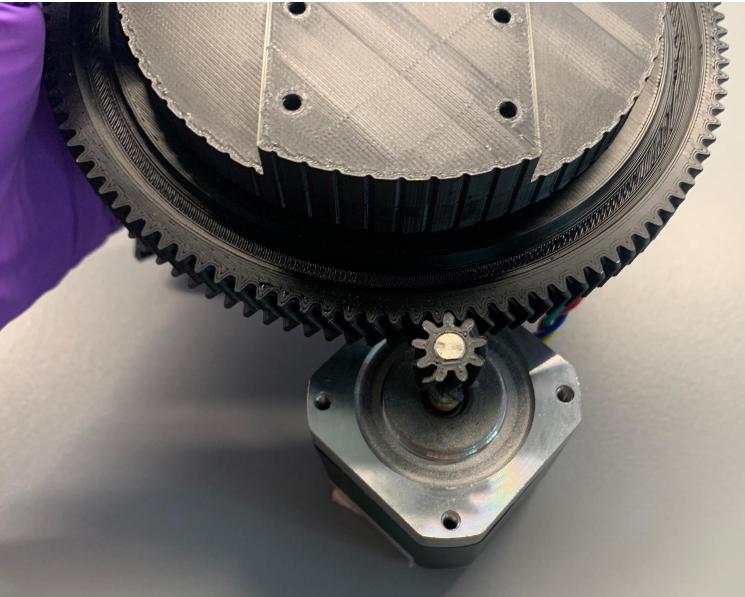
Slide small gear into NEMA 17 shaft, greased and oriented to couple with tilt (large) gear.



There is a flat edge on the shaft of the motor that will match up to the hole shape of the small gear.



Slide small gear into NEMA 17 shaft, greased and oriented to couple with tilt (large) gear.

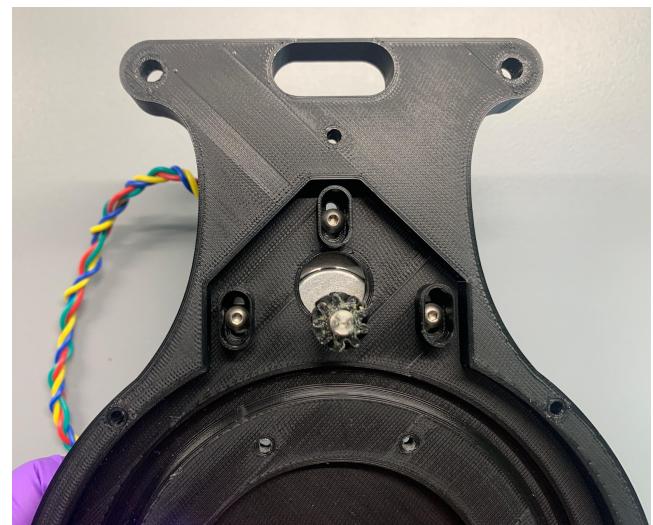
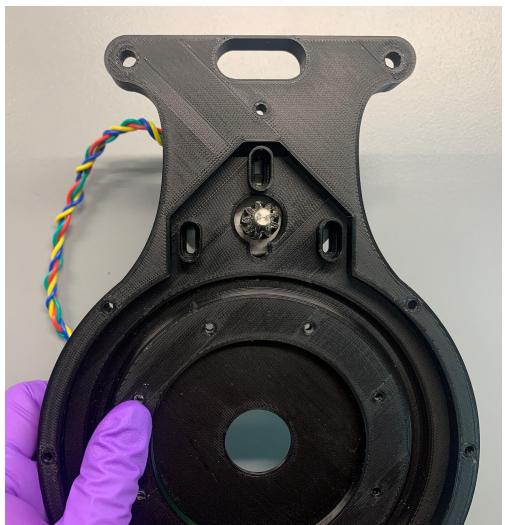


Slide small gear into NEMA 17 shaft, greased and oriented to couple with tilt (large) gear.

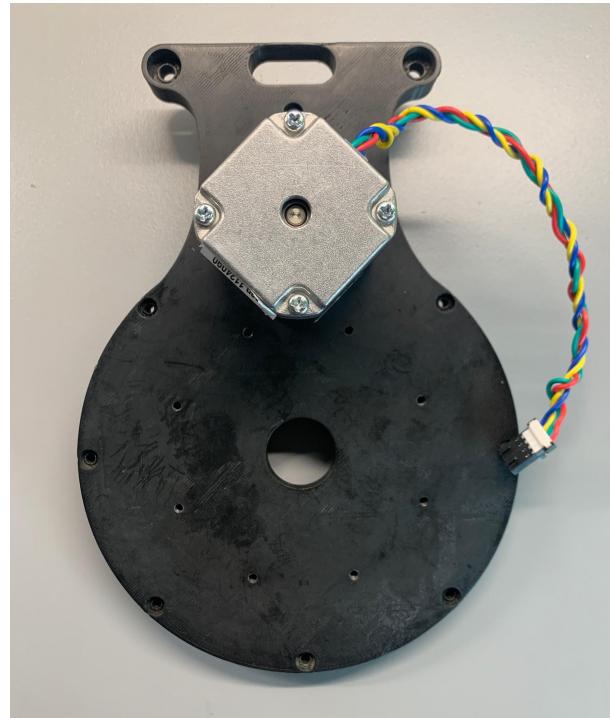
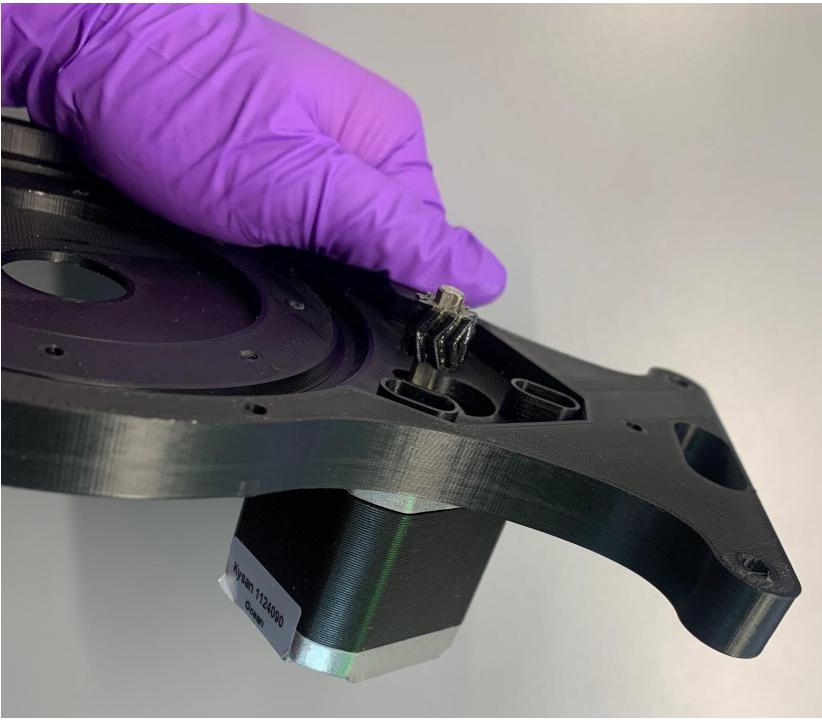
For the correct orientation, the grooves of the small gear should fit into the groove of the large gear with the geared-side tilt shoulder plate raised side up.



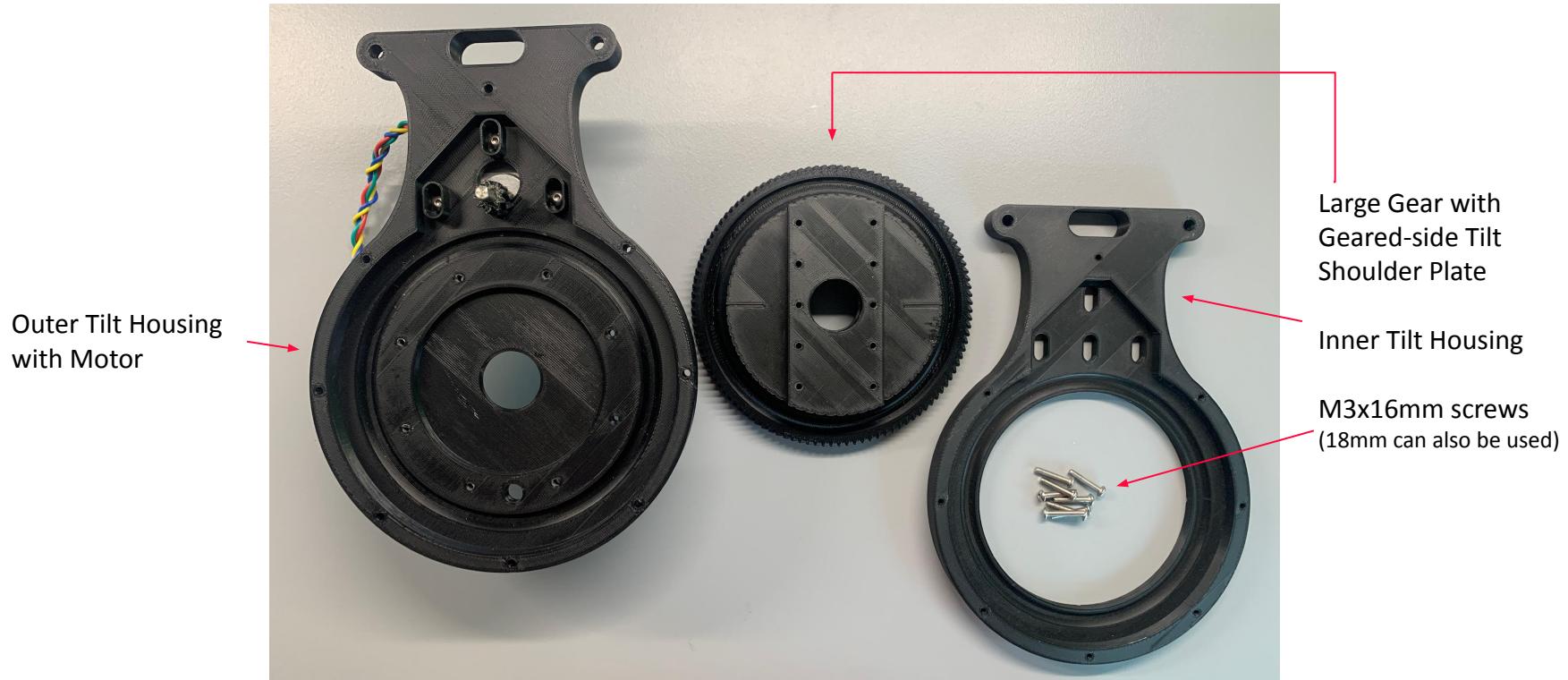
Attach the motor to the outer tilt housing with 3 M3x10mm screws (8mm screws can be used). Position the motor so that the attached cord is upwards, either on the left or right side.



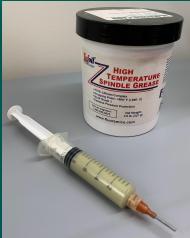
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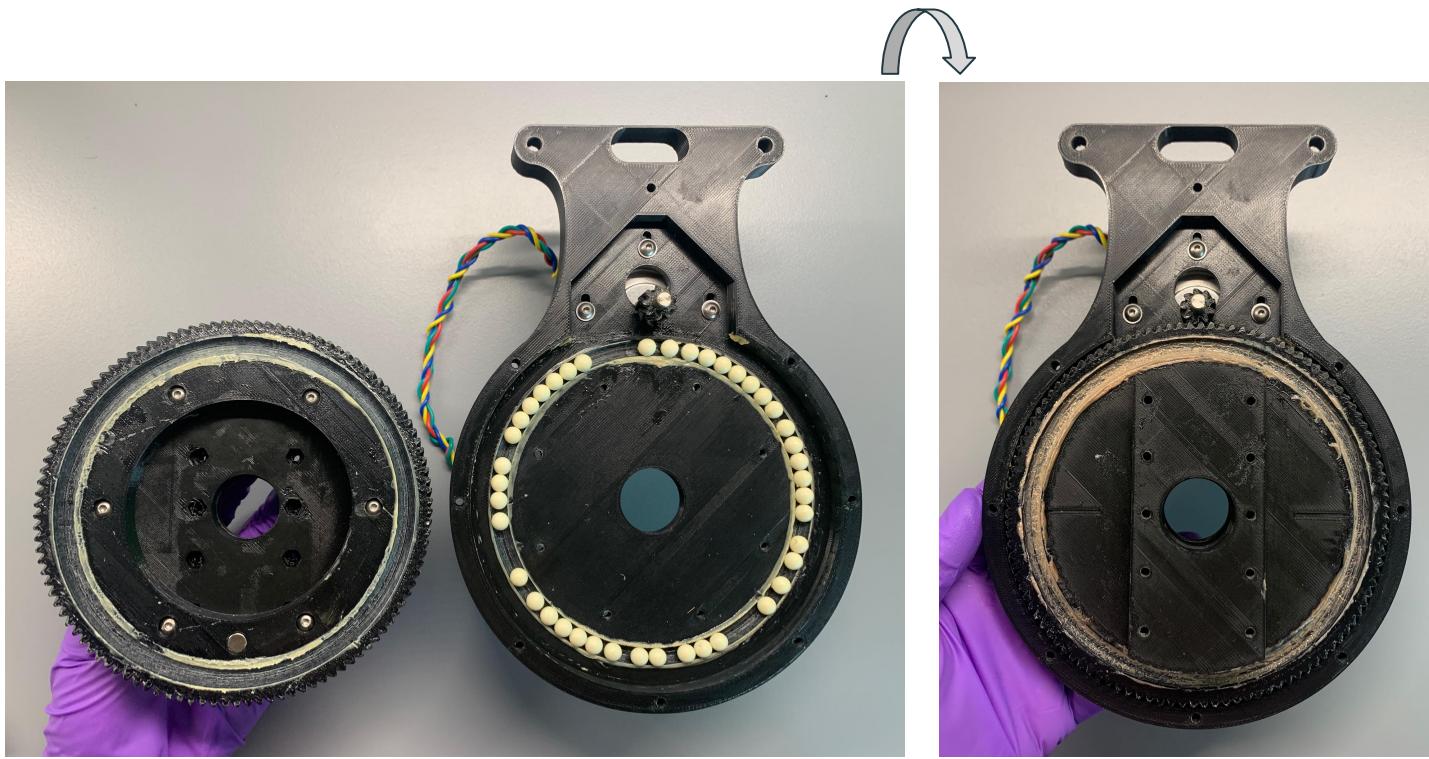
Attach inner and outer tilt housings together, encasing a greased large gear with 42 bearing balls on each greased side raceway, with 8 M3x16mm screws (18mm can also be used).



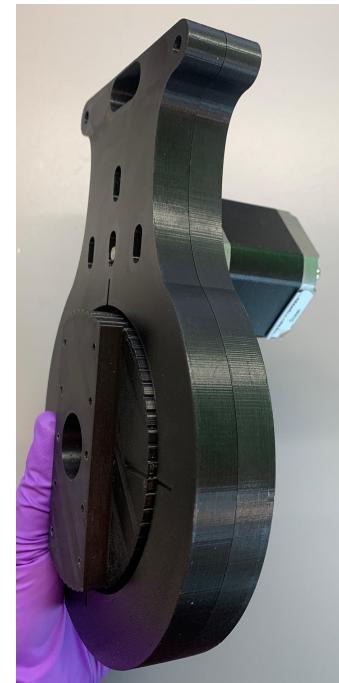
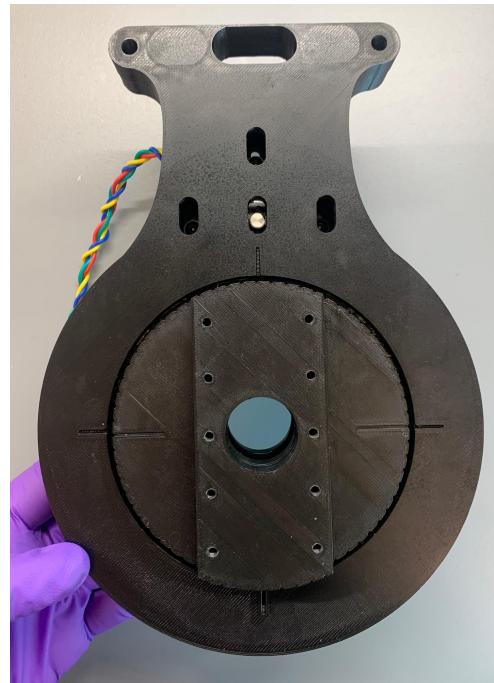
High Temperature Spindle Grease



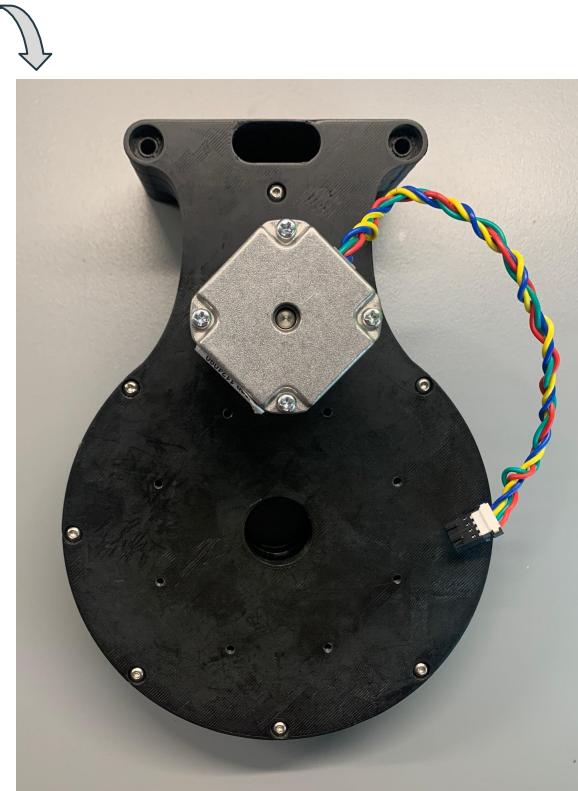
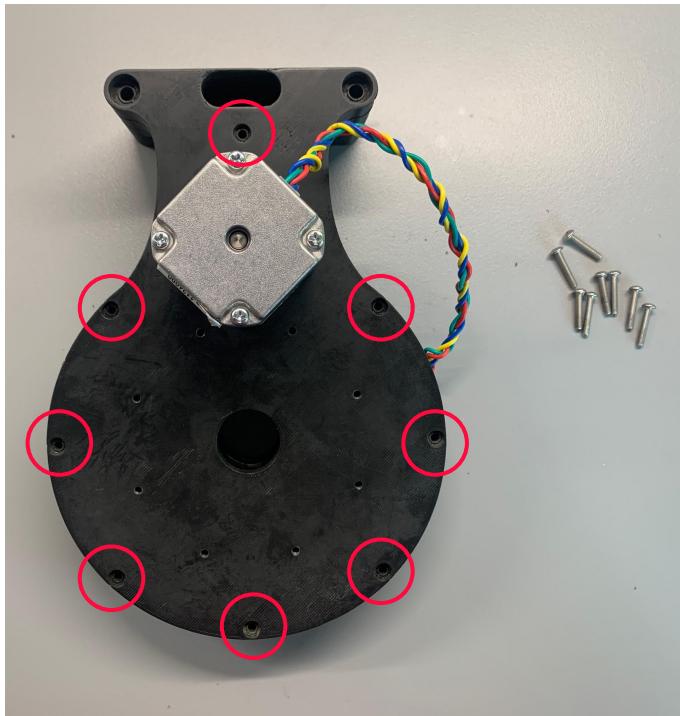
Attach inner and outer tilt housings together, encasing a greased large gear with 42 bearing balls on each greased side raceway, with 8 M3x16mm screws (18mm can also be used).



Attach inner and outer motor housings together, encasing a greased large gear with 42 bearing balls on each greased side raceway, with 8 M3x16mm screws (18mm can also be used).



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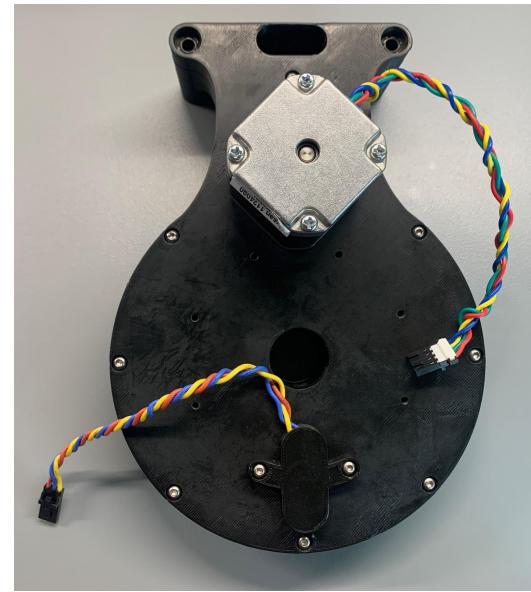
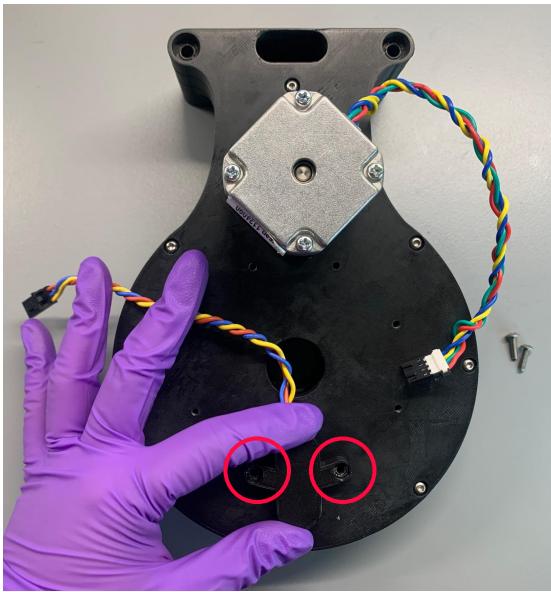
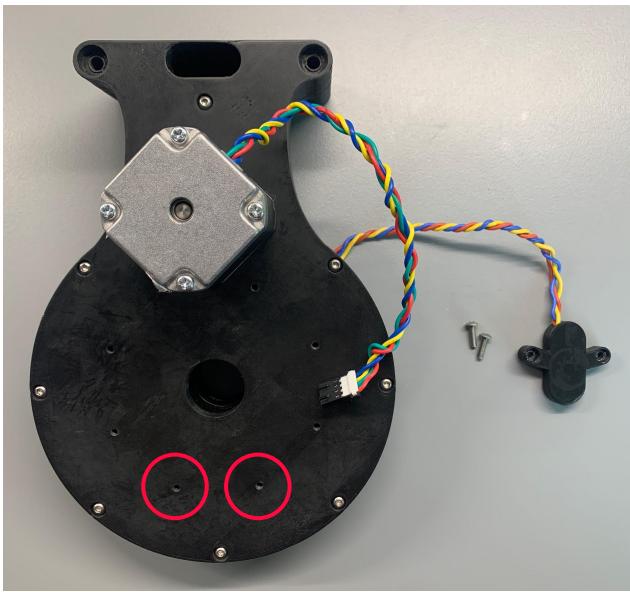


Press the inner and outer tilt housing very tightly together when putting in the final screws.

