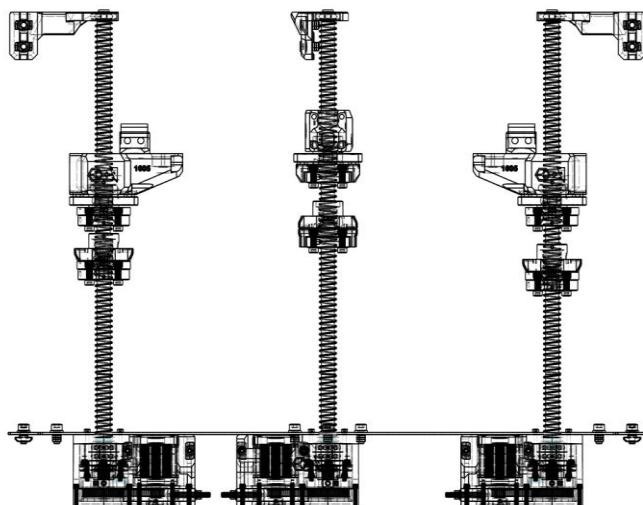


Z-Upgrade 3.2c/d manual

Evolutions

Indice	Date	Description de l'évolution	Auteur
0.0	27/10/2024	Création	FBR
0.1	12/11/2024	M3x25mm to full M3x20mm change	FBR
0.2	19/11/2024	3.2b revision / StarLock design	FBR
0.3	20/01/2025	3.2c revision / Belt lenght + Screws changes 25-22mm	FBR
0.4	13/02/2025	Small details additions to the manual for fine tuning	FBR
0.5	16/06/2025	Spring retainers variant	FBR
0.6	04/01/2026	Manual update / TMC / Autotune	FBR



