Mostly Printed CNC – Assembly Instructions

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0 – Calculate the length of your conduits, belts, etc.

Conduits

The length of the conduits depends on your desired workroom. Here is what you need to add to compensate the loss of length caused by mounts etc.

On the X and Y axis you have to add 11" (27cm) and on the Z axis 7.9" (20cm).

Example: You want your CNC be able to move 30" on the X axis, 25" on the Y axis and 10" on the Z axis, you need:

three 41" conduits for X,
three 36" conduits for Y and
two 17.9" conduits for Z

Belts

Use your calculated length for X and Y axis and add another 2". Using the example from above you would need:

2x 43" belt
2x 38" belt

(Z axis doesn't need a belt, it has an all-thread)

All-thread

Substract 2" from the length of your Z conduit, this is the length for your all-thread.

1 – Parts you need

Unit-independent

- 53x 608zz (better: 608rs) bearings
- 5x NEMA 17 stepper motor
- 4x GT2 16tooth belt pulley
- GT2 belt (length: look at "0 – Calculate the length of your conduits, belts, etc.")
- at least 20 zip ties
- 20x M3x10 screws for NEMA Stepper Motors

Imperial

- 1x $^5/_{16}$ all-thread (length: look at "0 – Calculate the length of your conduits, belts, etc.")
- 28x bolt $^5/_{16}$ x 1.25
- 2x bolt $^5/_{16}$ x 1.5
- 2x bolt $^5/_{16}$ x 1.75
- 8x bolt $^5/_{16}$ x 2.5
- 4x bolt $^5/_{16}$ x 3
- 8x $^5/_{16}$ fender washer
- 16x $^5/_{16}$ speed washer
- 3x $^5/_{16}$ nut
- 44x $^5/_{16}$ lock nut
- 1x $^5/_{16}$ x 0.75 coupler nut
- 2x screw $^6/_{32}$ x 0.5
- 34x screw $^6/_{32}$ x 0.75
- 36x $^6/_{32}$ lock nut

Metric

The description of the bolts mean: e.g. M8x30 = bolt with 8mm diameter, 30mm length (without the head), regular pitch, they are called "Maschinenschrauben".

- 2x M4x10
- 2x M4x16
- 28x M4x20
- 4x M4x20 (with small heads as they have to fit within the tool holders)
- 36x M4 nut
- 1x M8 coupler nut
- 1x M8 all-thread (length: look at "0 – Calculate the length of your conduits, belts, etc.")
- 28x M8x30
- 4x M8x40
- 8x M8x70
- 4x M8x80
- 3x M8 nut
- 44x M8 lock nut (these won't move without force as soon as they are on a bolt)
- 16x M8 washer (8mm inner, 15,7mm outer diameter) „M8 Beilagscheiben"
- 8x M8 washer (8mm inner, 26,8mm outer diameter) „M8 Bauscheiben"

2 – Part preparation

All bolts with bearings on it must not be tightened too strong. It's perfect when the bolts are turnable by hand with a bit force after you tightened the lock nuts on them.

All parts that are there more than once are all prepared the same way. The named number of bolts etc. is for each part, so if there's a 4x in front of the part-headline that means, you need to prepare four of this parts and each parts needs the given number of bolts etc.

4x Roller_F + Roller_Motor_Mount

- 2x bolt $^5/_{16}$ x 2.5 (M8x70)
- 2x $^5/_{16}$ fender washer (big M8 washer)
- 4x $^5/_{16}$ speed washer (small M8 washer)
- 7x 608zz bearing
- 3x bolt $^5/_{16}$ x 1.25 (M8x30)
- 5x $^5/_{16}$ lock nut (M8 lock nut)

Put one bearing on each of the short bolts, insert them as shown above and put the locking nuts on them.
The order for the longer bolts is: bolt – fender washer – speed washer – 608zz – speed washer – Roller_Motor_Mount – Roller_F – 608zz – lock nut.