Attach inner and outer motor housings together, encasing a greased large gear with 42 bearing balls on each greased side raceway, with 8 M3x16mm screws (18mm can also be used).



Place limit sensor with cable in tilt limit sensor housing and attach to outer tilt housing using 2 M3x10mm screws (limit housing screw holes may need to be enlarged to 3mm)



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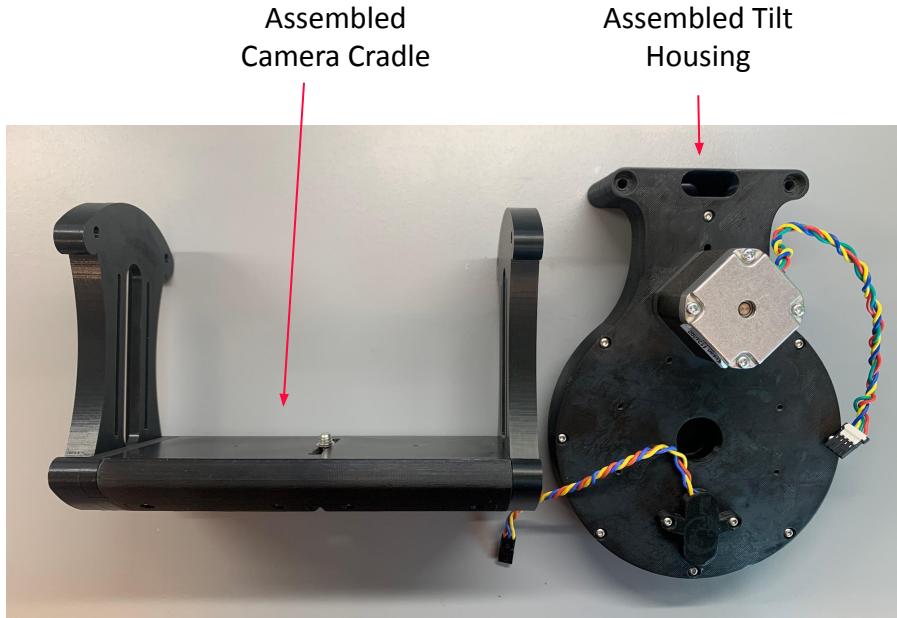


Assemble Tilt Mechanism

(This section is broken into smaller builds necessary to assemble the entire tilt mechanism)

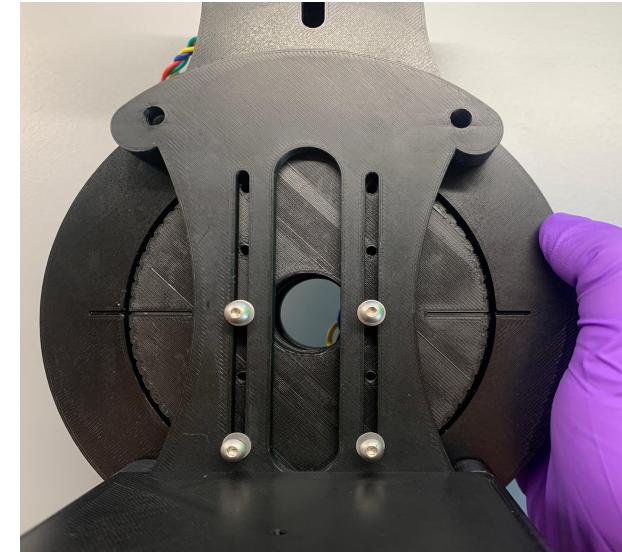
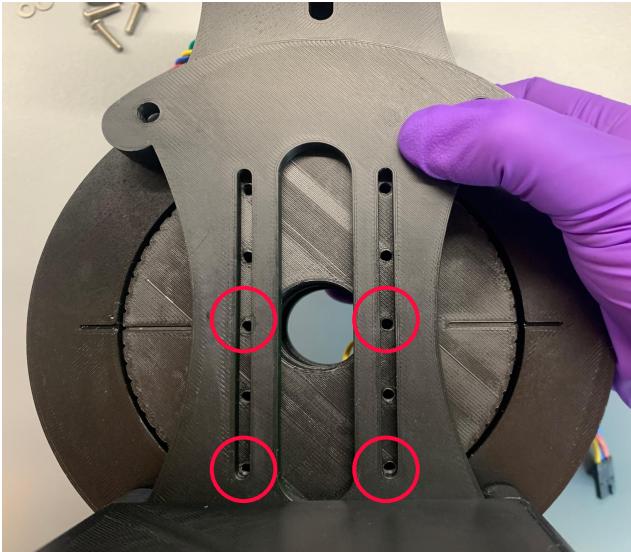
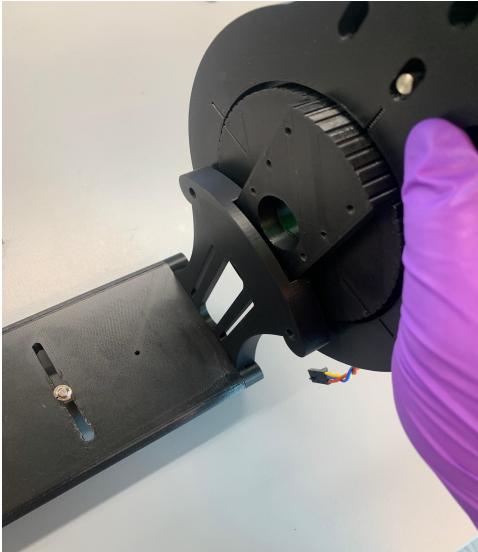
Attach Camera Cradle and Tilt Housing



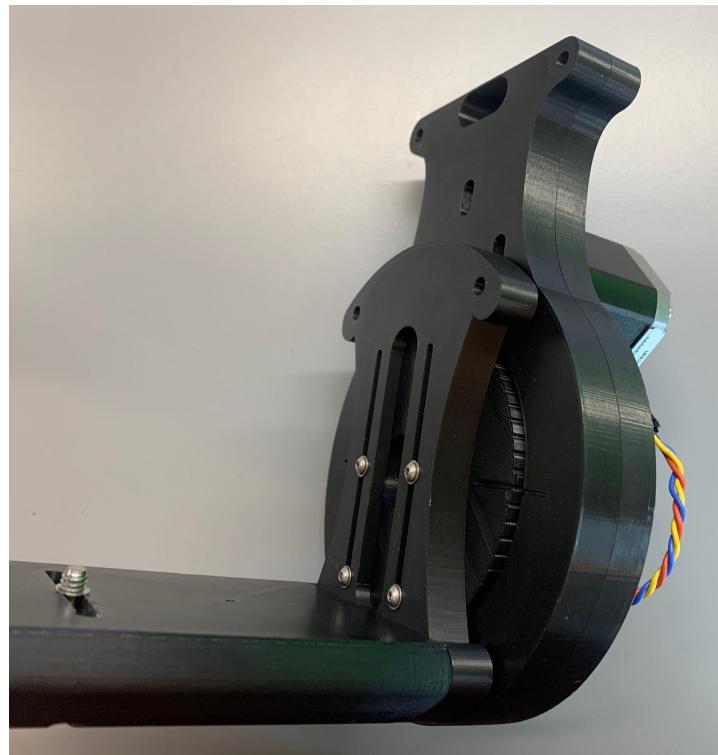
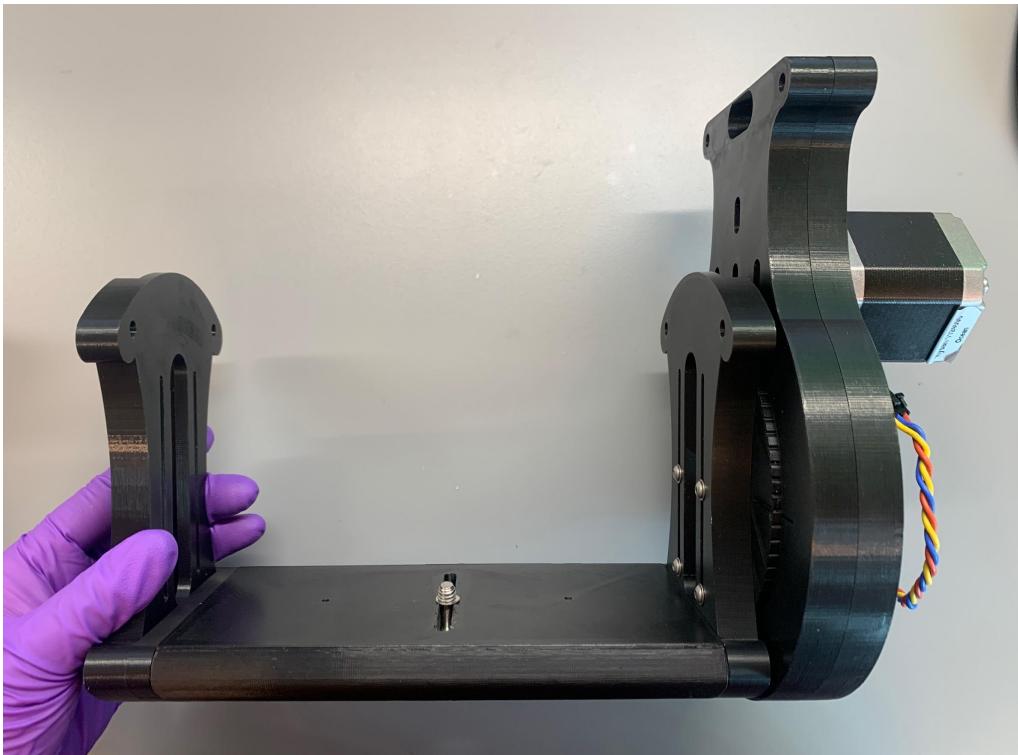


Use 4 M3x12mm screws and washers to attach the motor side tilt shoulder to the sliding tilt hanger. Attach it on the side of the cradle that does not have the spacer.

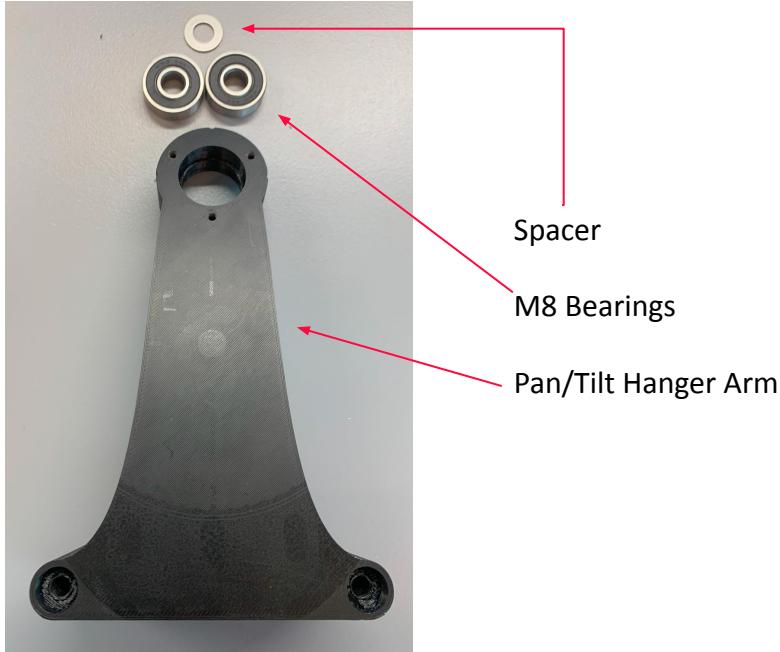
Line up the holes on the geared-side tilt shoulder plate with the spaces in the sliding tilt hanger. Put the screws in the middle and bottom two holes.



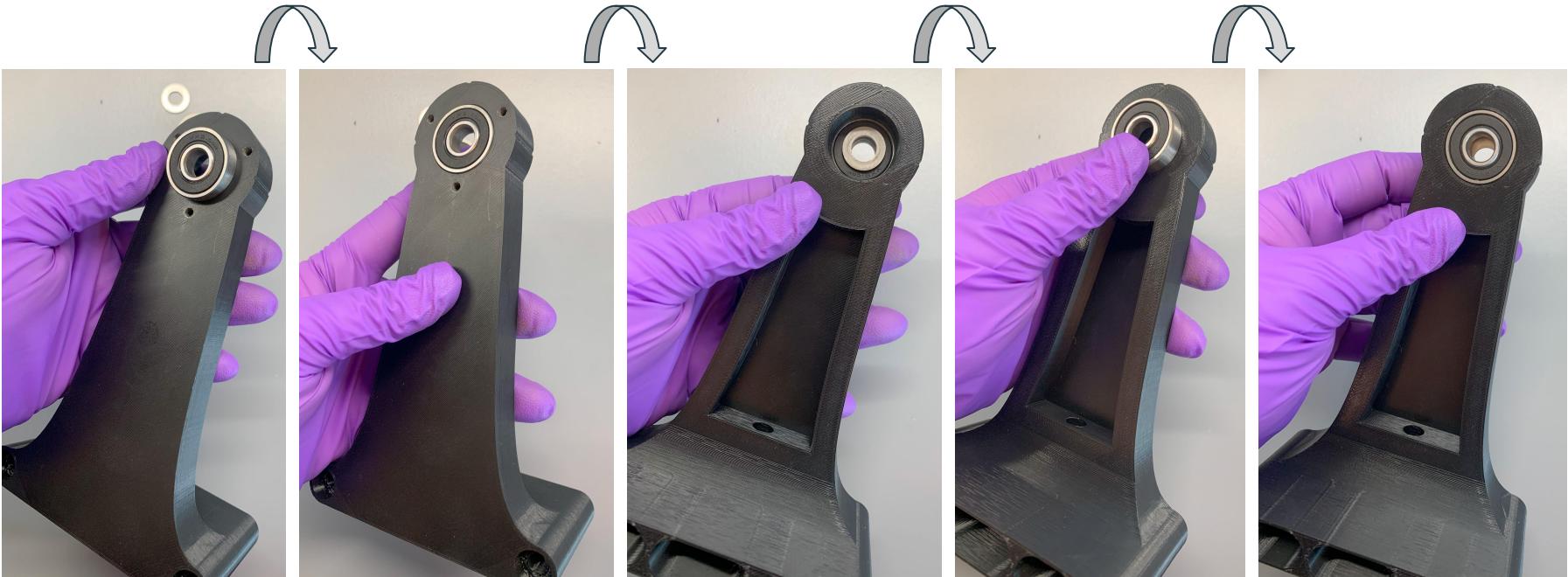
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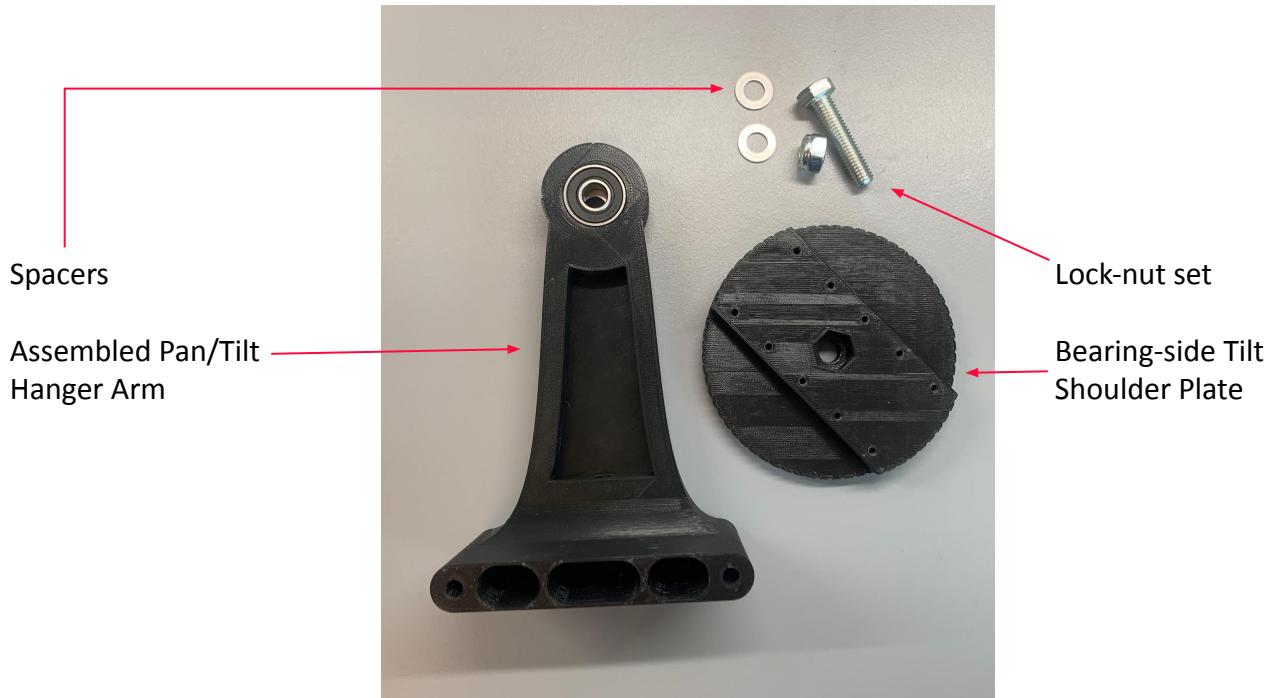
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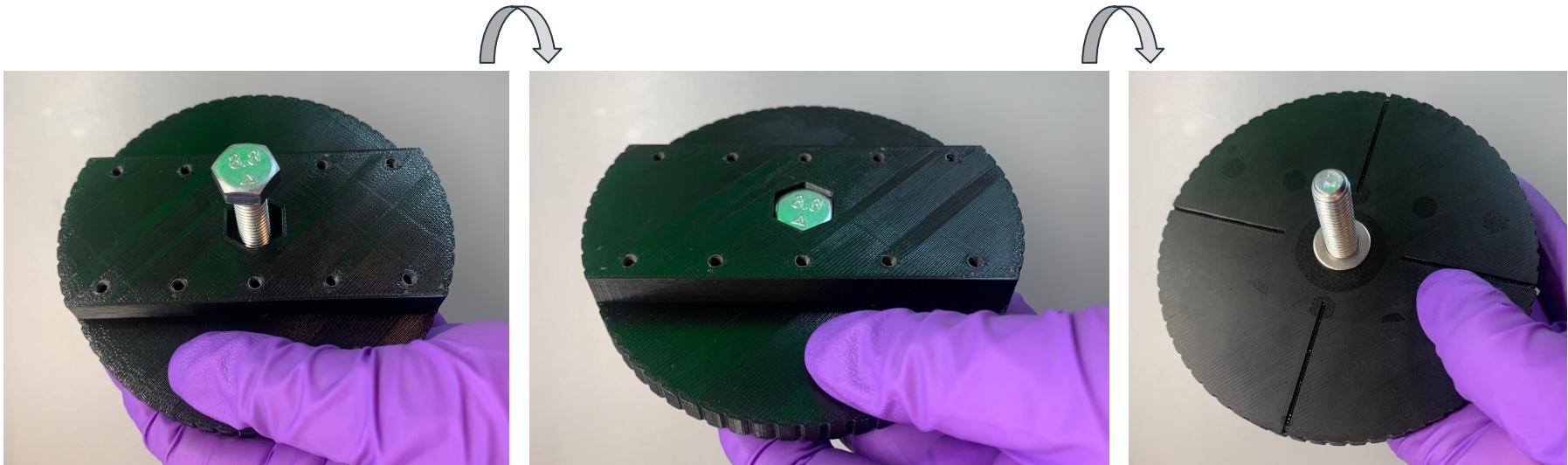
Attach bearing side tilt shoulder plate to the pan/tilt hanger arm with 2 M8 bearings and 3 to 4 spacers (1 or 2 spacers between the bearings, 1 spacer between the shoulder and plate and 1 spacer between the lock-nut and shoulder) and 1 M8x35mm screw and M8 lock-nut set.