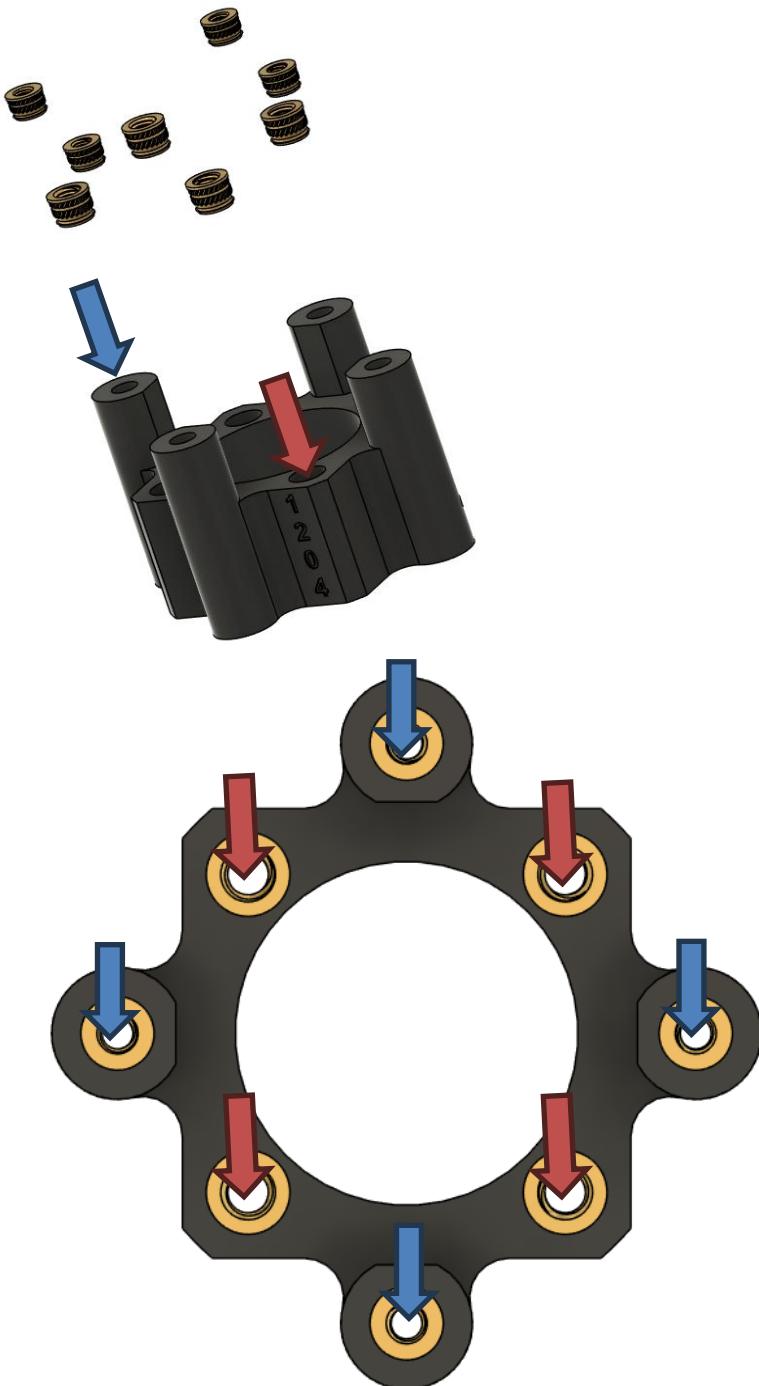
1 Parts preparation

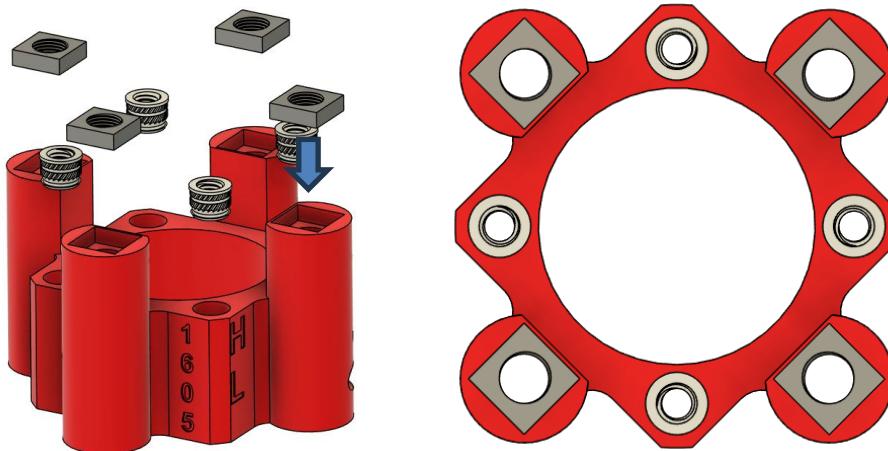
NOTE: If you got the parts from the BRS-ENGINEERING store, you can go directly to [page 9](#)