2x Middle_Joiner

- 2x 608zz bearing

- 2x bolt $^5/_{16}$ x 1.25
- 2x $^5/_{16}$ lock nut

2x Middle_End

- 3x 608zz bearing
- 2x bolt $^5/_{16}$ x 1.25 (M8x30)
- 2x bolt $^5/_{16}$ x 1.5 (M8x40)
- 3x $^5/_{16}$ lock nut (M8 lock nut)

4x Middle_Z

- 2x 608zz bearing
- 2x bolt $^5/_{16}$ x 1.25 (M8x30)
- 2x $^5/_{16}$ lock nut (M8 lock nut)

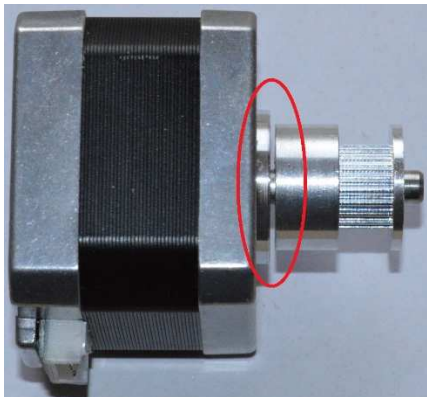## 4x Corner_Block + Corner_Block_Lock

- 4x screw $^6/_{32}$ x 0.75 (M4x20)
- 4x $^6/_{32}$ lock nut (M4 lock nut)

1x Z_Motor_Mount

- 2x screw $^6/_{32}$ x 0.75 (M4x16)
- 2x $^6/_{32}$ lock nut (M4 lock nut)

4x NEMA Stepper Motor + GT2 16tooth Belt Pulley

Leave a little gap between the stepper motor and the pulley, so the pulley can turn free without striking against the stepper.

If you have trouble with your belts later being pressed against the outer fender washers, just turn your pulley around and the teeth are closer to the stepper motor.

3 – Middle Part Assembly

Step 1 – Joining the Middle_Joiners and Z_Nut_Lock

- 2x bolt $^5/_{16}$ x 1.5 (M8x40)
- 2x $^5/_{16}$ lock nut (M8 lock nut)
- 1x $^5/_{16}$ coupler nut (M8 coupler nut)
- 2x 608zz bearing
- 2x screw $^6/_{32}$ x 0.75 (M4x20)
- 2x $^6/_{32}$ lock nut (M4 lock nut)

Begin with the two Middle_Joiner and let the locking nuts very loose. Insert the coupler nut into the Z_Nut_Lock and attach it to the two joiners and tighten the nuts for the Z_Nut_Lock. Now tighten the nuts of the two bolts.

Step 2 – Adding Middle_Z and Middle_End

- 4x bolt $^5/_{16}$ x 3 (M8x80)
- 4x $^5/_{16}$ lock nut (M8 lock nut)
- 4x 608zz bearing