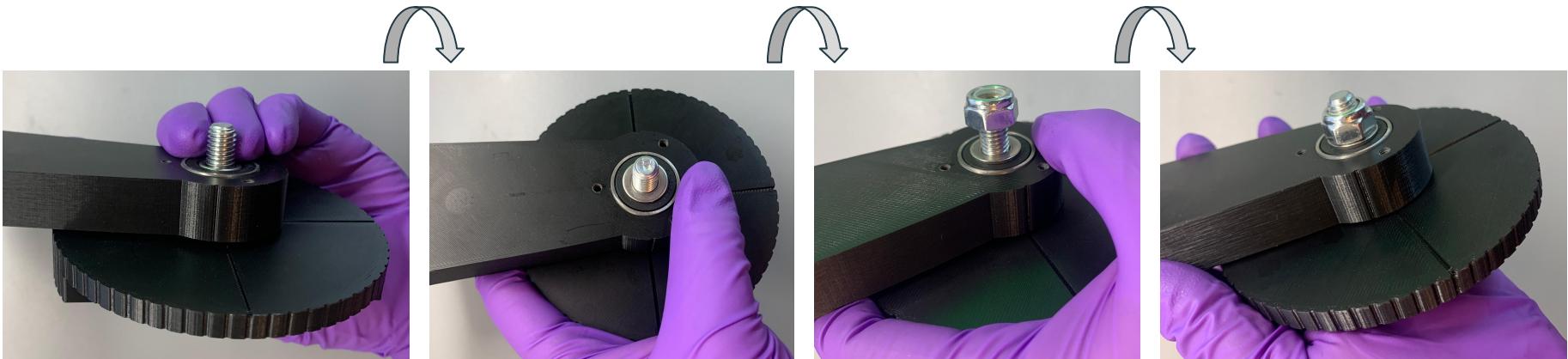
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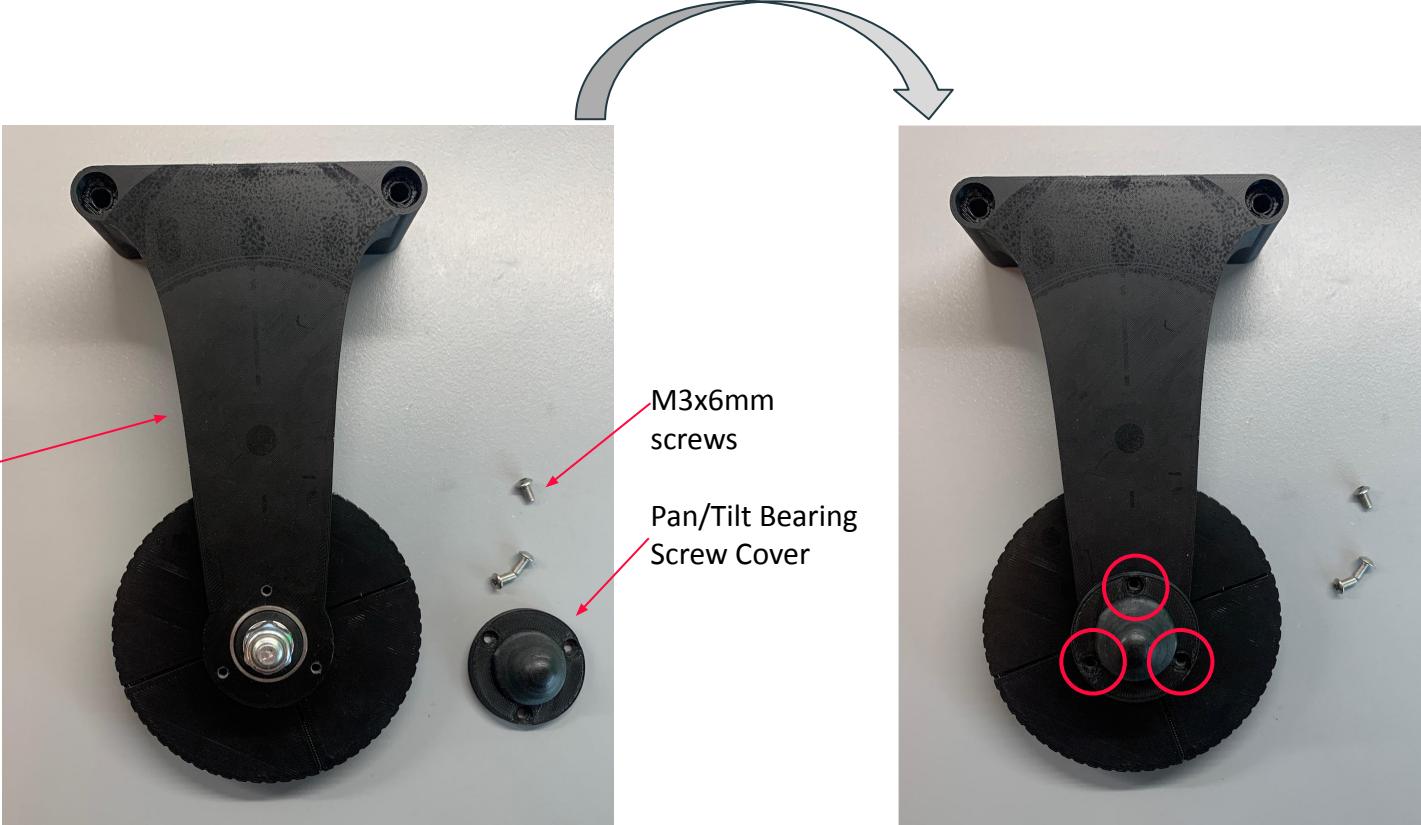
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Attach bearing side tilt shoulder plate to the pan/tilt hanger arm with 2 M8 bearings and 3 to 4 spacers (1 or 2 spacers between the bearings, 1 spacer between the shoulder and plate and 1 spacer between the lock-nut and shoulder) and 1 M8x35mm screw and M8 lock-nut set.

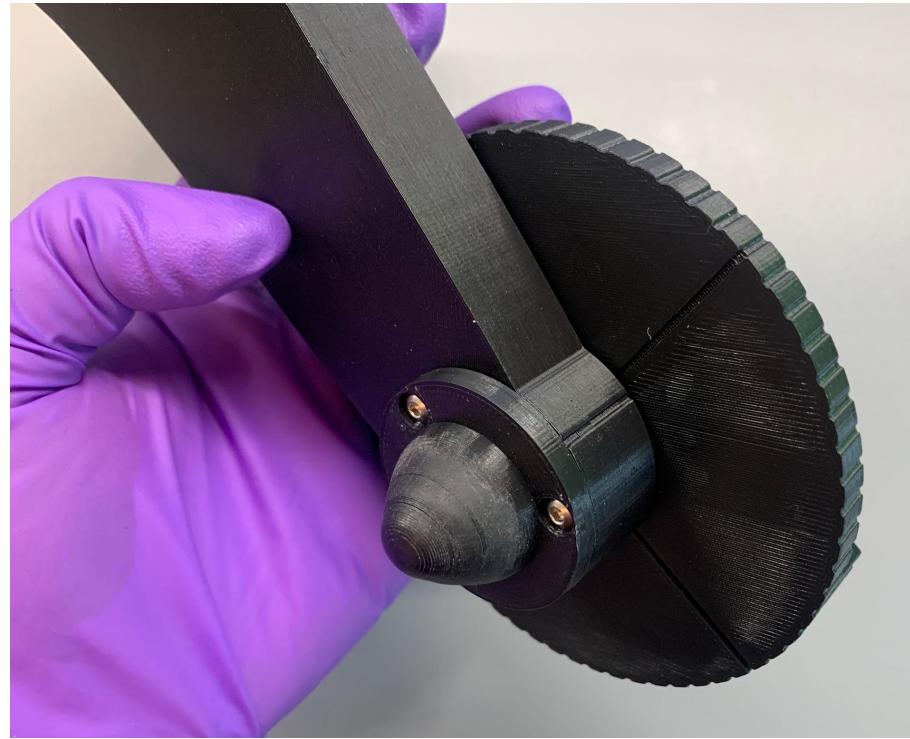


Assembled
Pan/Tilt
Hanger Arm

M3x6mm
screws

Pan/Tilt Bearing
Screw Cover

Attach pan/tilt bearing screw cover with 3 M3x6mm screws.

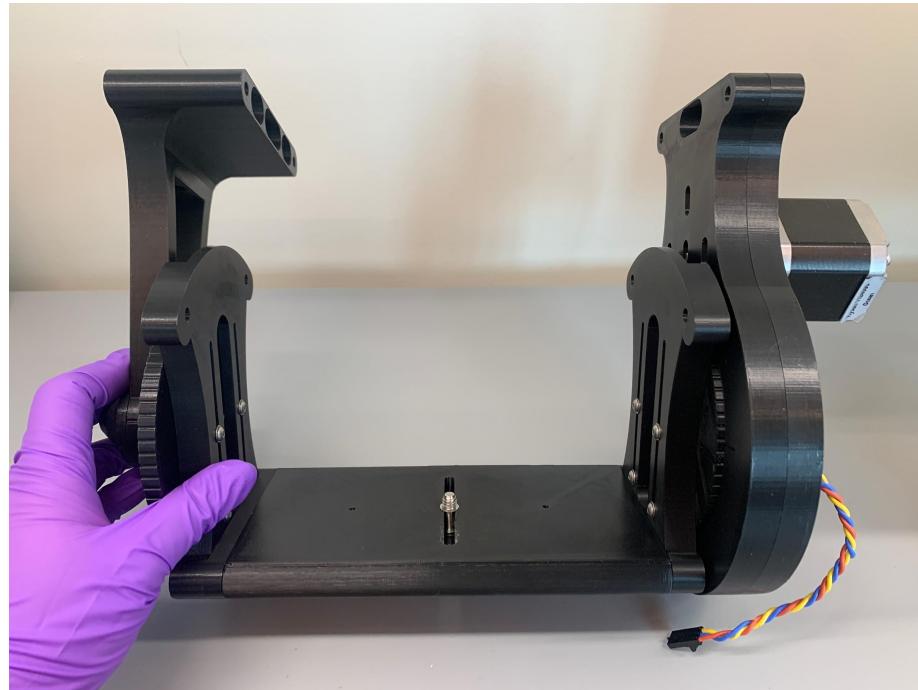


Attach pan/tilt bearing screw cover with 3 M3x6mm screws.

Line up the holes on the bearing-side tilt shoulder plate with the spaces in the sliding tilt hanger. Put the screws in the middle and bottom two holes.



Attach the bearing side tilt shoulder to the sliding tilt hanger using 4 M3x12mm screws and washers.



Attach the bearing side tilt shoulder to the sliding tilt hanger using 4 M3x12mm screws and washers.

Assemble Pan Mechanism



x4



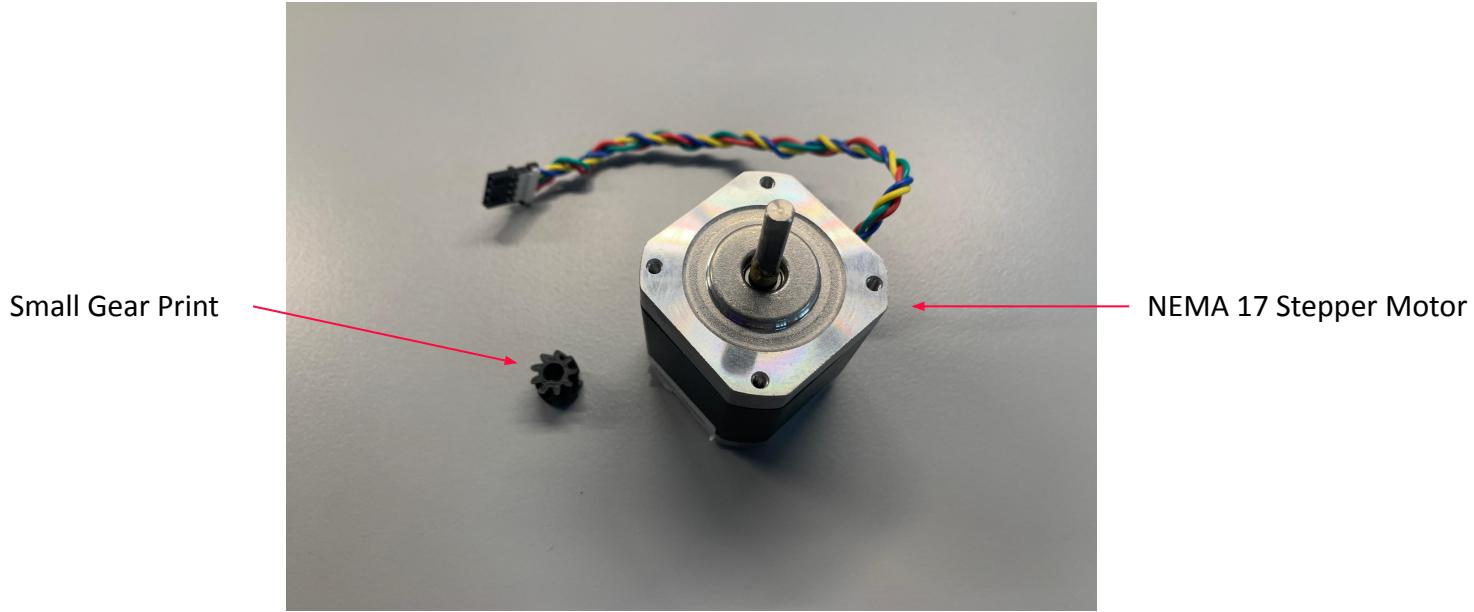
Insert 4 M3 nuts in the inner pan housing without a motor mount.



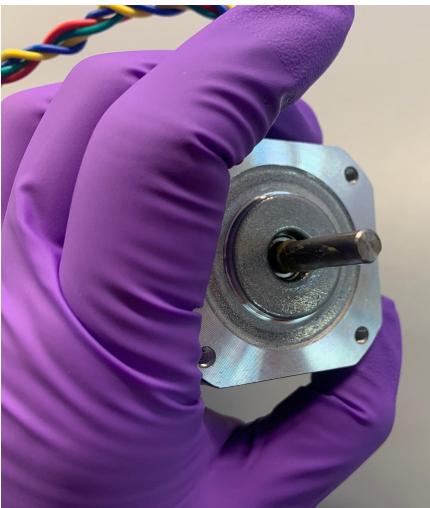
x1



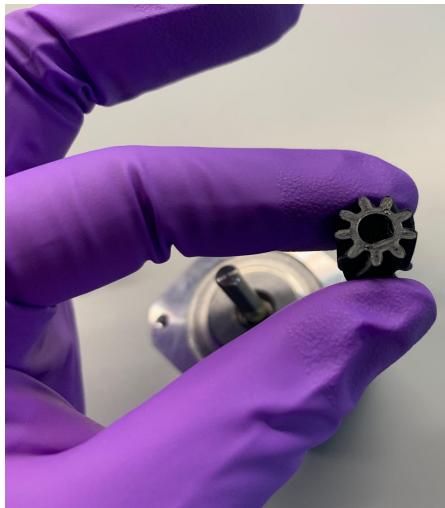
Insert radial magnet 0.236"DIA X 0.098"H CYL into large gear (use a bit of double sided tape if it is not snug).



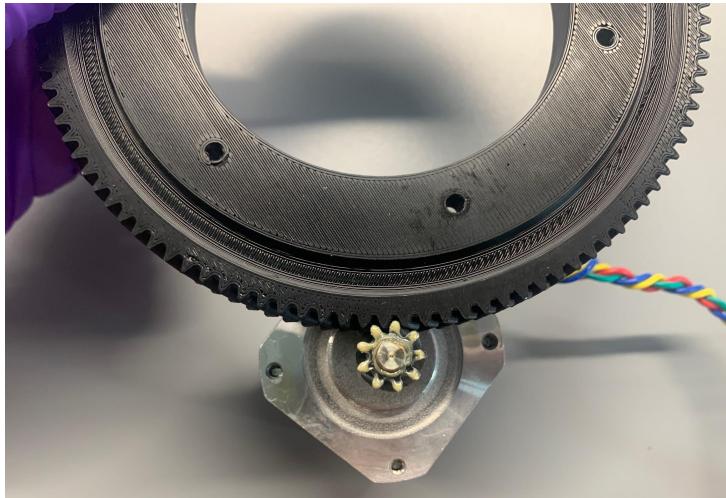
Slide small gear into NEMA 17 shaft, greased and oriented to couple with the tilt gear.



There is a flat edge on the shaft of the motor that will match up to the hole shape of the small gear.



Slide small gear into NEMA 17 shaft, greased and oriented to couple with the tilt gear.



For the correct orientation, the grooves of the small gear should fit into the groove of the large gear with magnet hole side do.

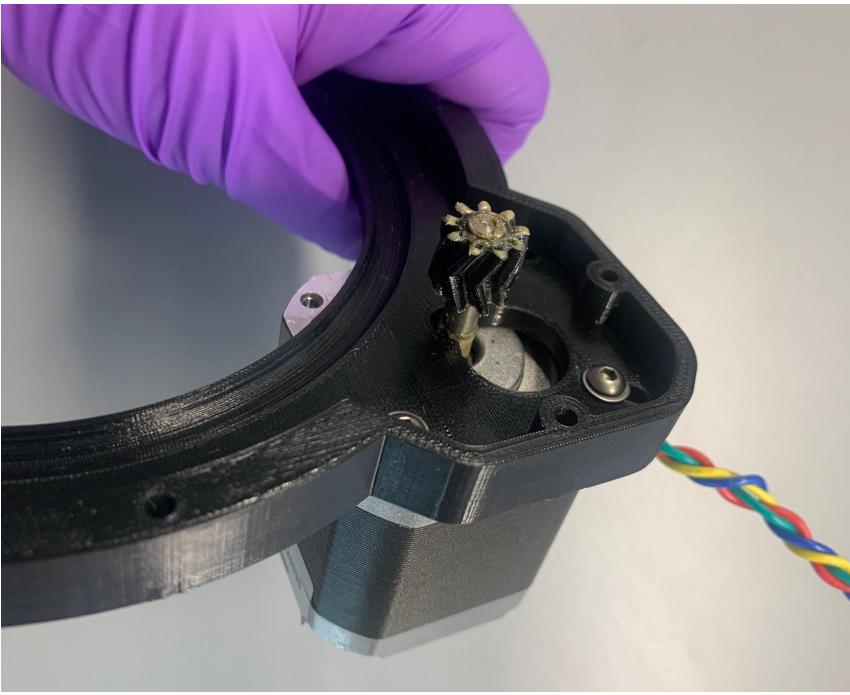
Slide small gear into NEMA 17 shaft, greased and oriented to couple with the tilt gear.



Attach the motor to the outer pan housing with 3 M3x10mm screws (8mm screws can be used).



Attach the motor to the outer pan housing with 3 M3x10mm screws (8mm screws can be used). Position the motor so that the attached cord is upwards, either on the left or right side.



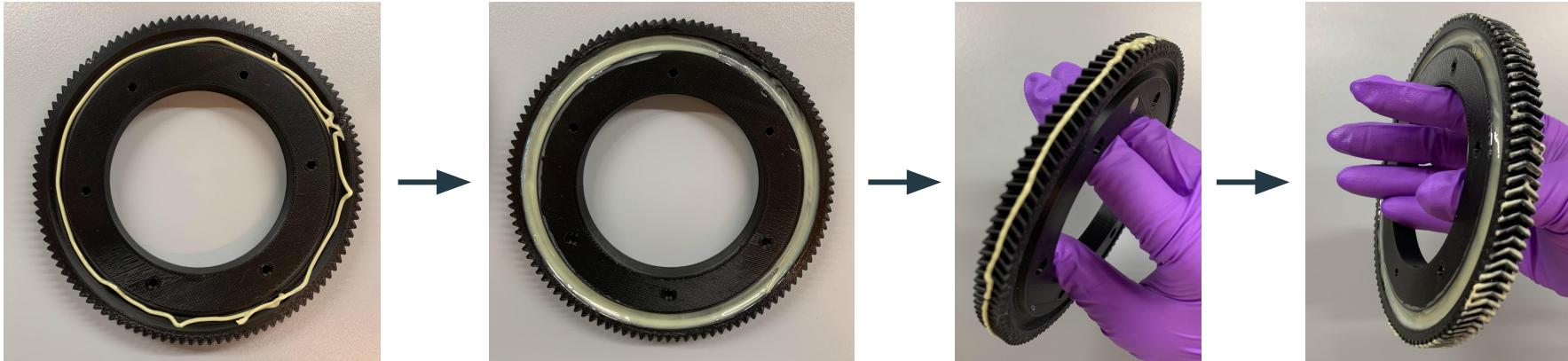
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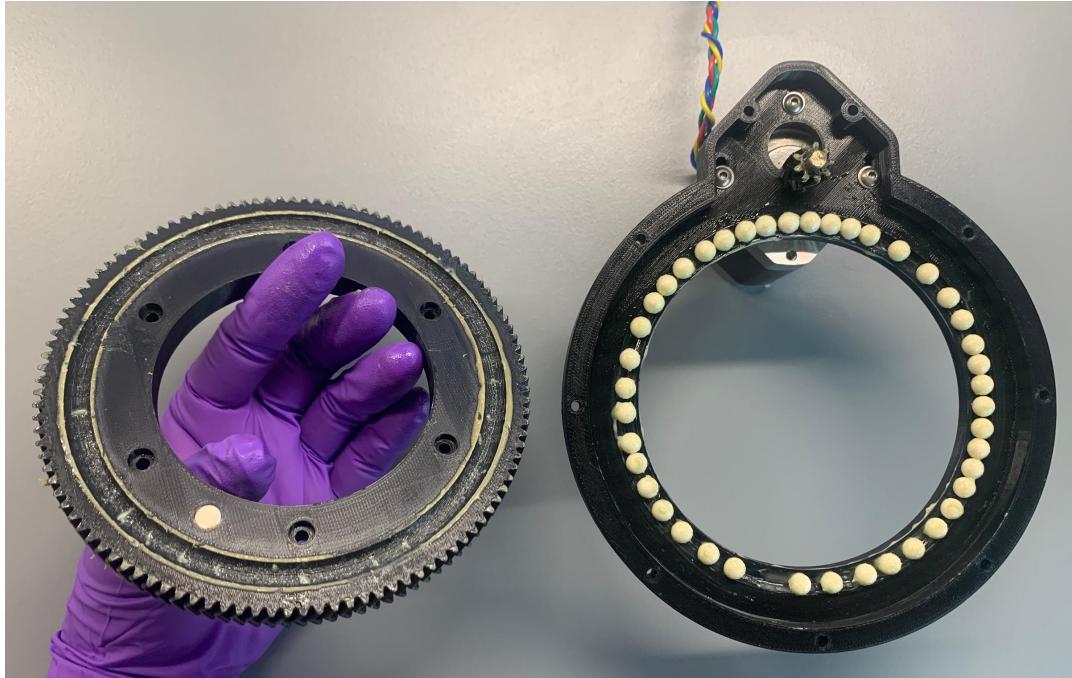
Attach inner and outer pan housings together, encasing a greased large gear with 42 bearing balls on each greased side raceway, with 5 M3x18mm (or 16mm) screws.