Standard StarLock

Start to prepare the 3 Blocks

Install the **4x M3** insert and the **4x M4** inserts in each Starlock

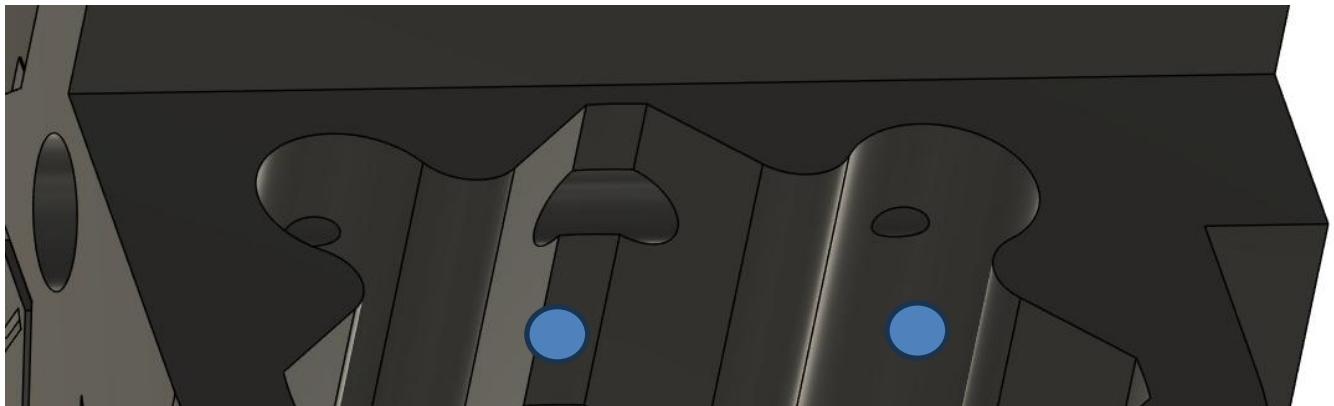
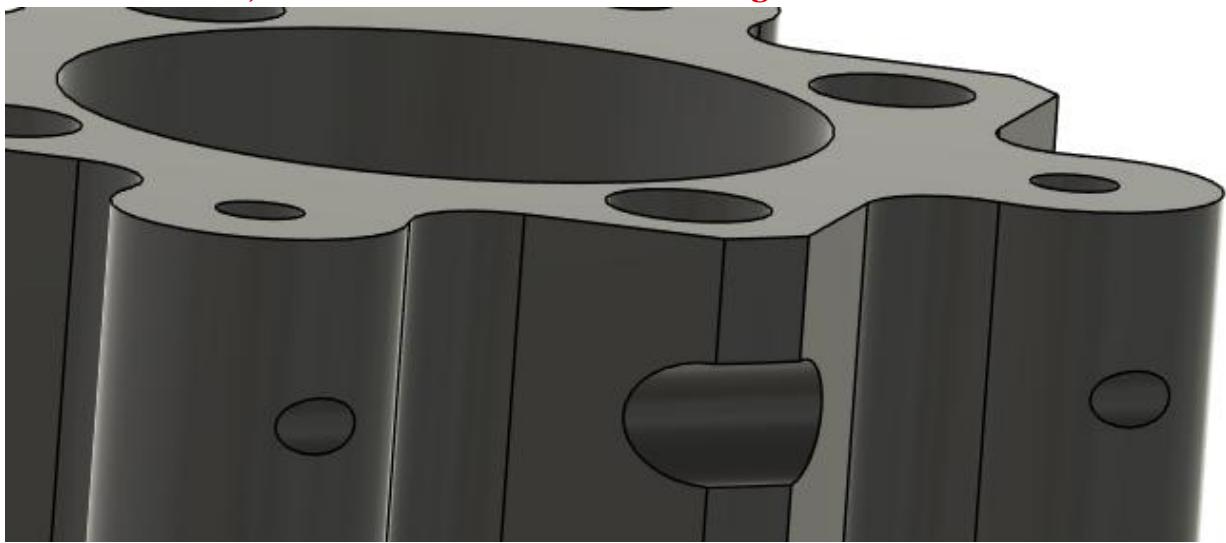


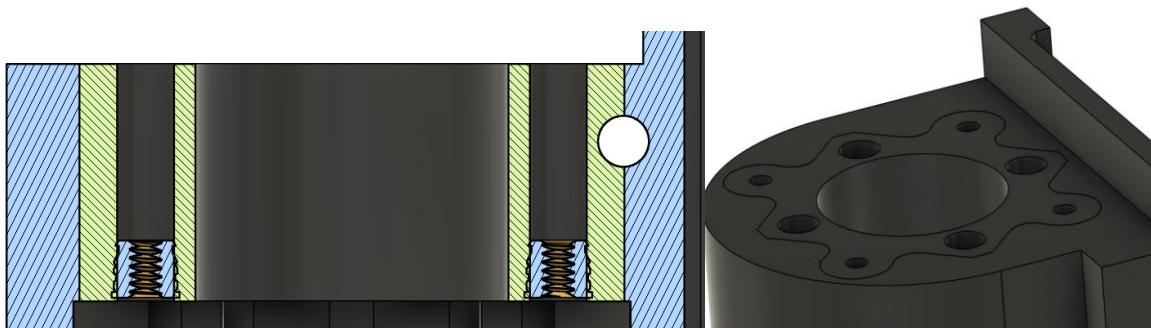
H variant Starlock:

Install the **square nut** with a bit of superglue

Starlock + blocks assembly:

You need to pressfit with some **Superglue points** the Starlock design **WARNING: They have a direction; there is a notch on the side to align**

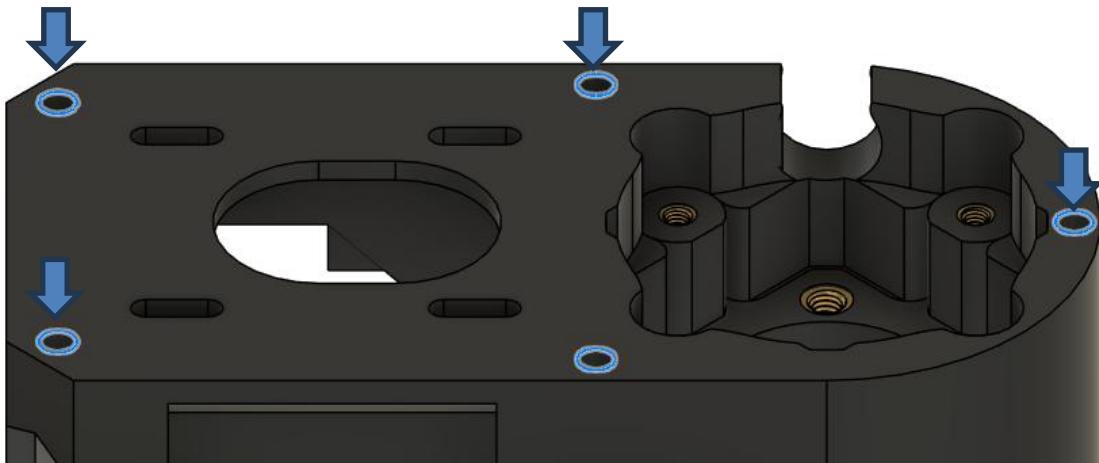




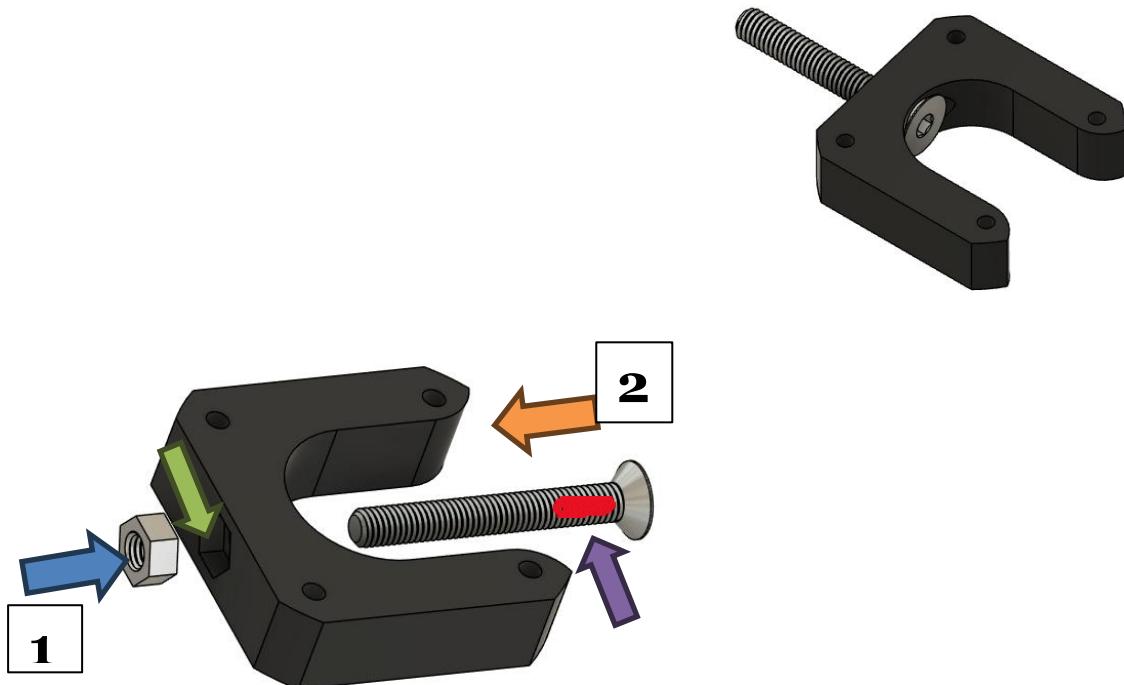
It is important for this part to be flush with the mainblock