4 – Frame Assembly
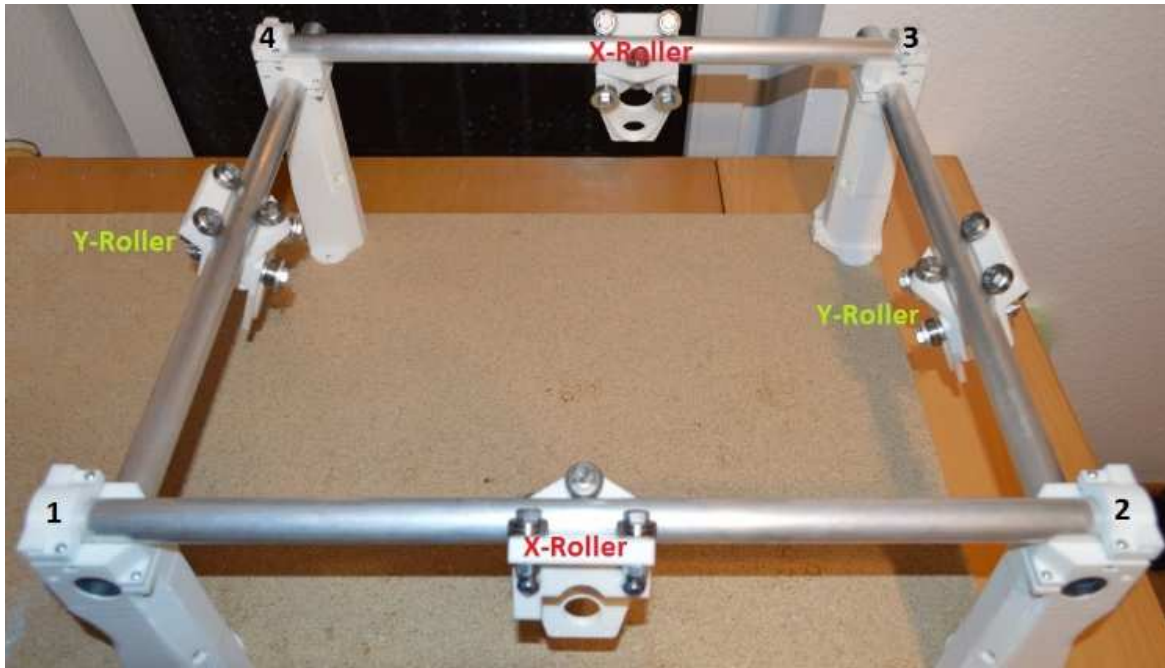
Put one finished Roller_F on each conduit, but don't tighten any screws of the Corner_Blocks yet. Insert the two remaining conduits into the assembled middle part (the Z_Nut_Lock should be looking towards Corner_Block 1). Now put the middle part with the conduits on the Roller_Fs and put the Roller_Locks on the Roller_Fs. You'll need 2x screw $^6/_{32}$ x 0.75 (M4x20) and 2x $^6/_{32}$ lock nut (M4 lock nut) for each Roller_Lock (don't tighten yet ;-))