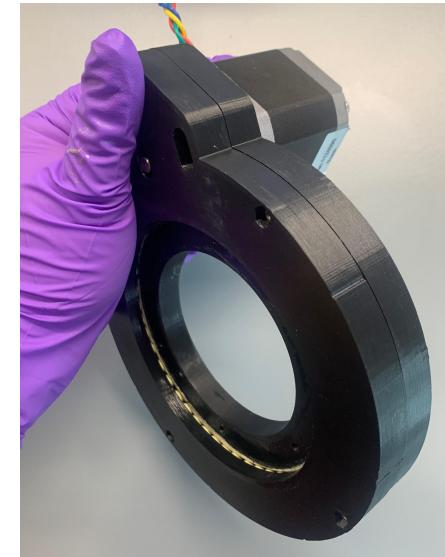
High Temperature Spindle Grease



Attach inner and outer motor housings together, encasing a greased large gear with 42 bearing balls on each greased side raceway, with 5 M3x18mm (or 16mm) screws.

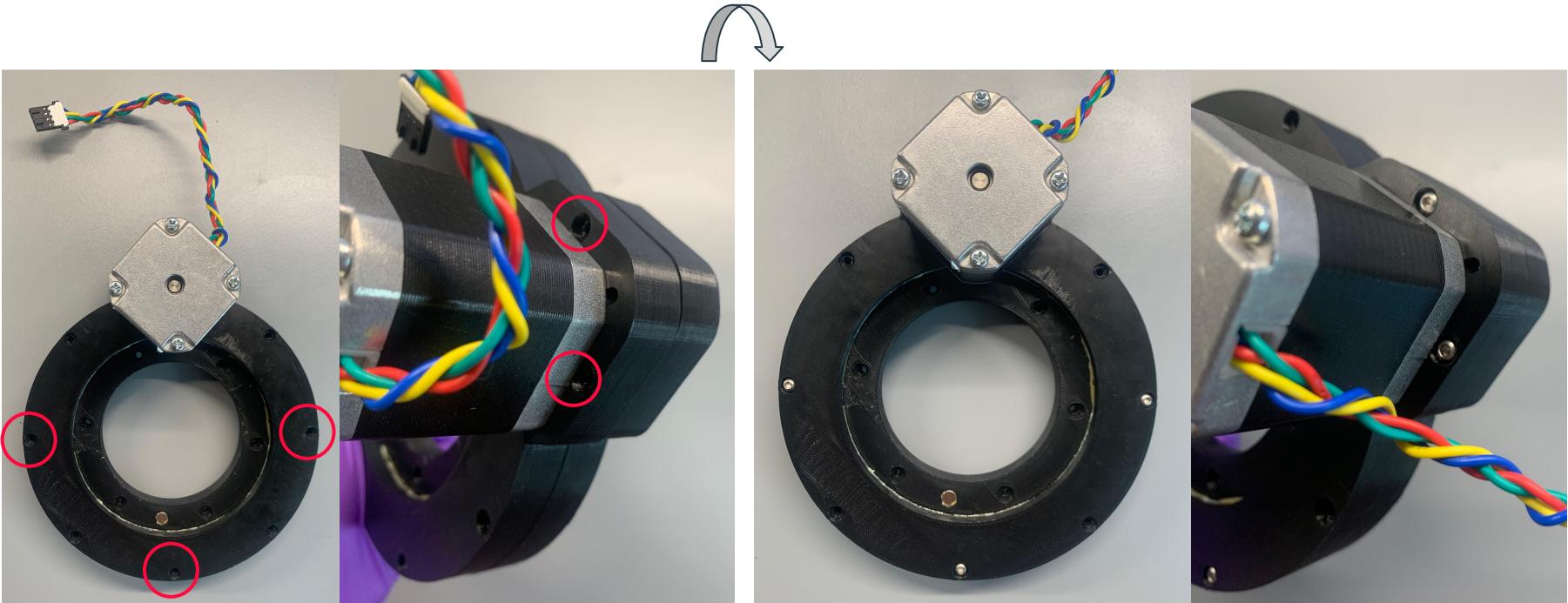


Attach inner and outer pan housings together, encasing a greased large gear with 42 bearing balls on each greased side raceway, with 5 M3x18mm (or 16mm) screws.



Attach inner and outer pan housings together, encasing a greased large gear with 42 bearing balls on each greased side raceway, with 5 M3x18mm (or 16mm) screws.

Press the inner and outer pan housing very tightly together when putting in the final screws.

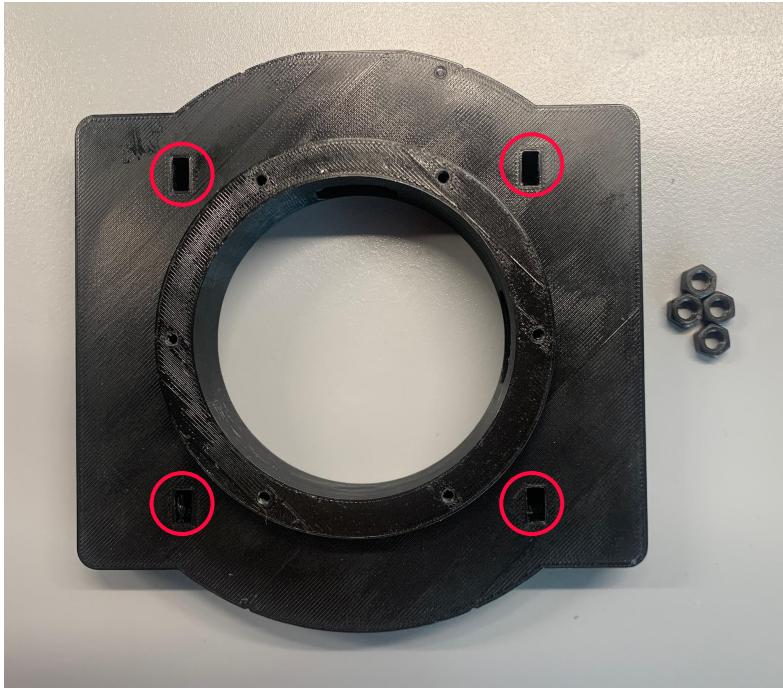


Attach inner and outer motor housings together, encasing a greased large gear with 42 bearing balls on each greased side raceway, with 8 M3x16mm screws (18mm can also be used).

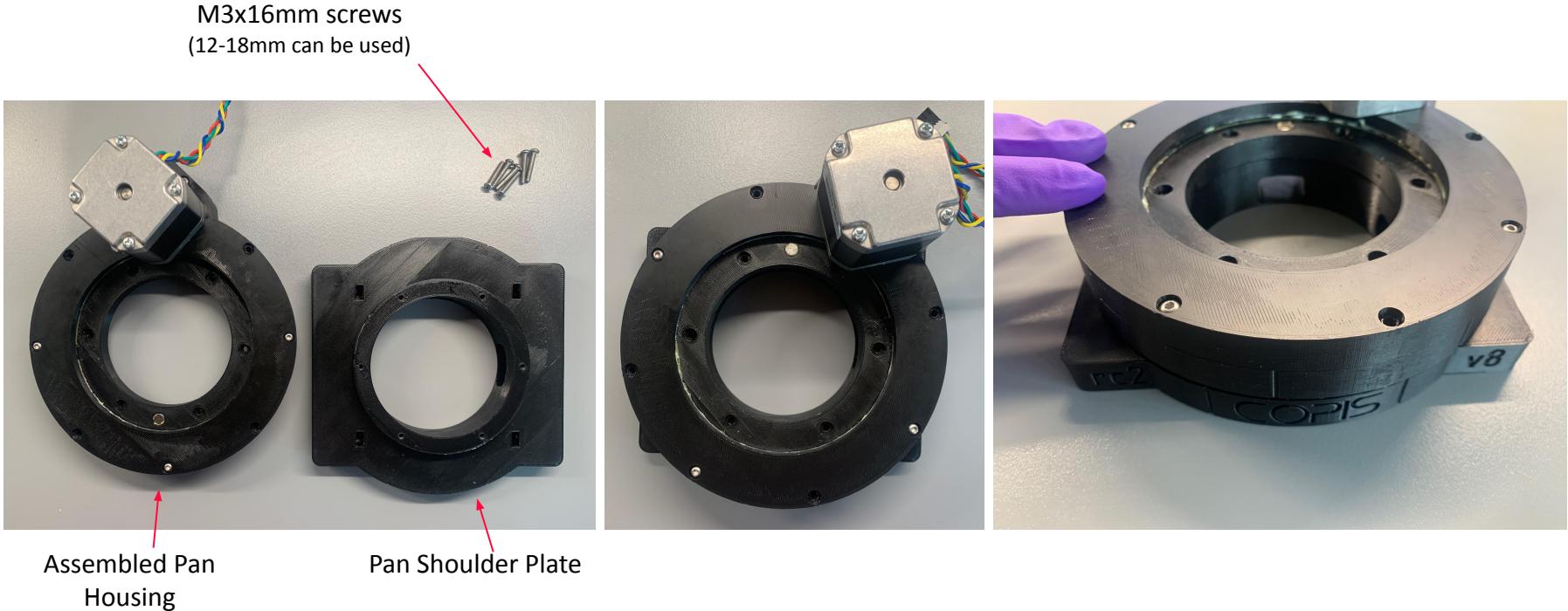
Make sure to take notice that there is a difference between the pan shoulder plate for the top and bottom camera gantries.



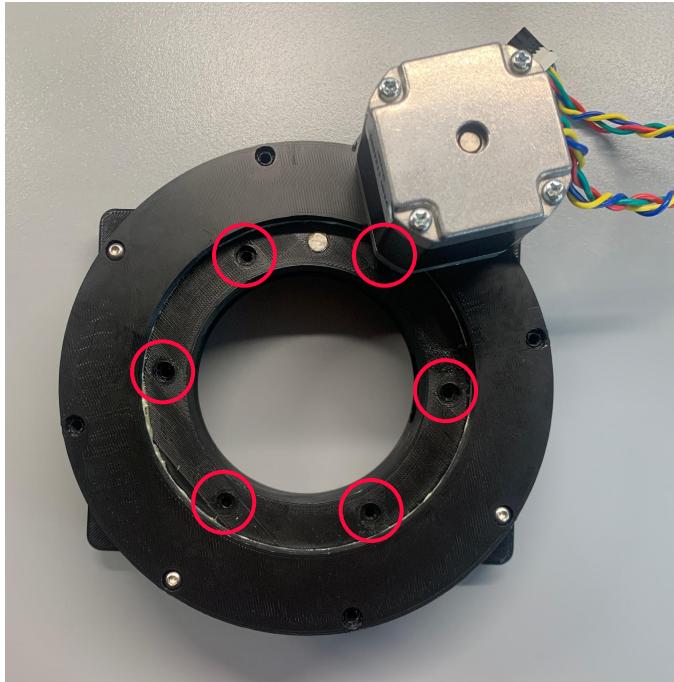
Insert 4 M5 nuts into the captive nut slots of the pan shoulder. Use a screw to "lock" them in place into the inner recess of the slot.



Insert 4 M5 nuts into the captive nut slots of the pan shoulder. Use a screw to "lock" them in place into the inner recess of the slot.



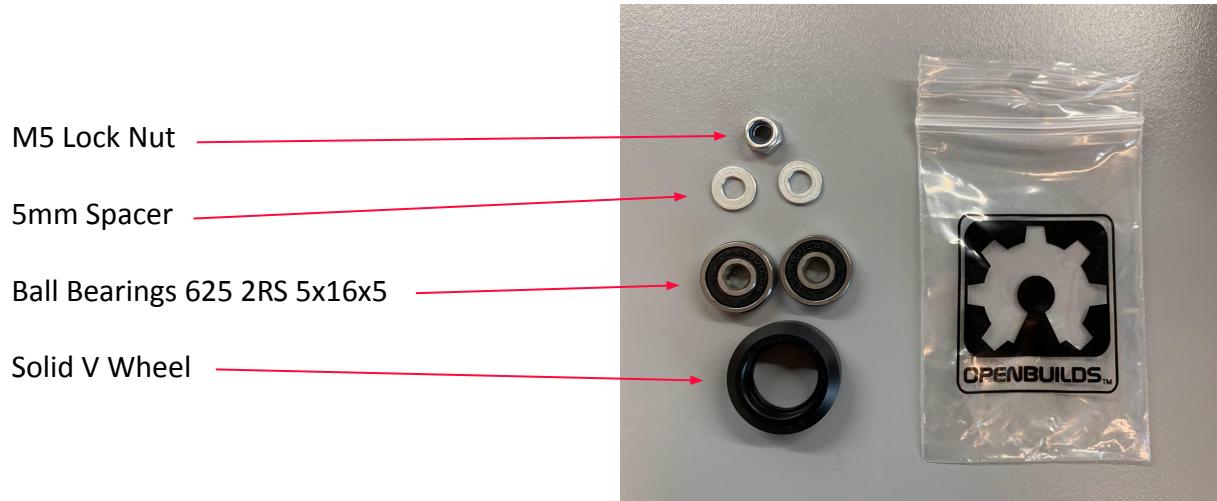
Attach the pan shoulder to the pan housing with 6 M3x16mm screws (12-18mm can be used). Position the magnet closest to the motor.



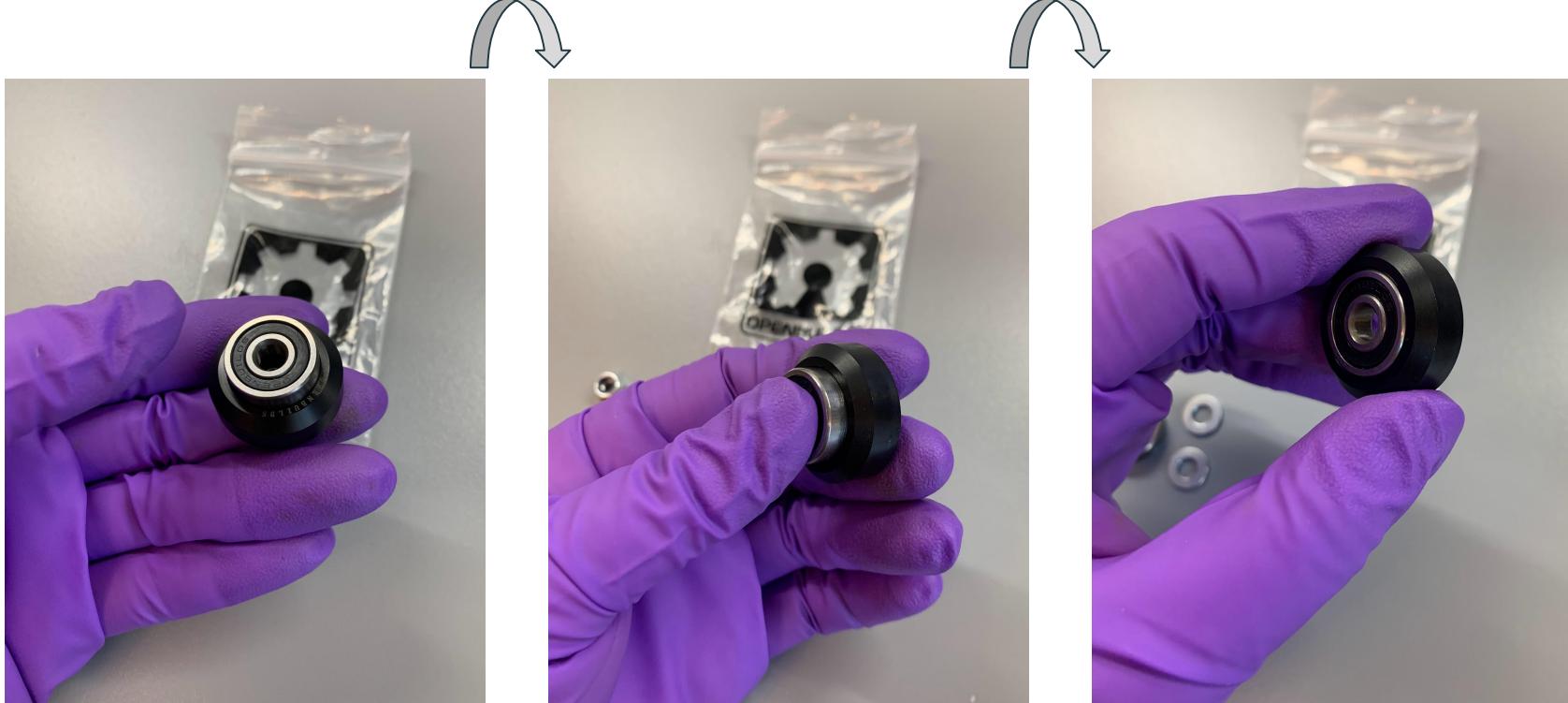
Attach the pan shoulder to the pan gear with 6 M3x16mm screws (12-18mm can be used). Position the magnet closest to the motor.



Assemble the Solid V Wheel



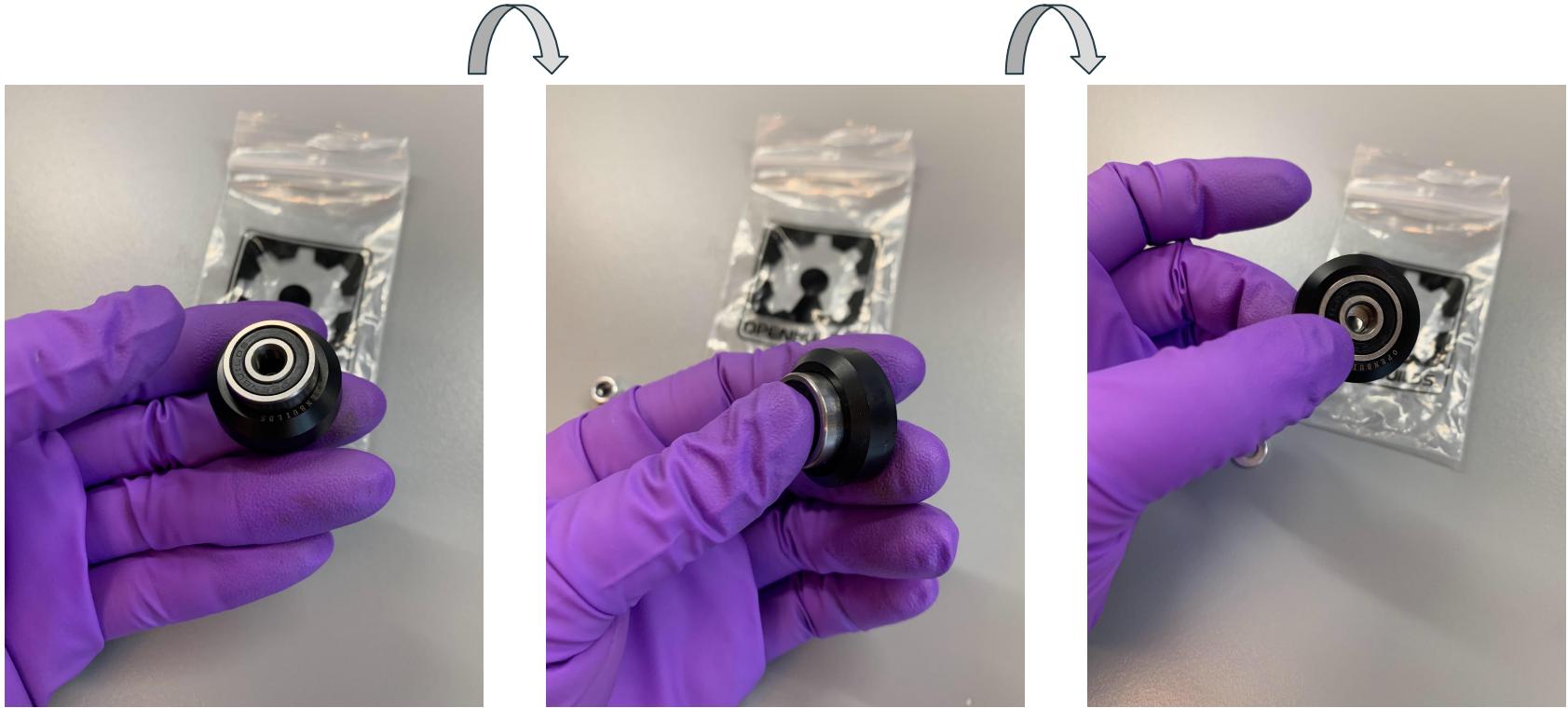
The wheel assembly comes in a package that includes the necessary hardware for a single wheel.