This has been designed to get better surfaces and a more clean printing experience and a stronger join

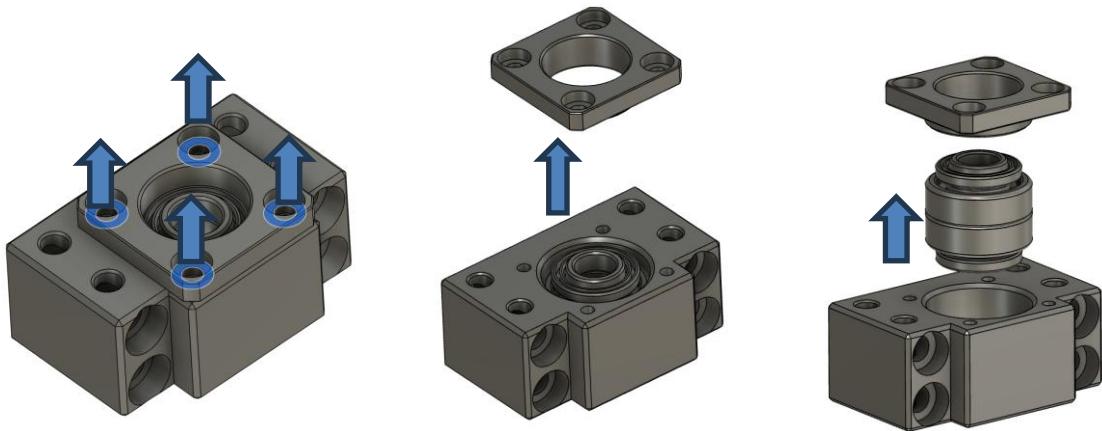
You will need to place m3 inserts at those places on the 3 pillar base blocks: 2



Assemble the tensioner:



Apply glue in the nut part location. [Install](#) a M5 nut or a Nyloc M5, then let it dry 5 min.
[Apply glue or threadlocker](#) on the first 6mm of the screw. Install the screw fully! Let it dry 10min

Disassemble the BK10:

Remove the 4x M4 screws and remove carefully the internal, some force can be needed to remove the 608 bearings.; If they are stuck, use a some heat with a lighter or a little torch to heat and expand a bit the black housing

We will keep only that- At this setup you can replace those bearings with optional angular contact ones