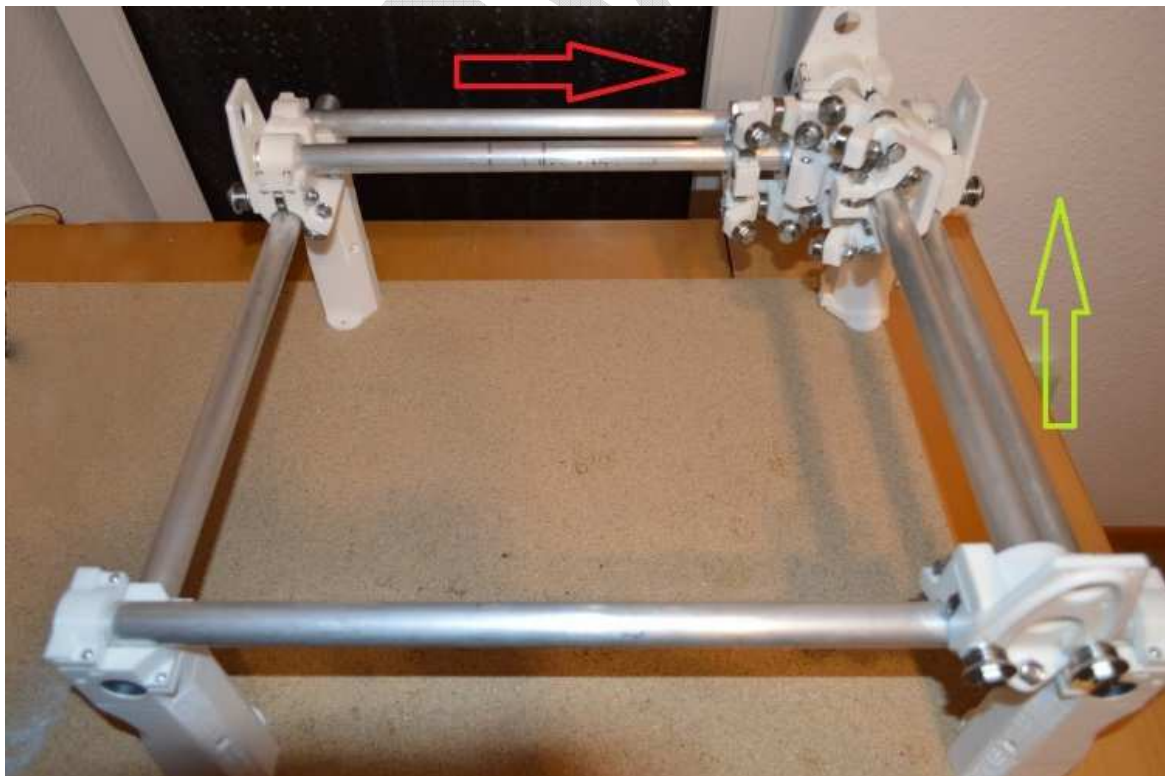
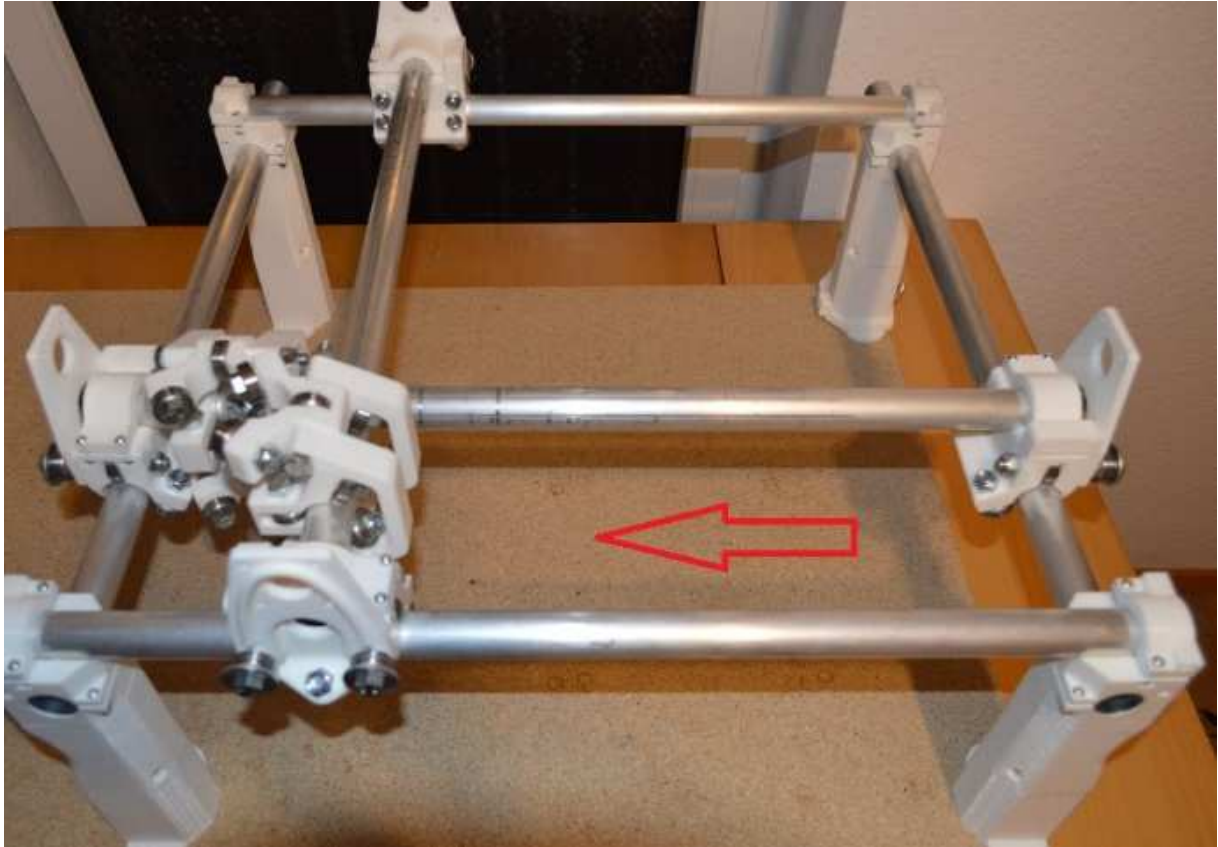The upper X and Y conduits should be flush mount with the corner blocks 3 and 4. Tighten all screws of corner block 3 and 4. Now move the middle part to the right upper corner and tighten all screws of the Roller_Locks of the Y Rollers (left and right one) and of the upper X Roller_F.
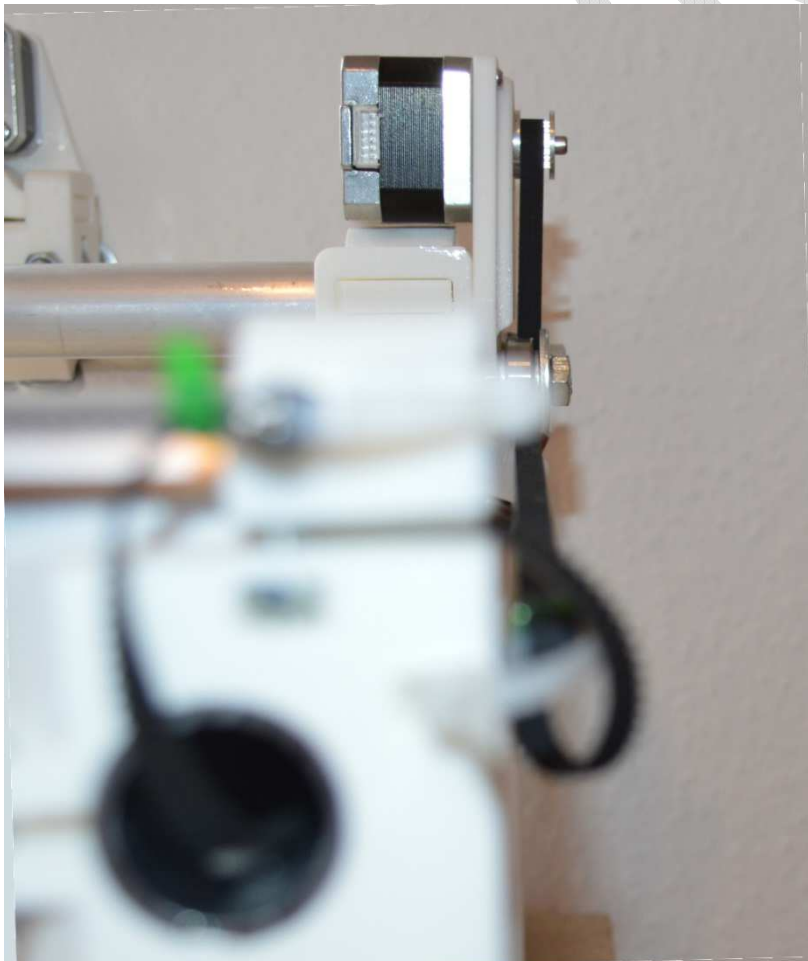