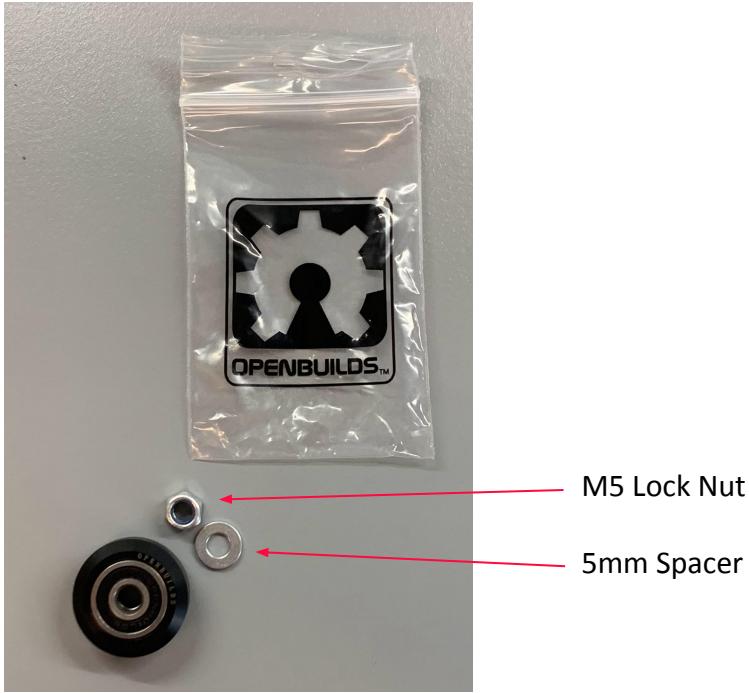
Push 1 of the ball bearings into one side of the solid v wheel.



Place 1 spacer on the inside of the wheel.

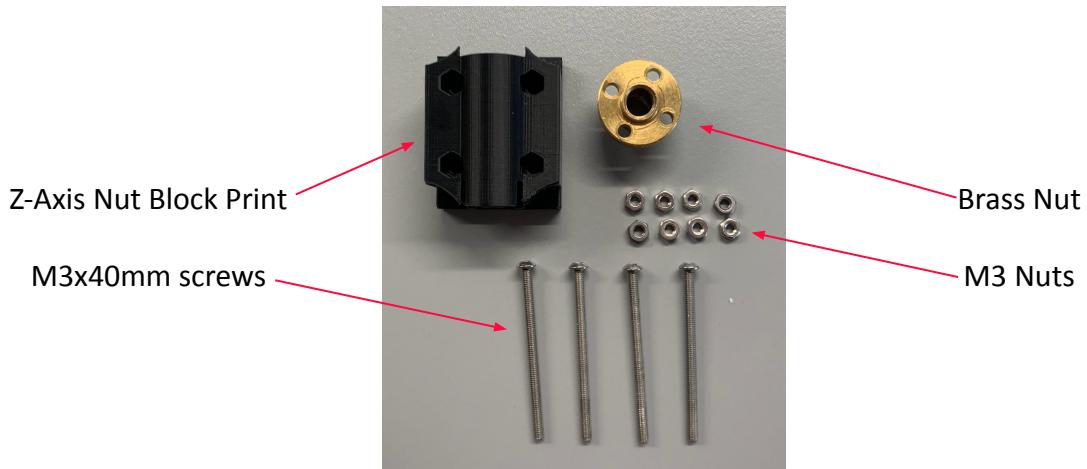


Push the other ball bearing into the other side of the wheel.

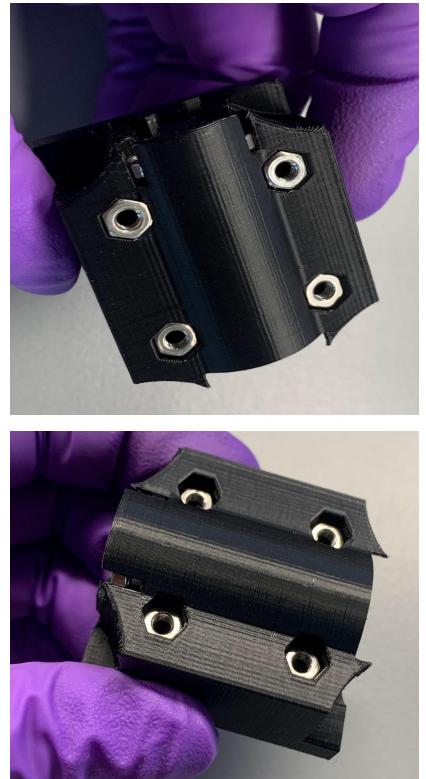
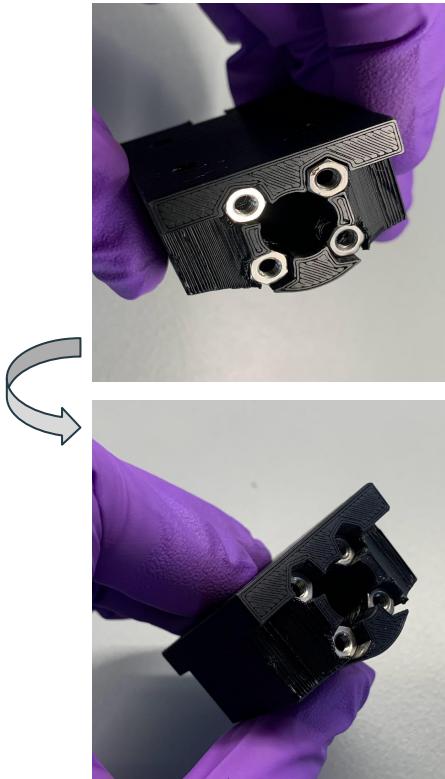


The leftover spacer and lock nut will be used when attaching the wheel to the 2060 and 2040 X/Z Plates

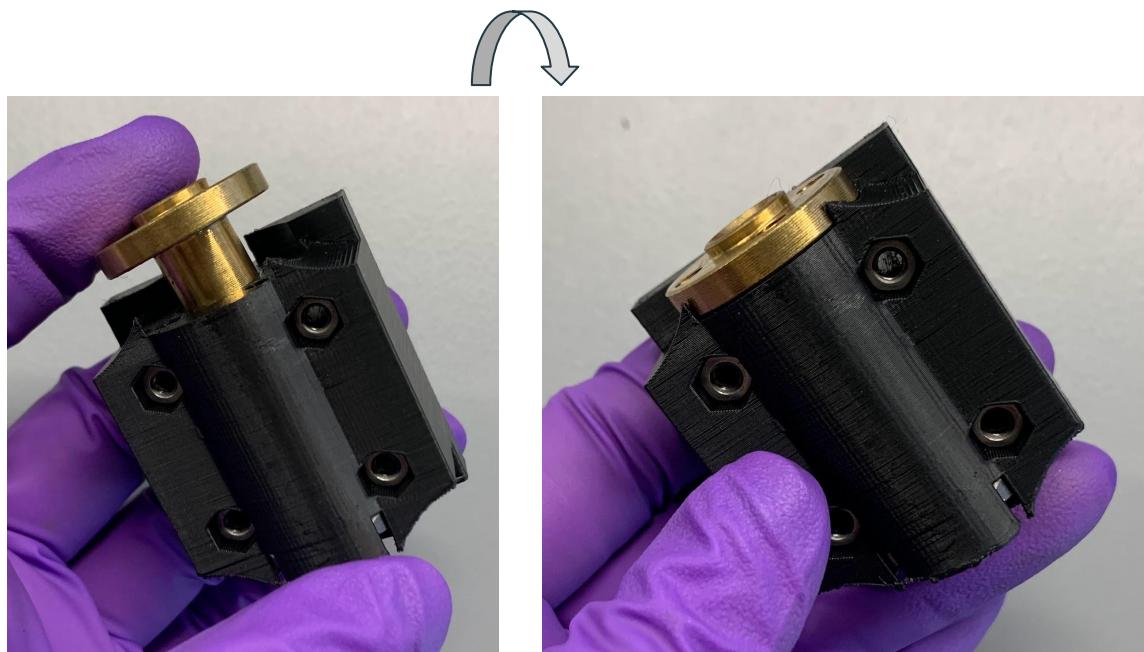
Assemble Z-Axis Nut Block



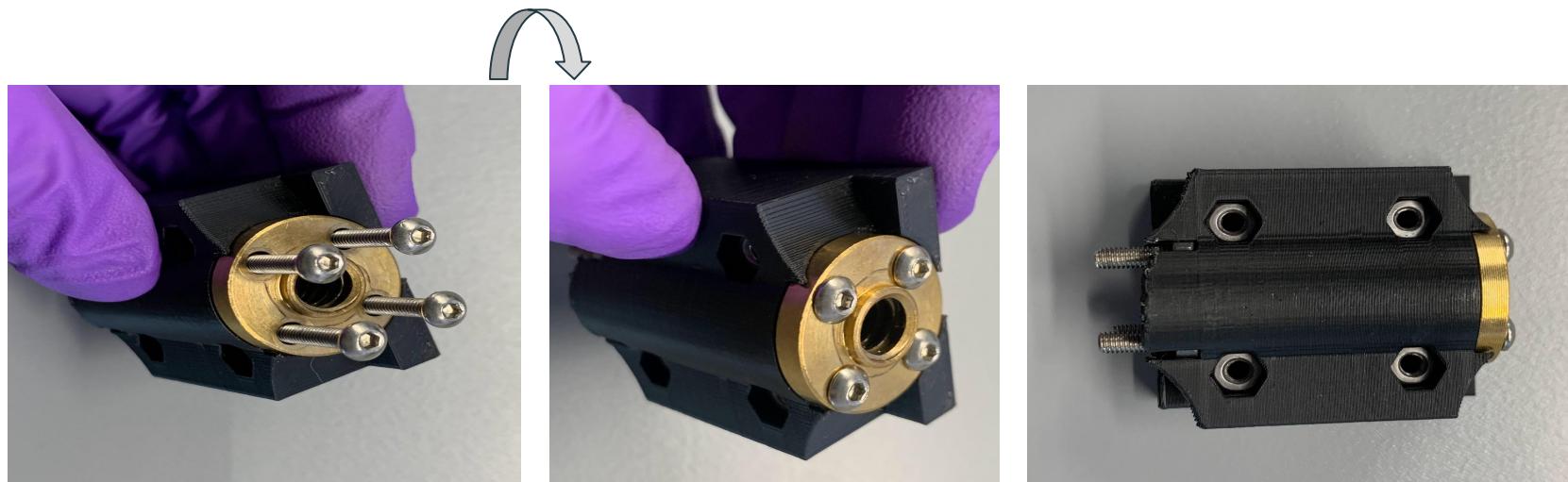
Inventory for Z-Axis Nut Block



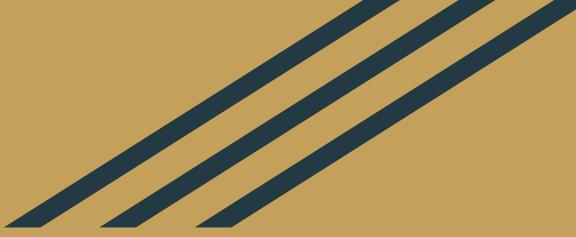
Insert 8 M3 nuts into the nut block.



Insert the brass nut into the nut block.

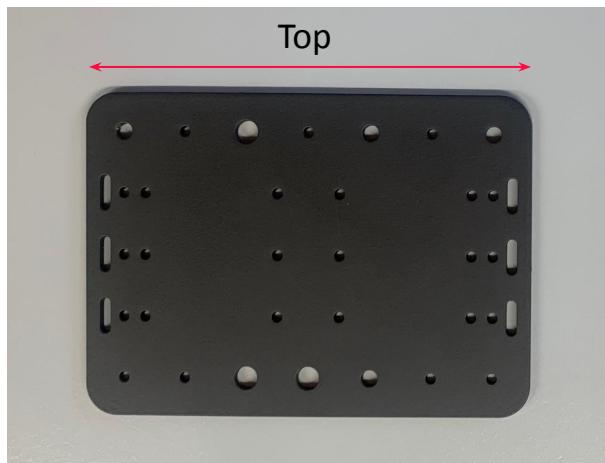


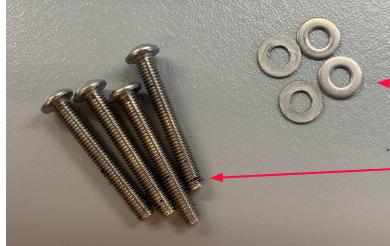
Secure the brass nut into the nut block with 4 M3x40mm screws.



Assemble 2060 X/Z Plate

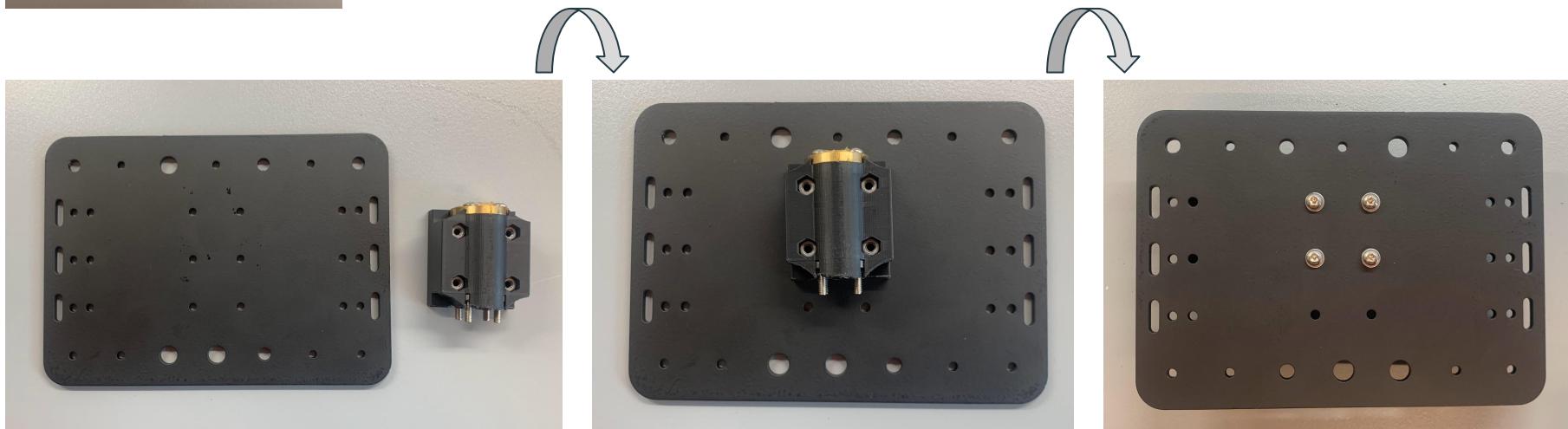
2060 X/Z Plate



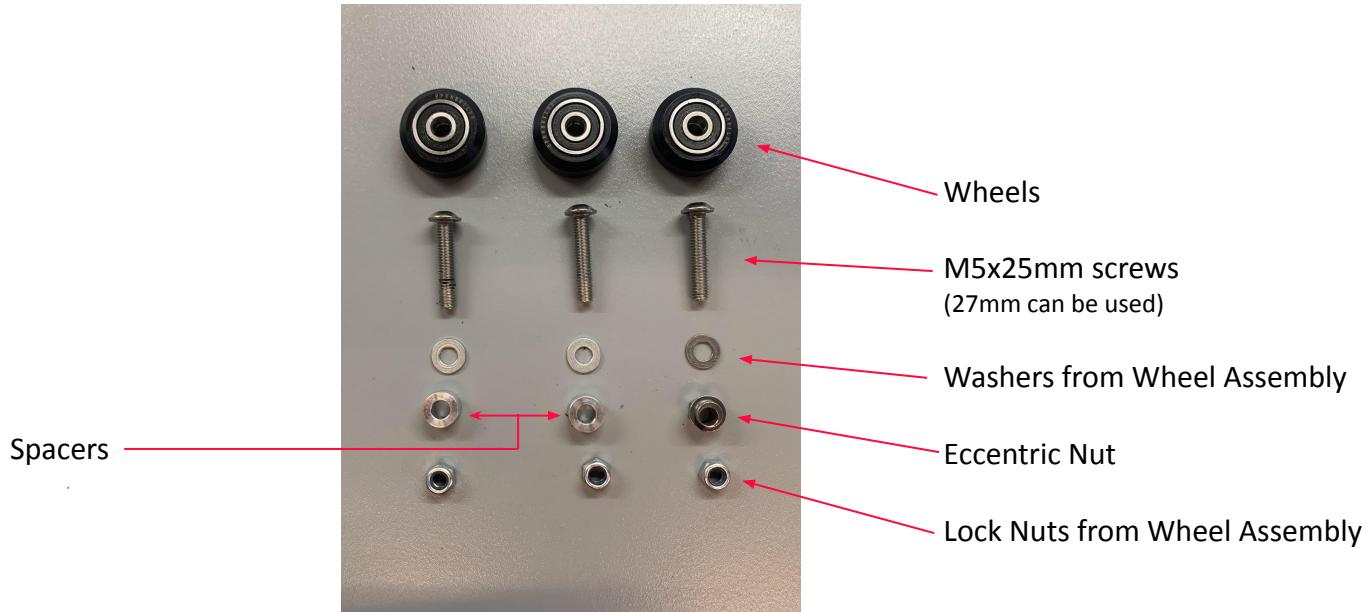


M3 washers

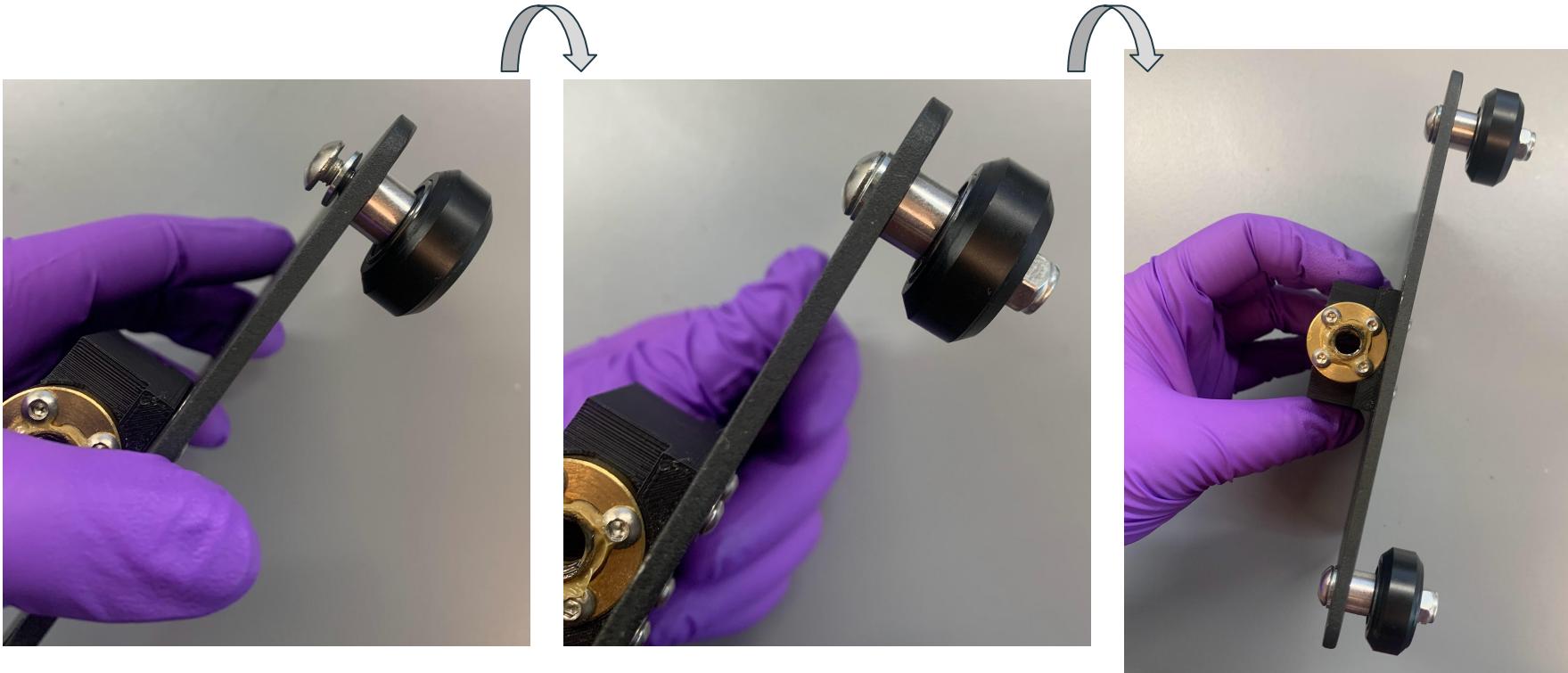
M3x22mm screws



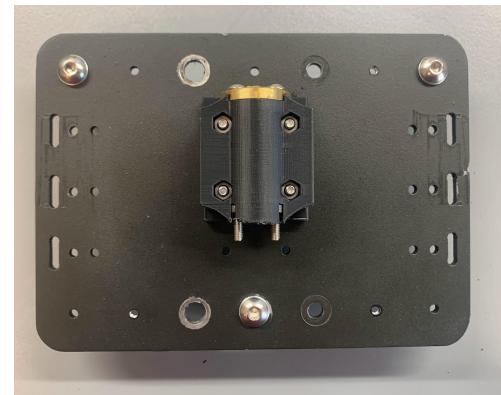
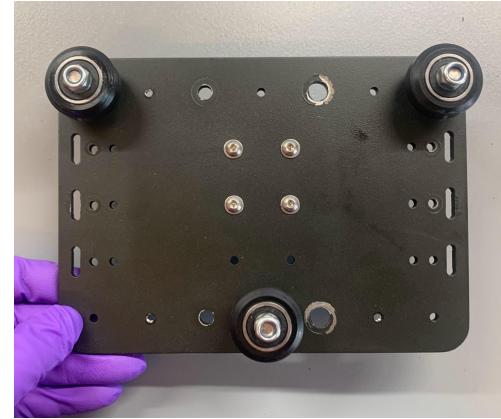
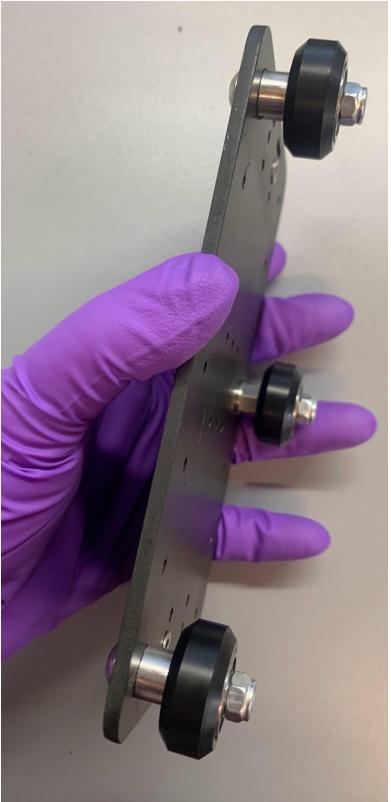
Attach the nut block to the 2060 X/Z plate with 4 M3x22mm screws and 4 M3 washers placed on the other side of the plate. It does not matter which side you first put it on. The brass nut of the nut block will go up towards the top of the plate.