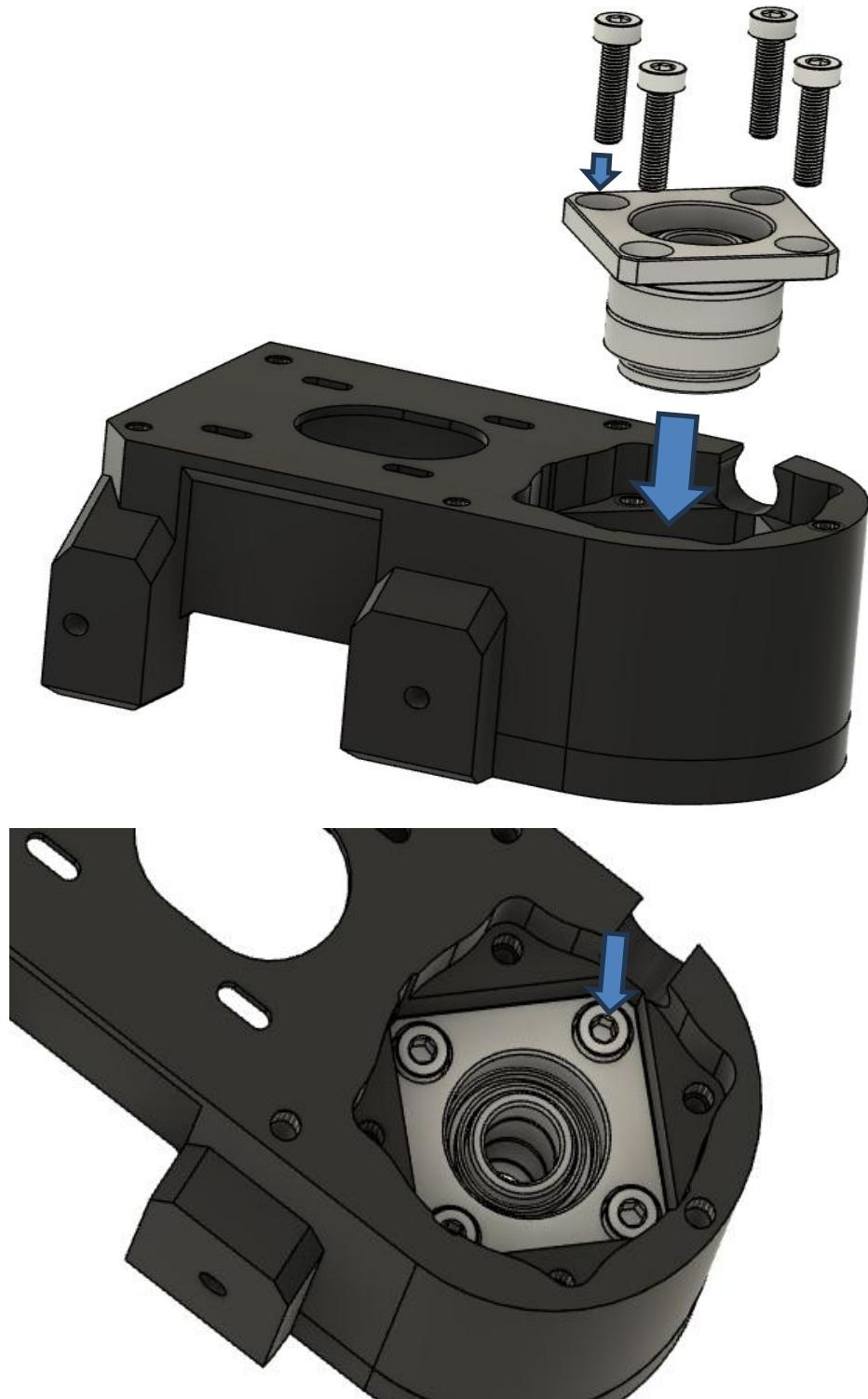
A bit more expensive but better in lifespan for heavy assembly