Move the middle part to the lower left corner. Move the conduits of Corner_Block 1 and 2 if they are too close / too wide. As soon as you can move the middle part without being blocked in any direction move it back to the lower left corner. Now tighten all screws of the remaining lower X Roller_F and of Corner_Block 1 and 2.
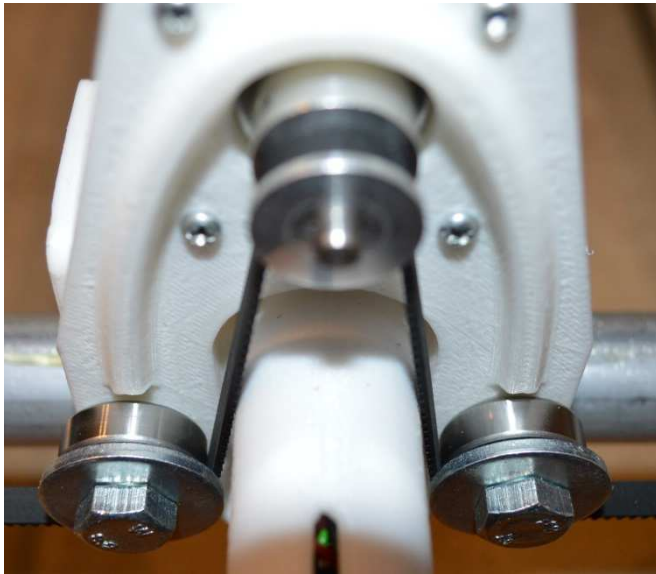
5 – Adding the belts