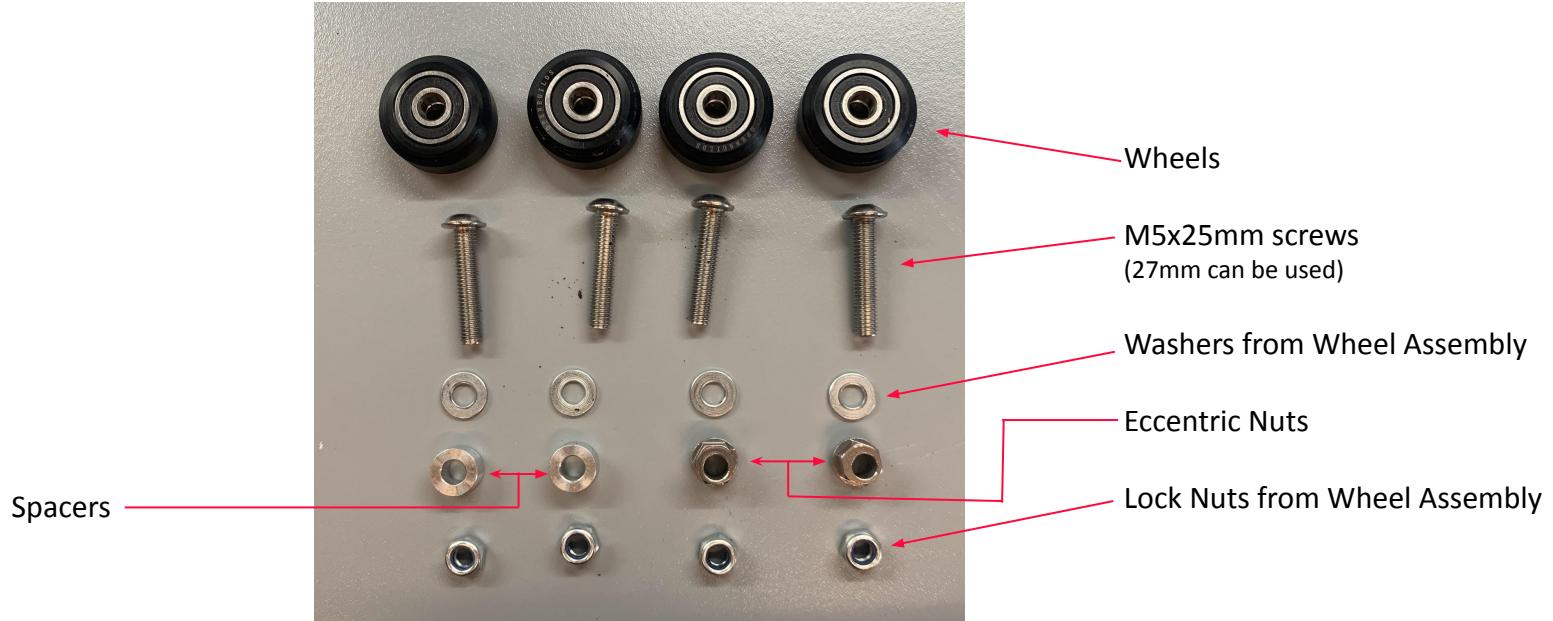
Use M5x25mm or 27mm screws for mounting each of the wheels.



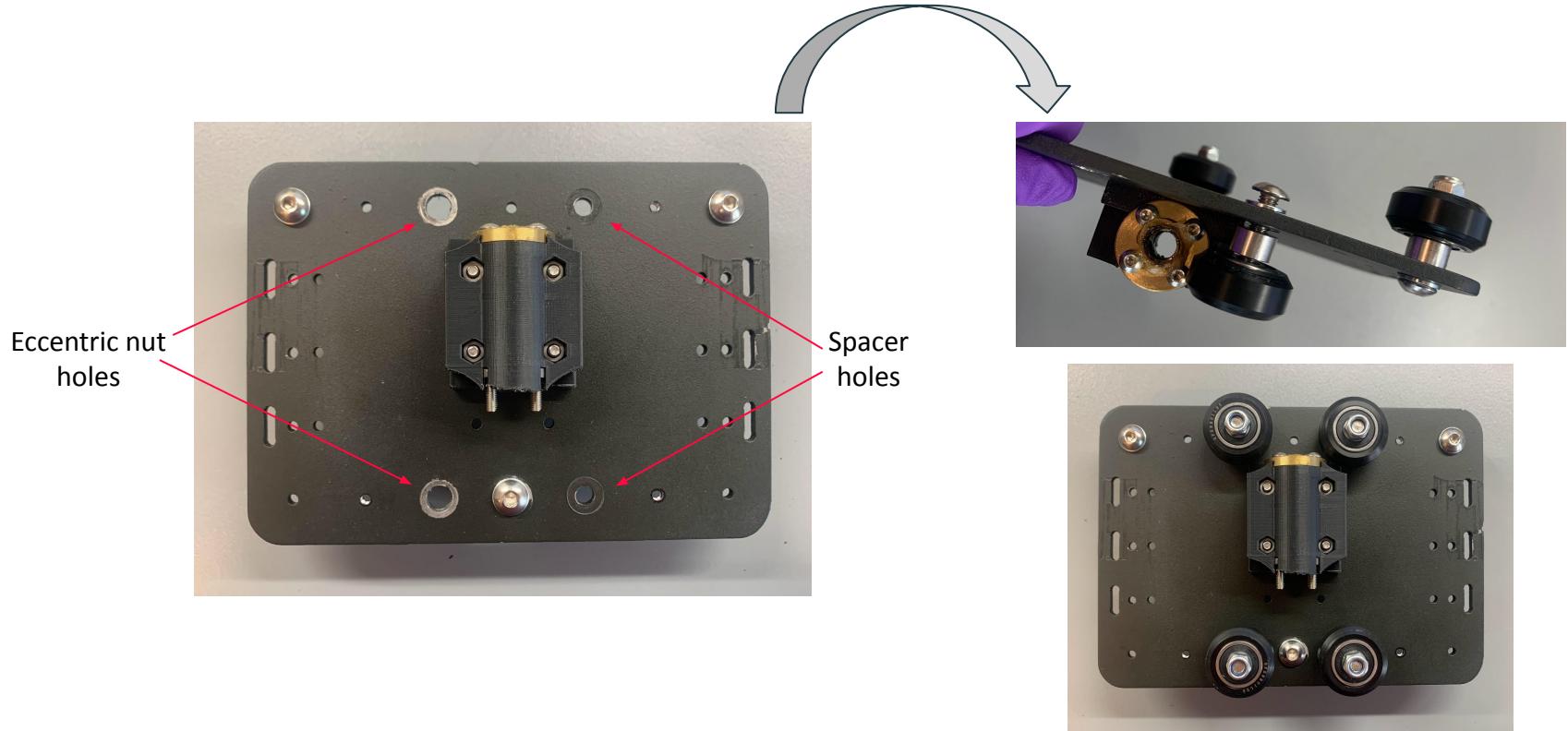
Attach 3 wheels on the outside, the 2 top ones with spacers and the bottom one with an eccentric nut.



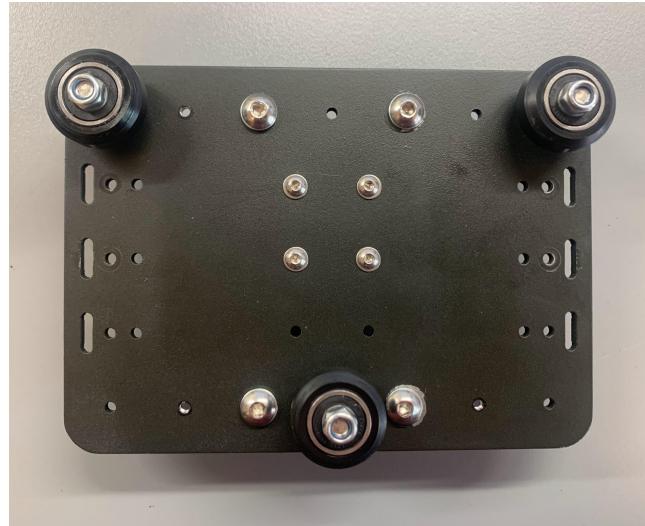
Attach 3 wheels on the outside, the 2 top ones with spacers and the bottom one with an eccentric nut. There is a bigger hole that will fit the eccentric nut at the bottom.



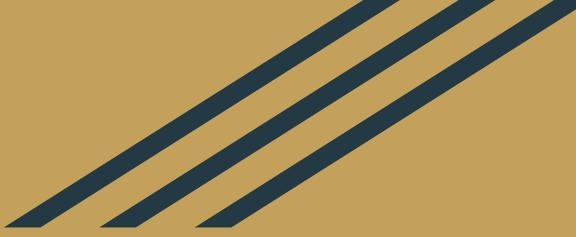
Attach 4 wheels on the inside, 2 with spacers and 2 with eccentric nuts, in a vertical arrangement. There are bigger holes that will fit the eccentric nuts on one side.



Attach 4 wheels on the inside, 2 with spacers and 2 with eccentric nuts, in a vertical arrangement. There are bigger holes that will fit the eccentric nuts on one side.

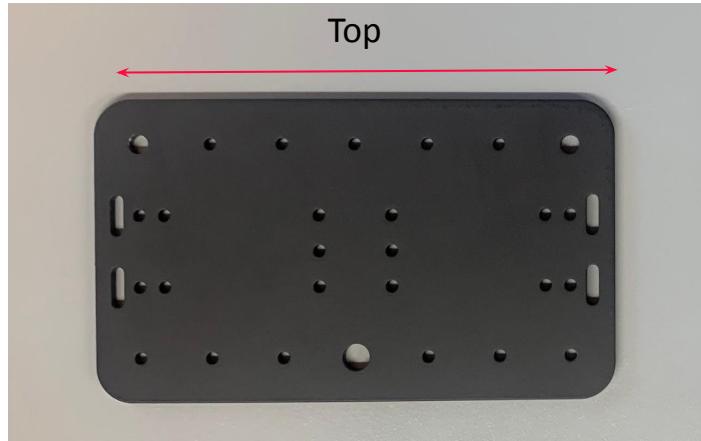


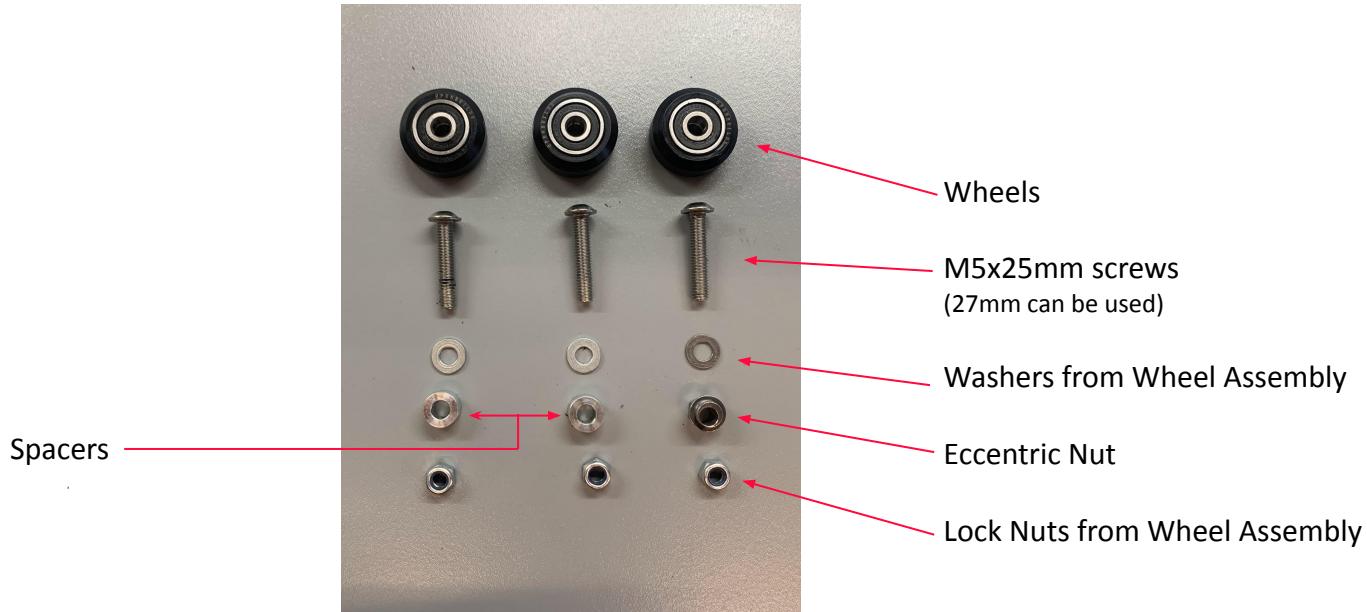
Attach 4 wheels on the inside, 2 with spacers and 2 with eccentric nuts, in a vertical arrangement. There are bigger holes that will fit the eccentric nuts on one side.



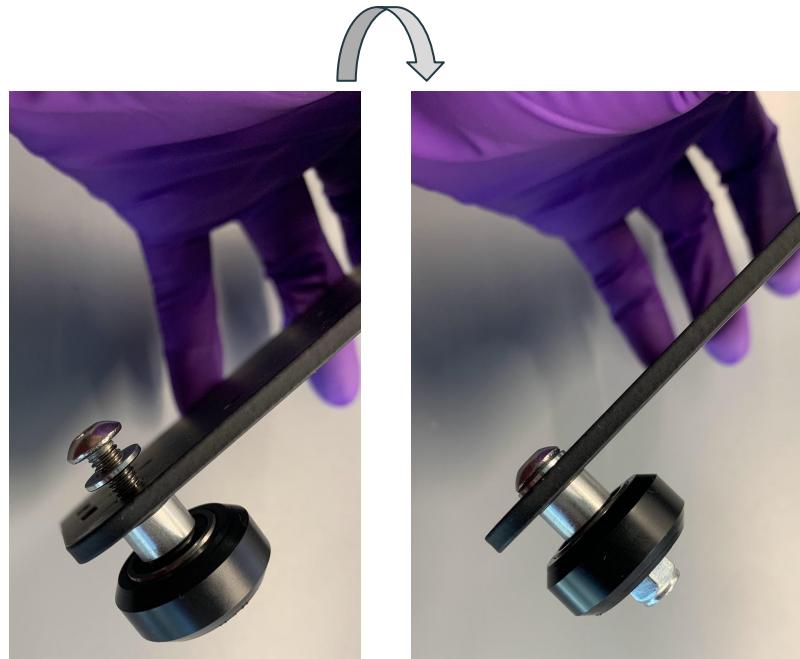
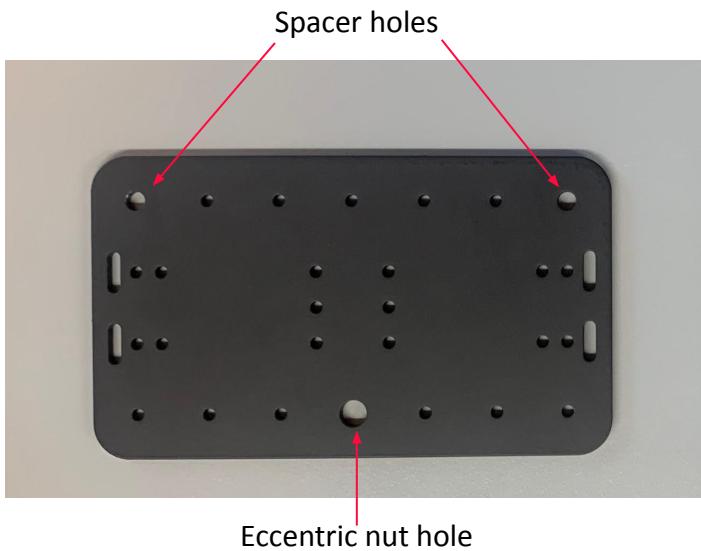
Assemble 2040 X/Z Plate

2040 X/Z Plate

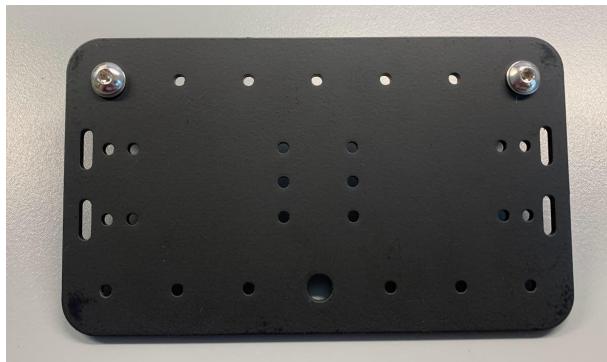
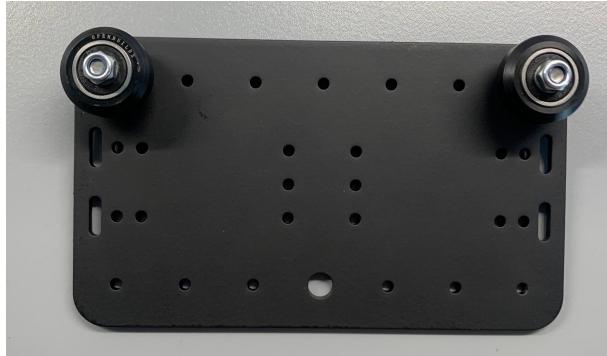
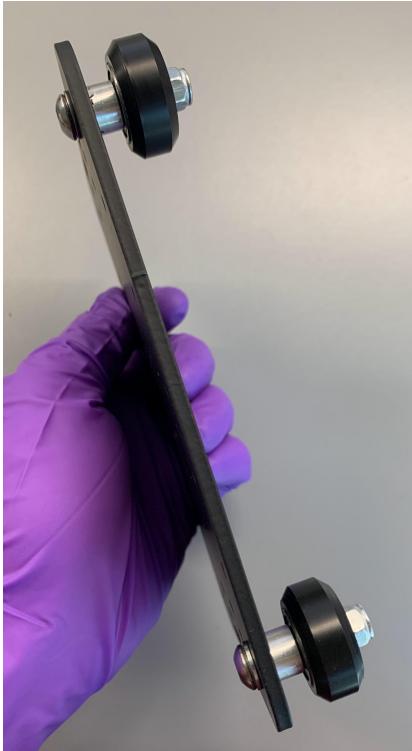




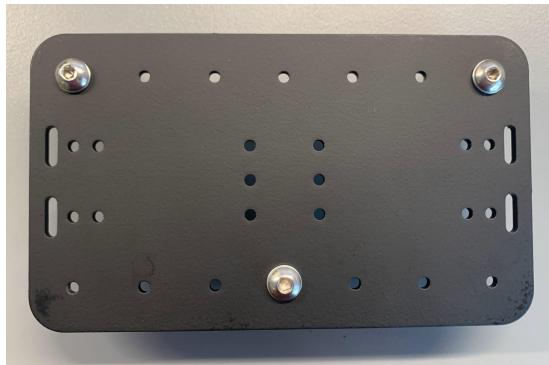
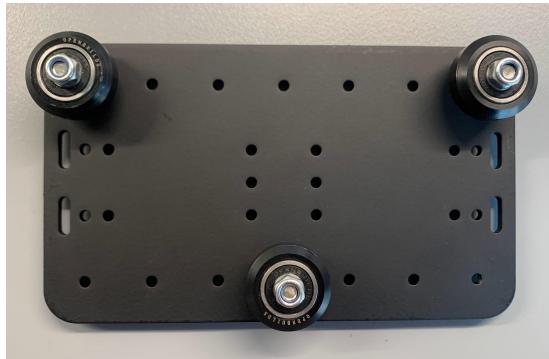
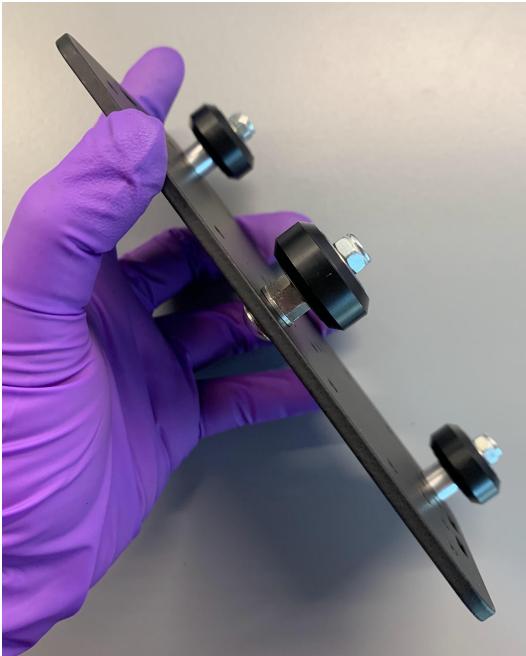
Use M5x25mm or 27mm screws for mounting each of the wheels.



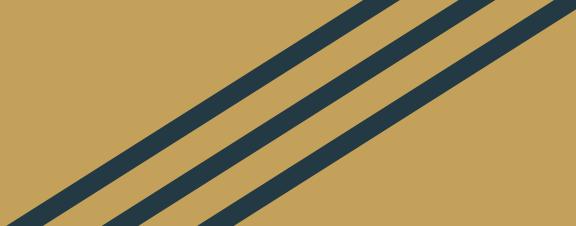
Attach 3 wheels on the outside, the 2 top ones with spacers and the bottom one with an eccentric nut. There is a bigger hole that will fit the eccentric nut at the bottom.