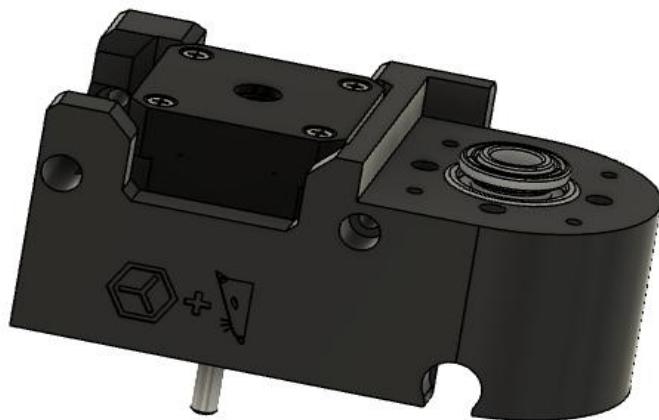
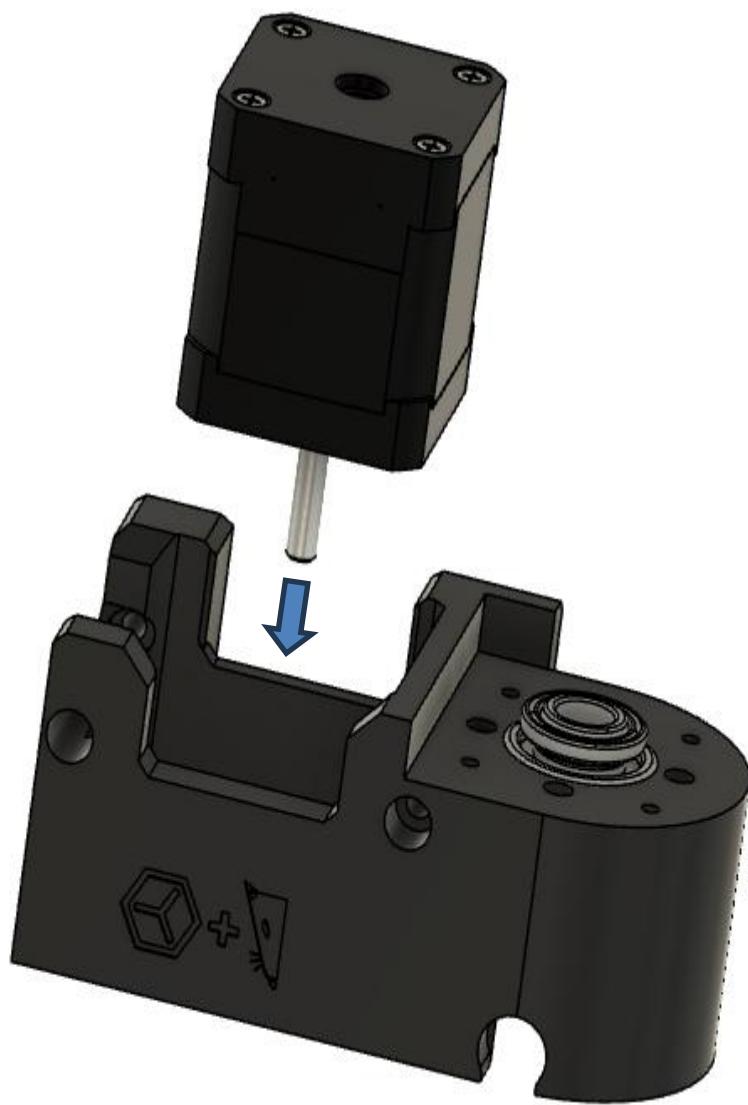
2 Preassembly

BODY :

Insert the BK10 internals on in the 3 blocks and secure it with the BK10s M4 short screw from the original block