Lock each belt on one end. You the holes in the corner_blocks for the belts on the Y axis and the holes in the corner_block_locks for the belts on the X axis. Start with the X axis and mount the belt as shown above.
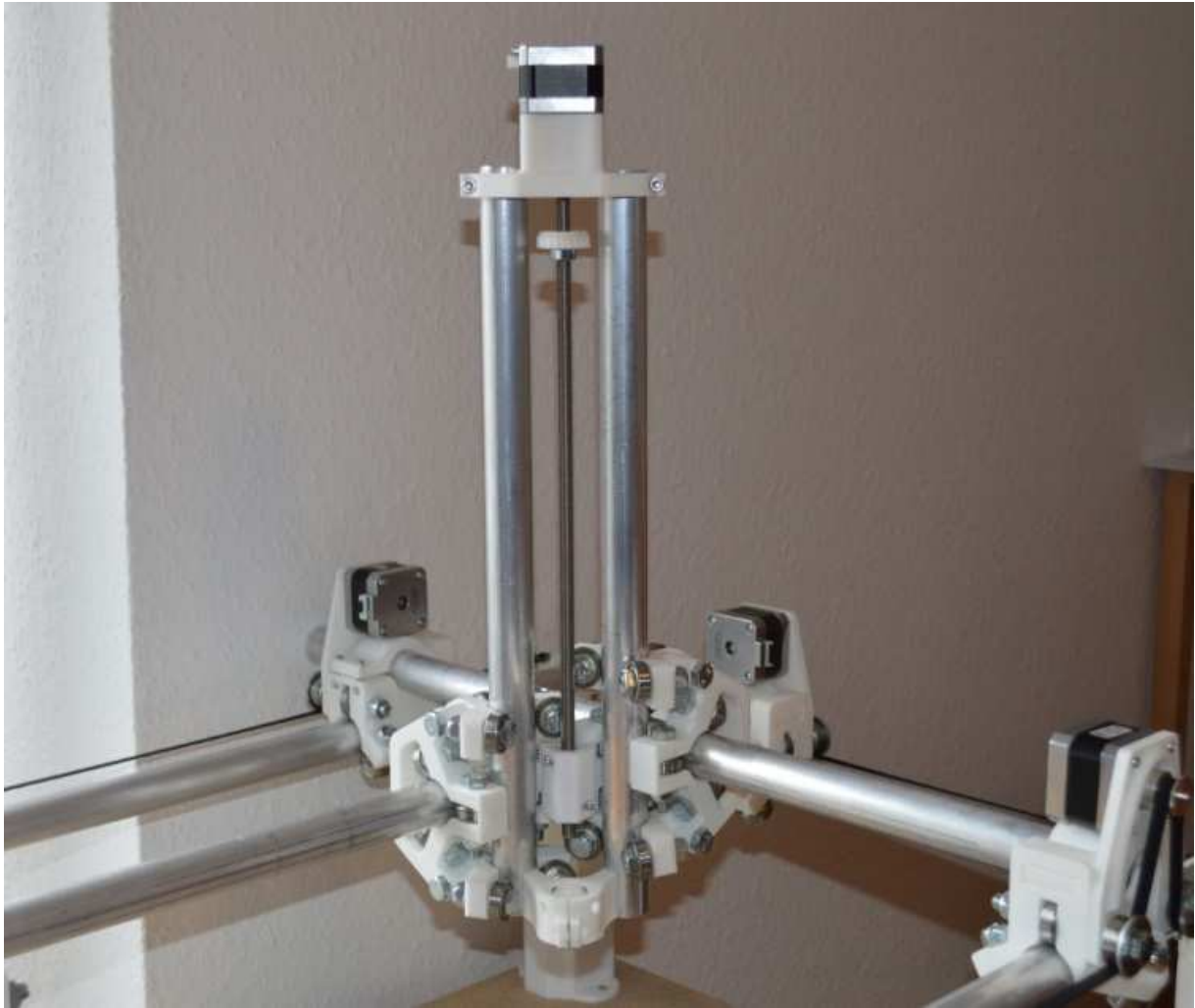
⚠️ Now lock the belt to the other end, the belts don't really need to be highly tightened. Better you leave some room to tighten them a bit more if needed. As soon as the Roller_Motor_Mount is leaning forwards the belt is tightened too heavily.