Attach 3 wheels on the outside, the 2 top ones with spacers and the bottom one with an eccentric nut. There is a bigger hole that will fit the eccentric nut at the bottom.



Attach 3 wheels on the outside, the 2 top ones with spacers and the bottom one with an eccentric nut. There is a bigger hole that will fit the eccentric nut at the bottom.



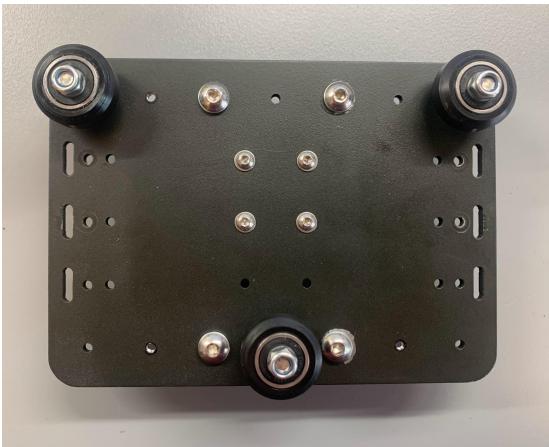
Bind 2060 X/Z Plate and 2040 X/Z Plate (TOP)

*Please note that the assembly for the 2060 and 2040 X/Z Plates are the same for the top and bottom camera gantries. The only difference is the orientation when binding them together.

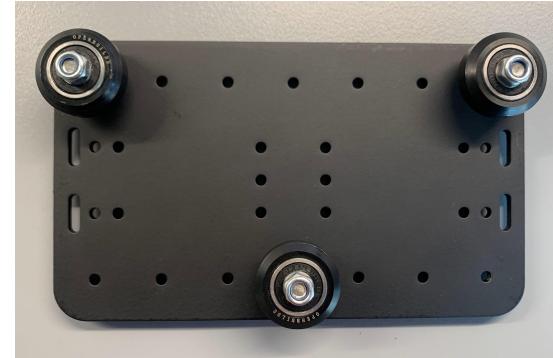




Completed
2060 X/Z
Plate



Completed
2040 X/Z
Plate



X/Z Plate Spacers

Has Magnet
Hole Shaft

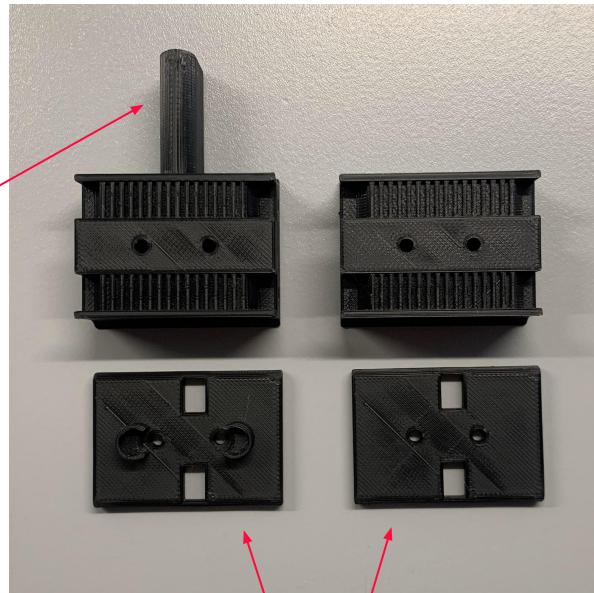
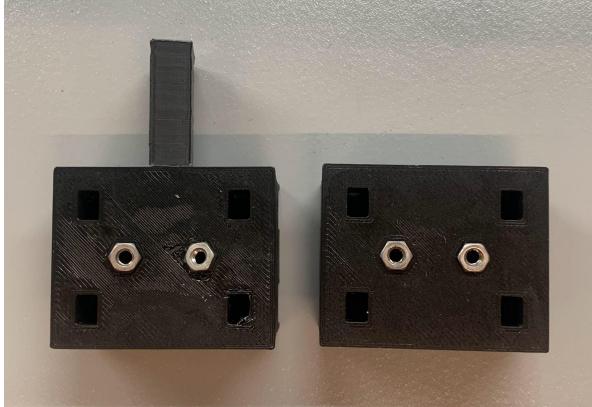
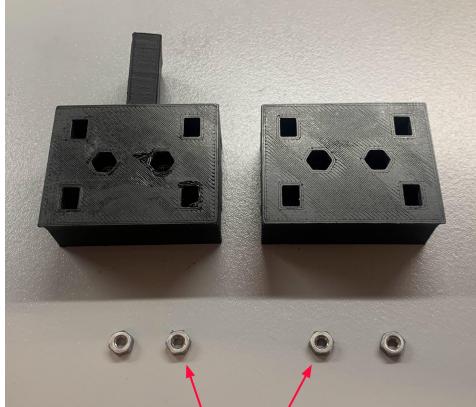
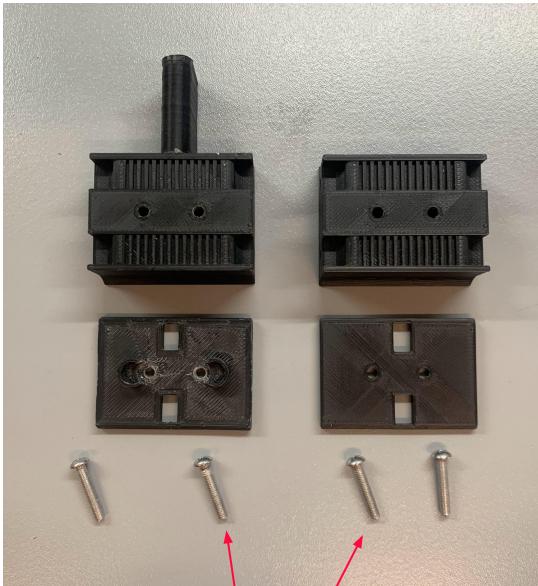


Plate Spacer Lids

X/Z Plate Spacers



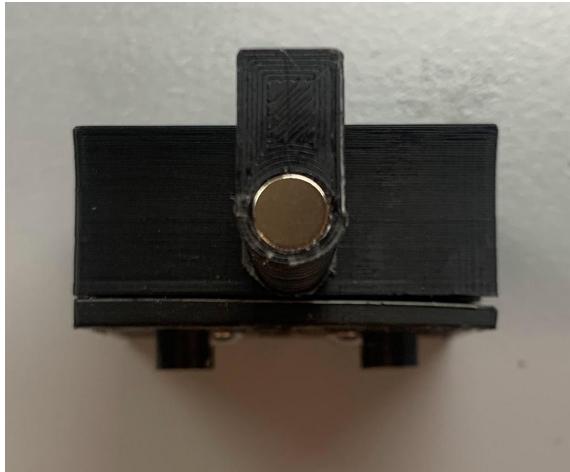
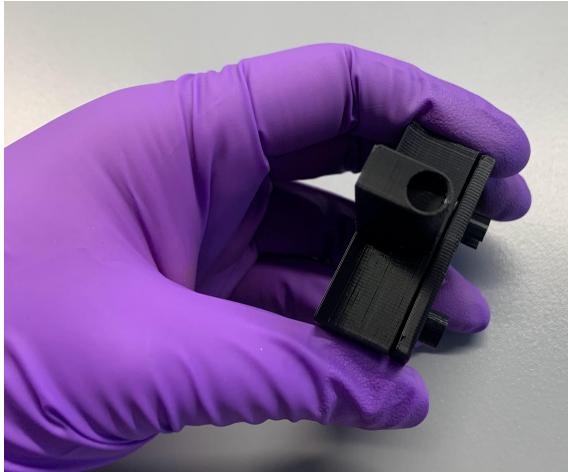
Insert 2 M3 nuts into the back of each X/Z plate spacer.



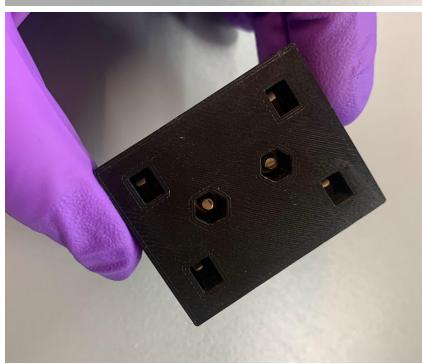
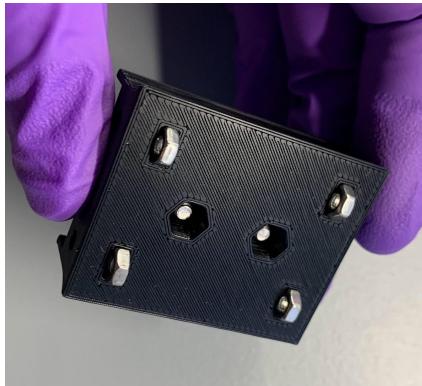
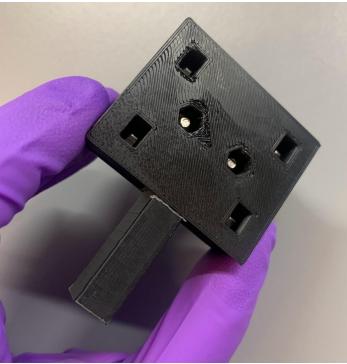
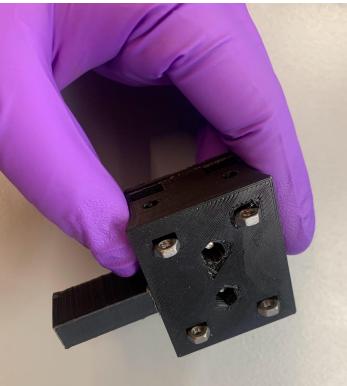
Attach the plate spacer lids with 2 M3x16mm screws per plate spacer.



x1

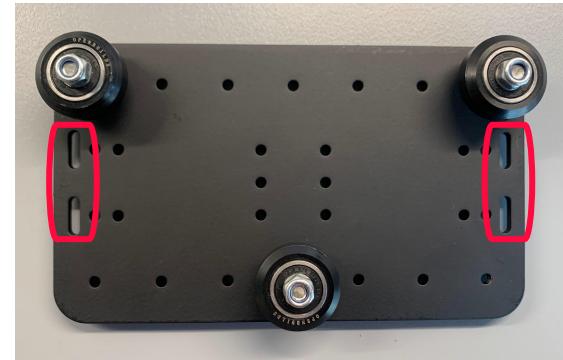
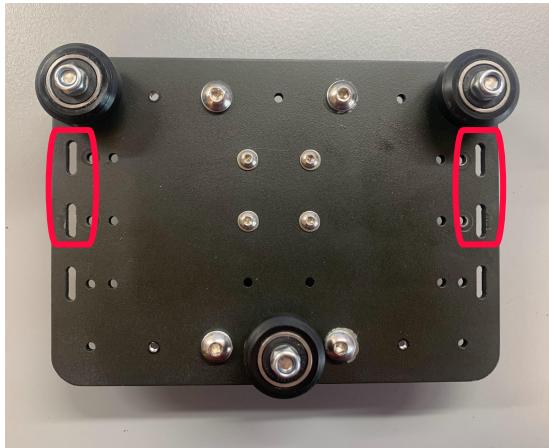
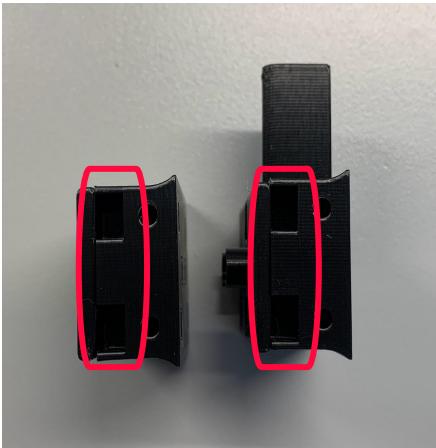


Insert radial magnet 0.236"DIA X 0.098"H CYL into the plate spacer with a magnet hole shaft.



The M3 nuts may fall out when trying to position the plate spacers for binding the plates together. Do one at a time and make sure they are in when putting in the screws.

Slide 4 M3 nuts into the captive nut chamber on the back per plate spacer. Turning the nut should help it slide into the rectangle holes.



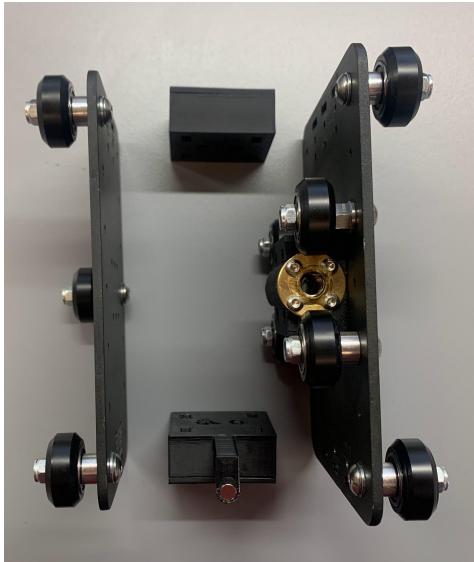
The rectangles on both sides of the plate spacers should match up with the oblong holes on the plates.

Bind the 2040 plate to the 2060 plate with 2 plate spacers (1 with a magnet hole shaft and 1 without) using 4 M3 washers and 4 M3x12mm screws (up to 18 mm can also be used).

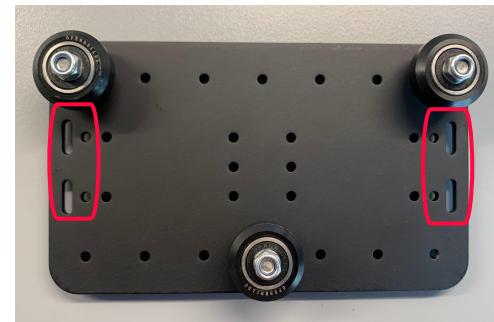
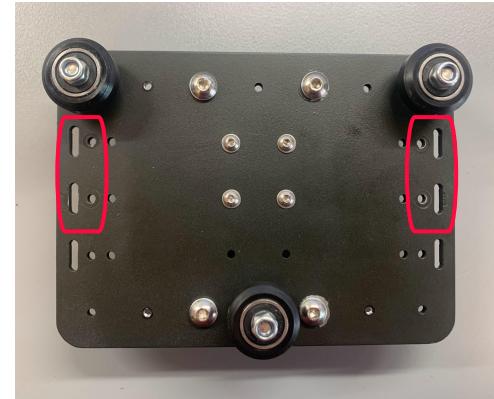


M3x12mm screws (Up to 18mm can also be used)

M3 washers



The plate spacer with the magnet hole shaft should be facing up towards the four top wheels and use the top two holes on both the 2060 and 2040 plates (closest to the four top wheels) for the screws.

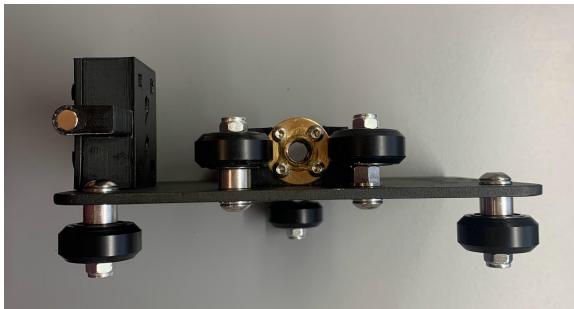


Bind the 2040 plate to the 2060 plate with 2 plate spacers (1 with a magnet hole shaft and 1 without) using 4 M3 washers and 4 M3x12mm screws (up to 18mm can also be used).



M3x12mm screws (Up to 18mm can also be used)

M3 washers

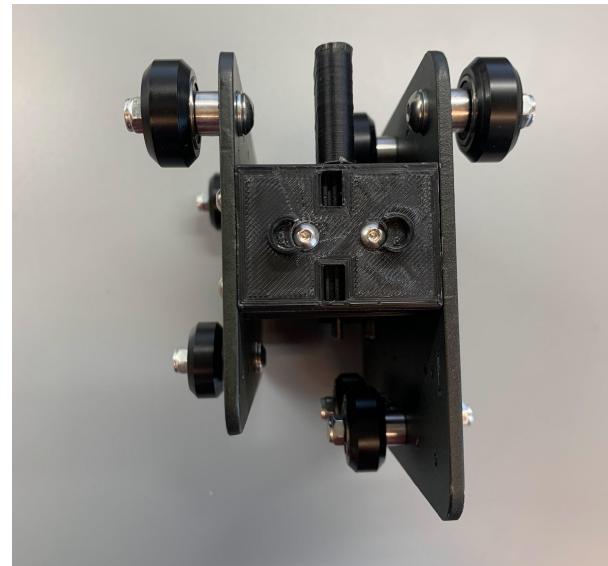
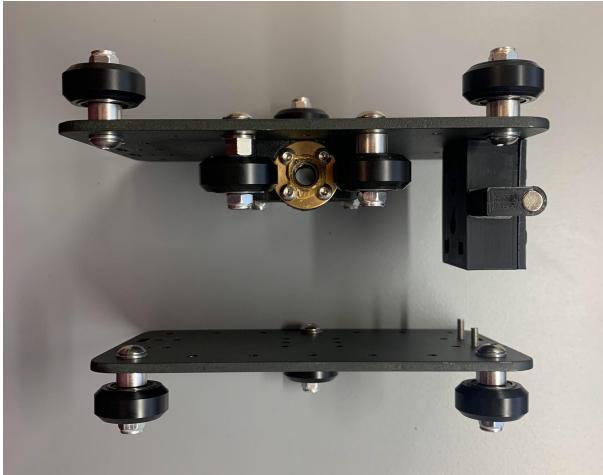


Bind the 2040 plate to the 2060 plate with 2 plate spacers (1 with a magnet hole shaft and 1 without) using 4 M3 washers and 4 M3x12mm screws (up to 18 mm can also be used).



M3x12mm screws (Up to 18mm can also be used)

M3 washers

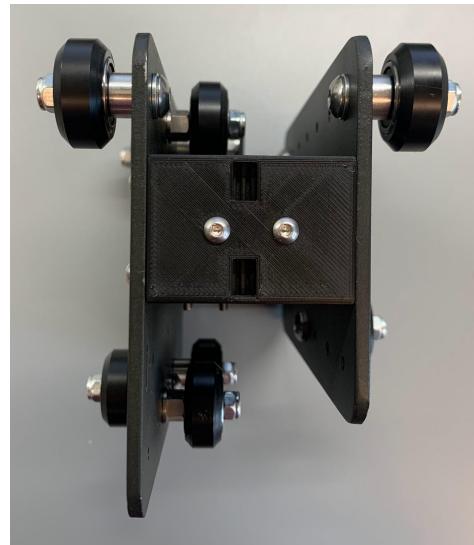
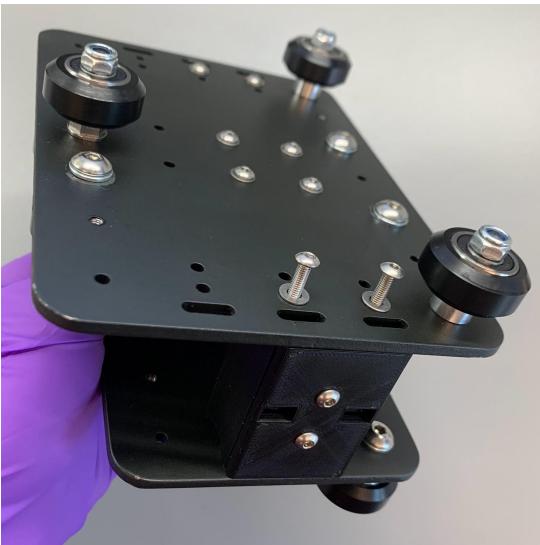


Bind the 2040 plate to the 2060 plate with 2 plate spacers (1 with a magnet hole shaft and 1 without) using 4 M3 washers and 4 M3x12mm screws (up to 18 mm can also be used).

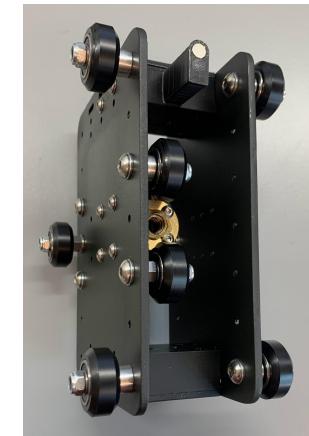
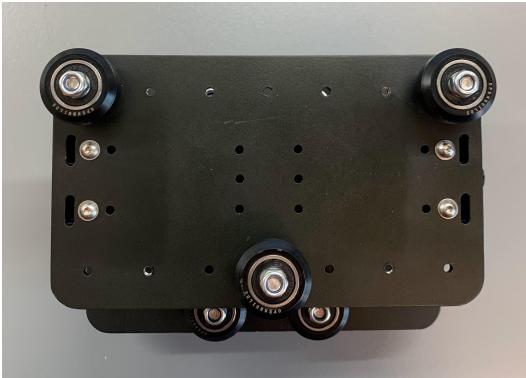
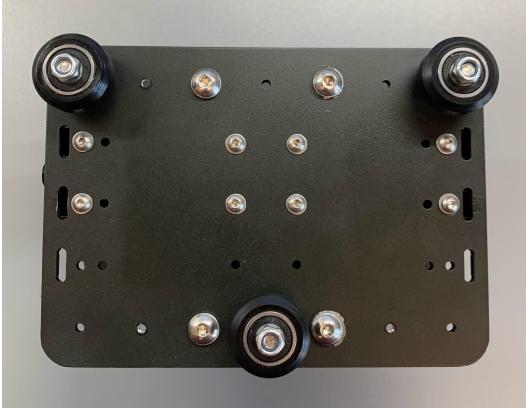


M3x12mm screws (Up to 18mm can also be used)

M3 washers



Bind the 2040 plate to the 2060 plate with 2 plate spacers (1 with a magnet hole shaft and 1 without) using 4 M3 washers and 4 M3x12mm screws (up to 18 mm can also be used).



Complete Binded 2060 and 2040 X/Z Plate for a Top Camera Gantry



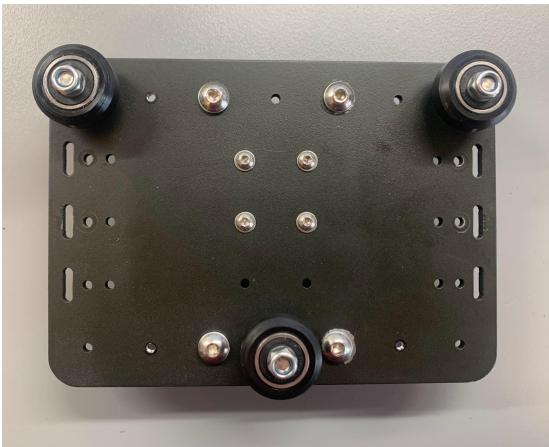
Bind 2060 X/Z Plate and 2040 X/Z Plate (BOTTOM)



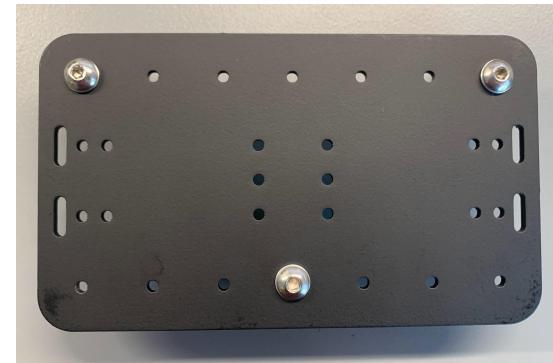
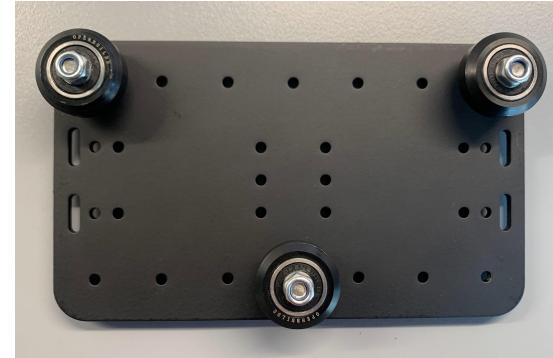
*Please note that the assembly for the 2060 and 2040 X/Z Plates are the same for the top and bottom camera gantries. The only difference is the orientation when binding them together.



Completed
2060 X/Z
Plate



Completed
2040 X/Z
Plate



X/Z Plate Spacers

Has Magnet
Hole Shaft

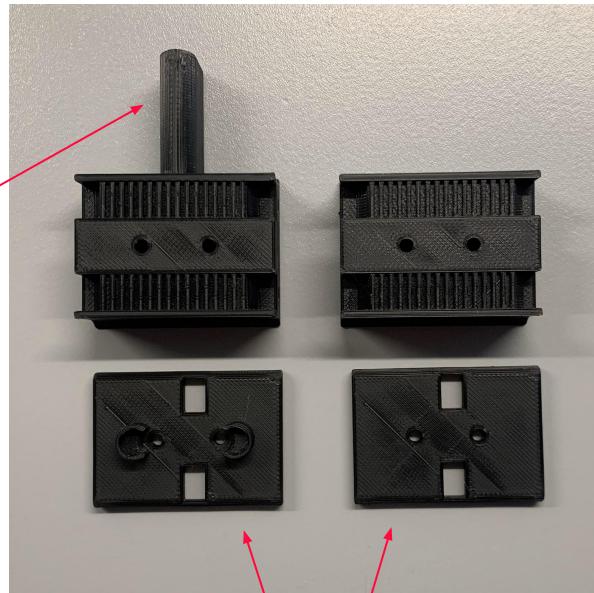
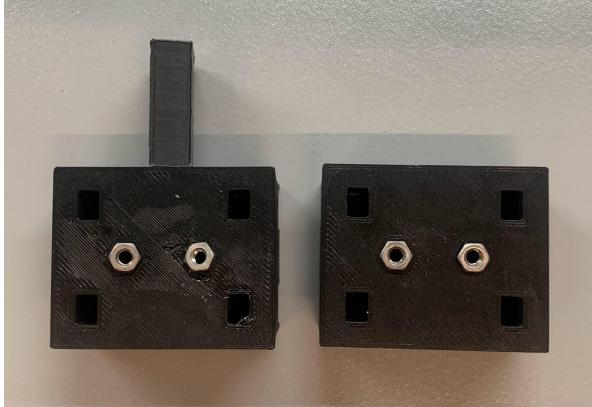
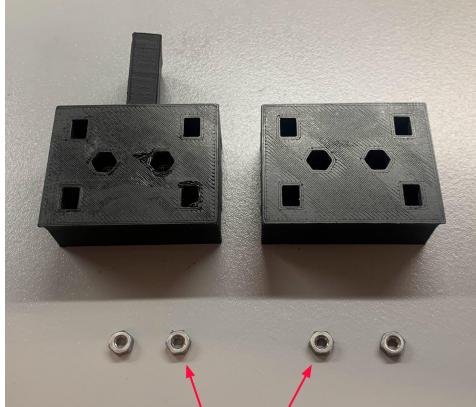
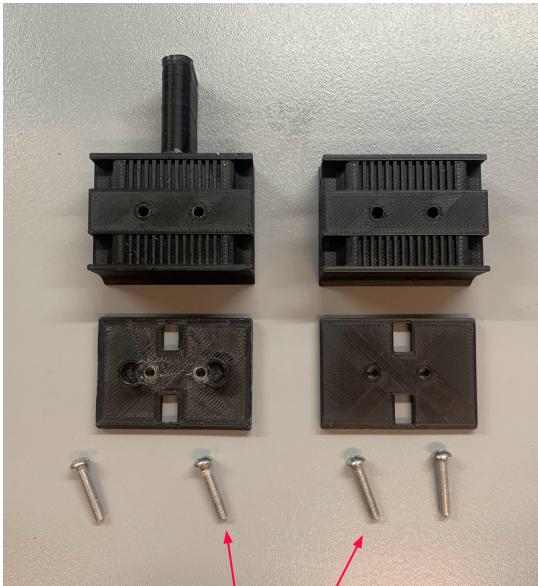


Plate Spacer Lids

X/Z Plate Spacers



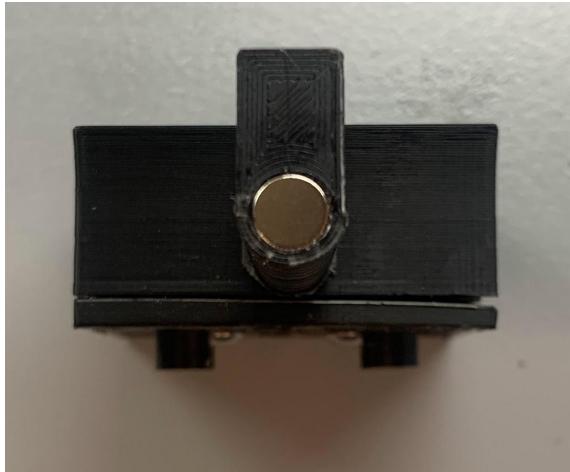
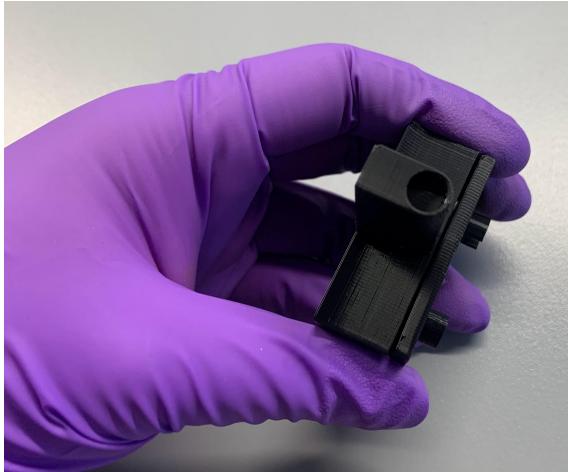
Insert 2 M3 nuts into the back of each X/Z plate spacer.



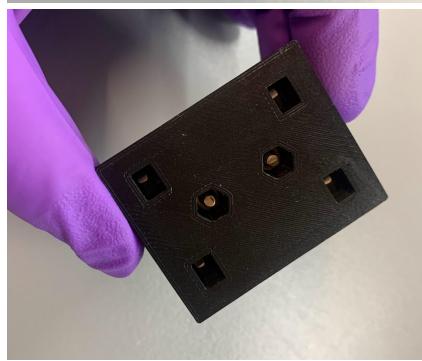
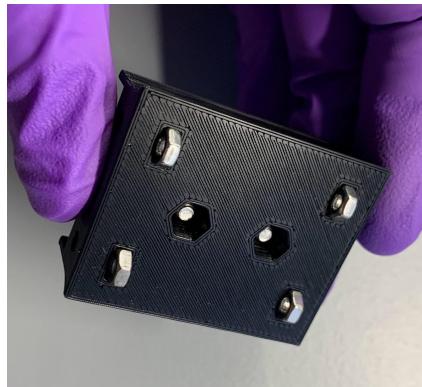
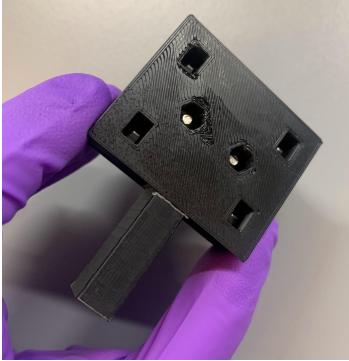
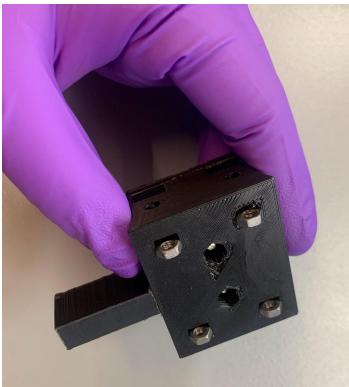
Attach the plate spacer lids with 2 M3x16mm screws per plate spacer.



x1

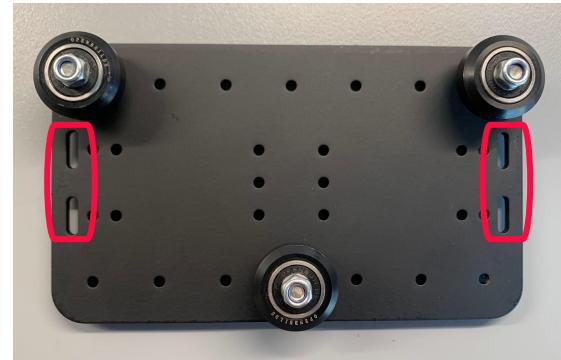
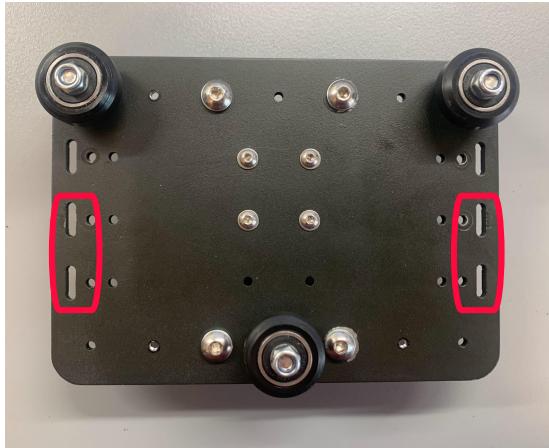


Insert radial magnet 0.236"DIA X 0.098"H CYL into the plate spacer with a magnet hole shaft.



The M3 nuts may fall out when trying to position the plate spacers for binding the plates together. Make sure they are in when putting in the screws.

Slide 4 M3 nuts into the captive nut chamber on the back per plate spacer. Turning the nut should help it slide into the rectangle holes.

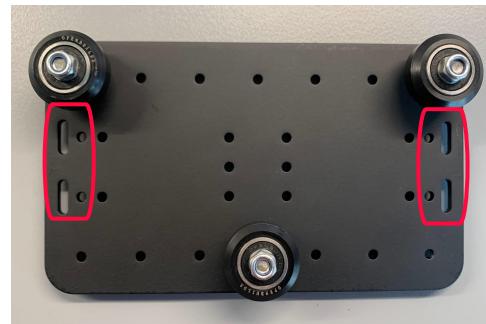
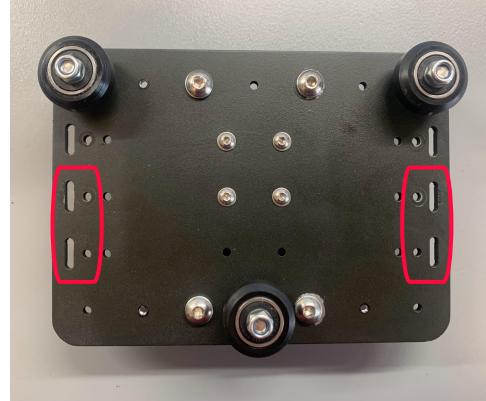


The rectangles on both sides of the plate spacers should match up with the oblong holes on the plates.

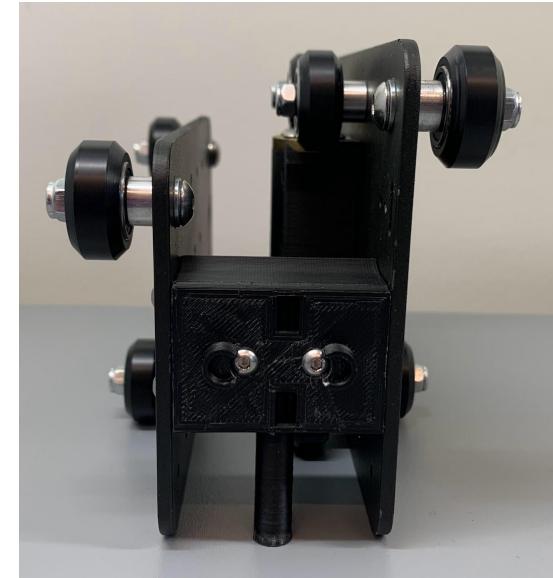
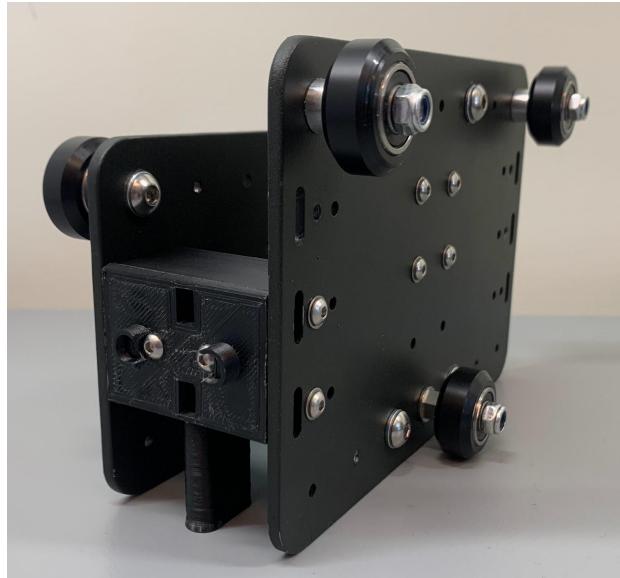
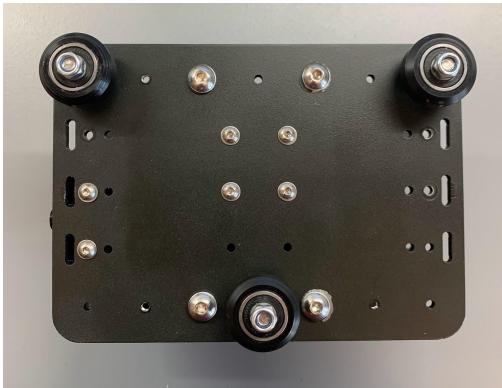
Bind the 2040 plate to the 2060 plate with 2 plate spacers (1 with a magnet hole shaft and 1 without) using 4 M3 washers and 4 M3x12mm screws (up to 18 mm can also be used).



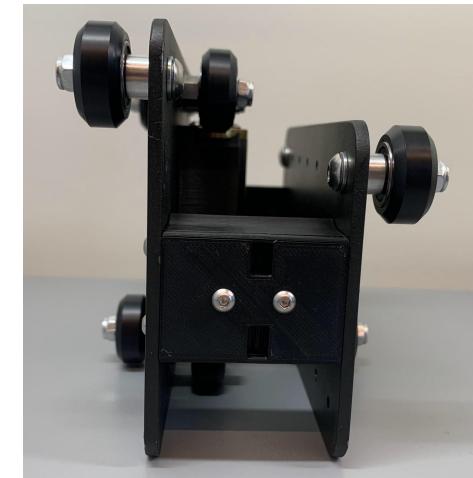
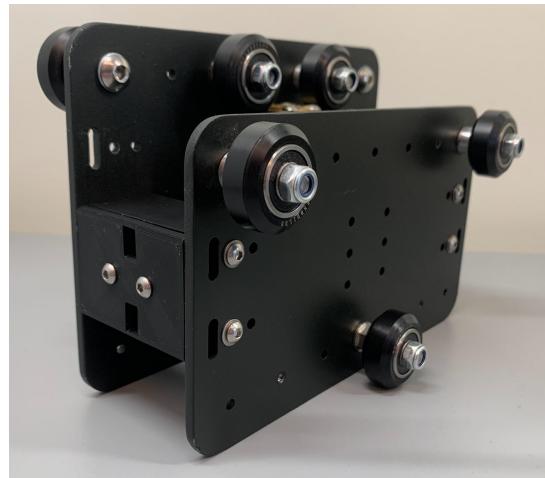
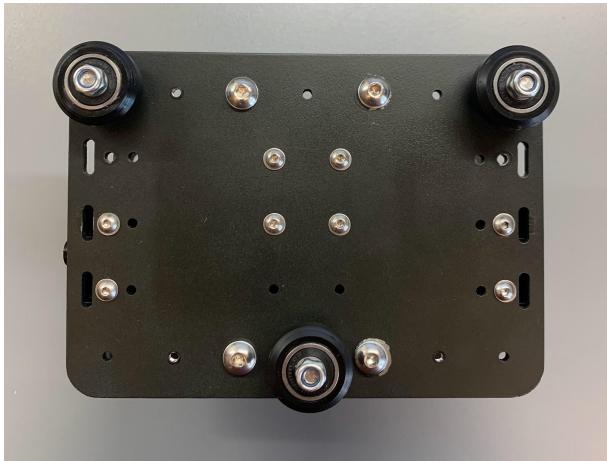
The plate spacer with the magnet hole shaft should be facing down away from the four top wheels and use the bottom two holes on the 2060 plate (away from the four top wheels) for the screws. The holes used on the 2040 plate should be the same as it was for the top. The top wheels on both plates will no longer be on the same level.



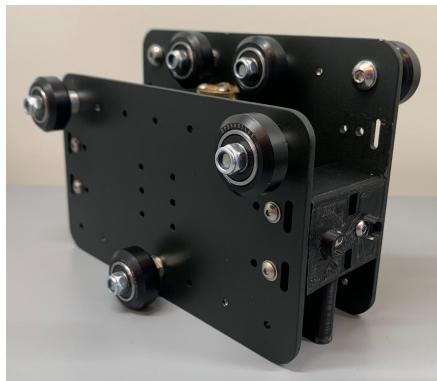
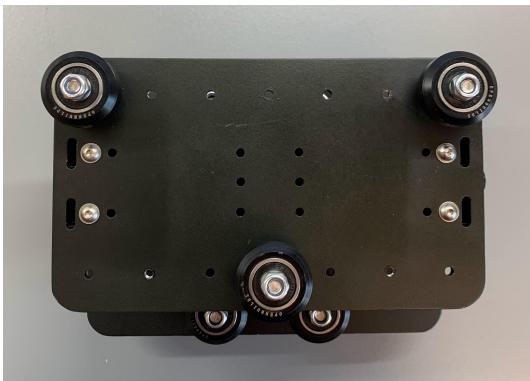
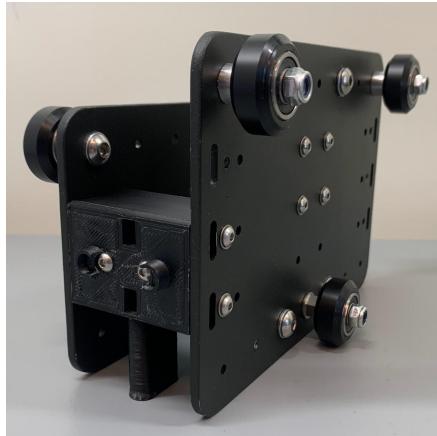
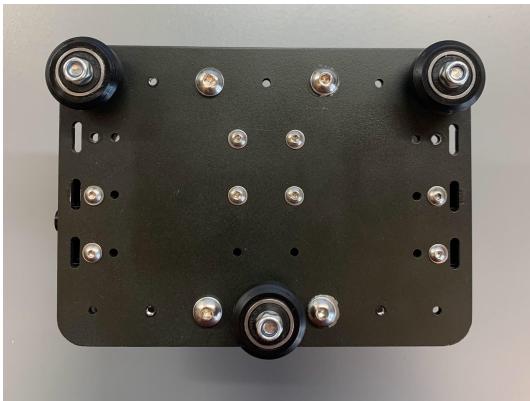
Bind the 2040 plate to the 2060 plate with 2 plate spacers (1 with a magnet hole shaft and 1 without) using 4 M3 washers and 4 M3x12mm screws (up to 18 mm can also be used).



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Complete Binded 2060 and 2040 X/Z Plate for a Bottom Camera Gantry