When you finished the two belts on the X axis do the same with the Y axis.

6 – Putting the Z tower together

You can build the Z tower separately and when finished you can add it to the middle part. On this picture you can see the addon "Z Adjust Knob", which is very useful.

Prepare your conduits

Lay the tool_holder_nut_trap on one of your z-conduits. Put a pencil through the holes and mark the points where you need to drill. Repeat with the other conduit and drill the holes.
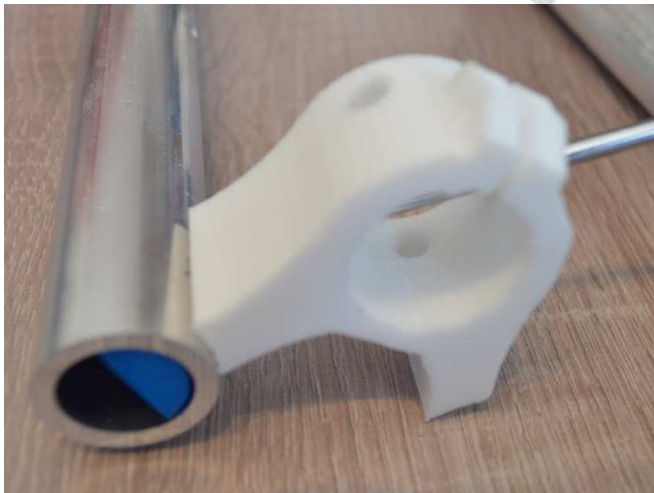
Prepare the tool_holder_nut_traps

Put a nut in each placeholder and use a bit tape to avoid that they can fall out again.

Now insert the nut_traps in your conduits, move them until you see that both holes in your conduits match the holes in the nut_trap.
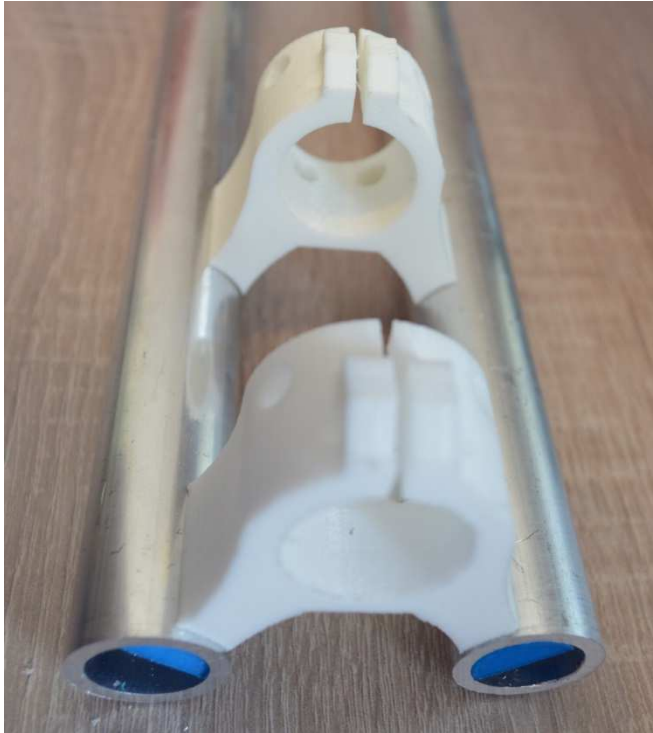
The conduits-tool_holder-tool_holder_nut_traps marriage

Put a screw in the tool_holder and now with a bit patience you can tighten the screw through tool_holder – conduit – nut_trap and with the nut.

It's easier to start with the one at the bottom because you can hold the nut_trap with your finger.

Repeat with the second tool_holder and then add the second conduit.

Well done!

Add the Z_Motor_Mount to the upper end of your conduits (the bulge has to point to the same direction as your tool_holders do) and tighten the screws. If you want to use the Z_Adjust_Knob add it now or never. Move the all-thread from below through the Z_Motor_Mount and add the Rigid_Coupler. Put the last stepper motor on the Z_Motor_Mount and use four M3x10 screws to mount it. Now tighten the screws of the Rigid_Coupler.

To insert the Z tower put it on the middle part (tool holder pointing to the lower left corner) and insert it between the Middle_Zs. As soon as the all-thread touches the coupler-nut in the middle part you can use the Z_Adjust_Knob and screw the Z tower a bit down (until the all-thread comes out of the coupler_nut at the other end).

7 – You're finished with the plastic and metal part

Congrats! Your frame is ready for some cables and electronics.

Please feel free to ask any question here:

http://www.vicious1.com/forums/topic/assembly-instructions/

Some links:

Mostly Printed CNC on thingiverse.com: http://www.thingiverse.com/thing:724999

Mostly Printed CNC (International Edition): http://www.thingiverse.com/thing:790533