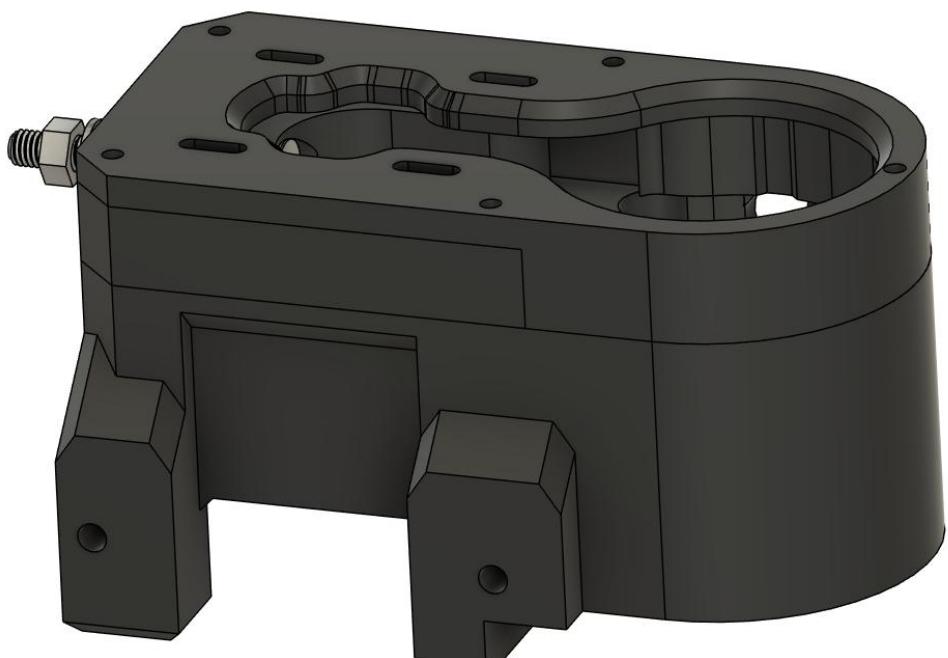
Install the NEMA



It should be flush

Now fit the under section and the tensioner

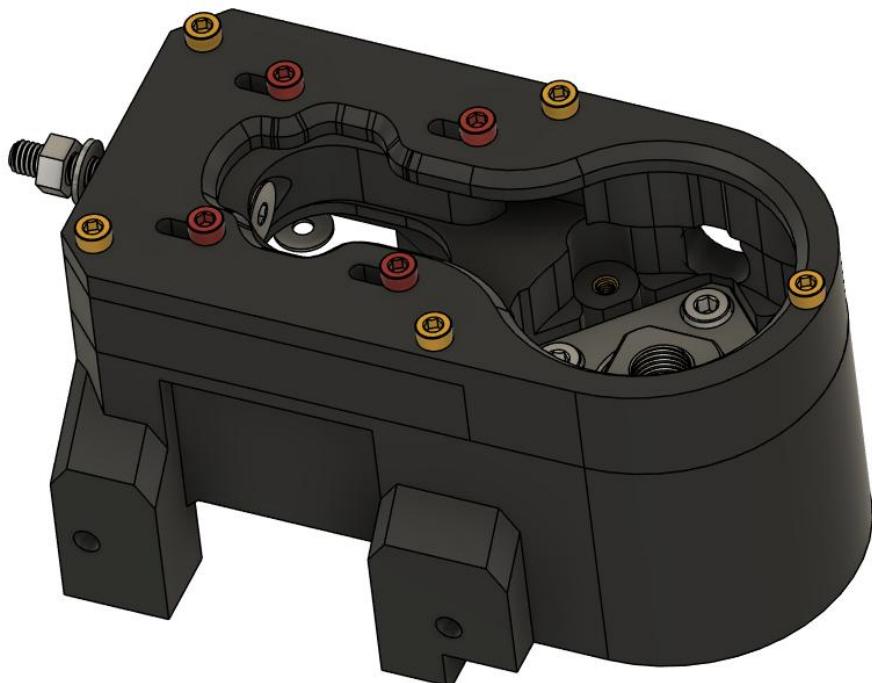
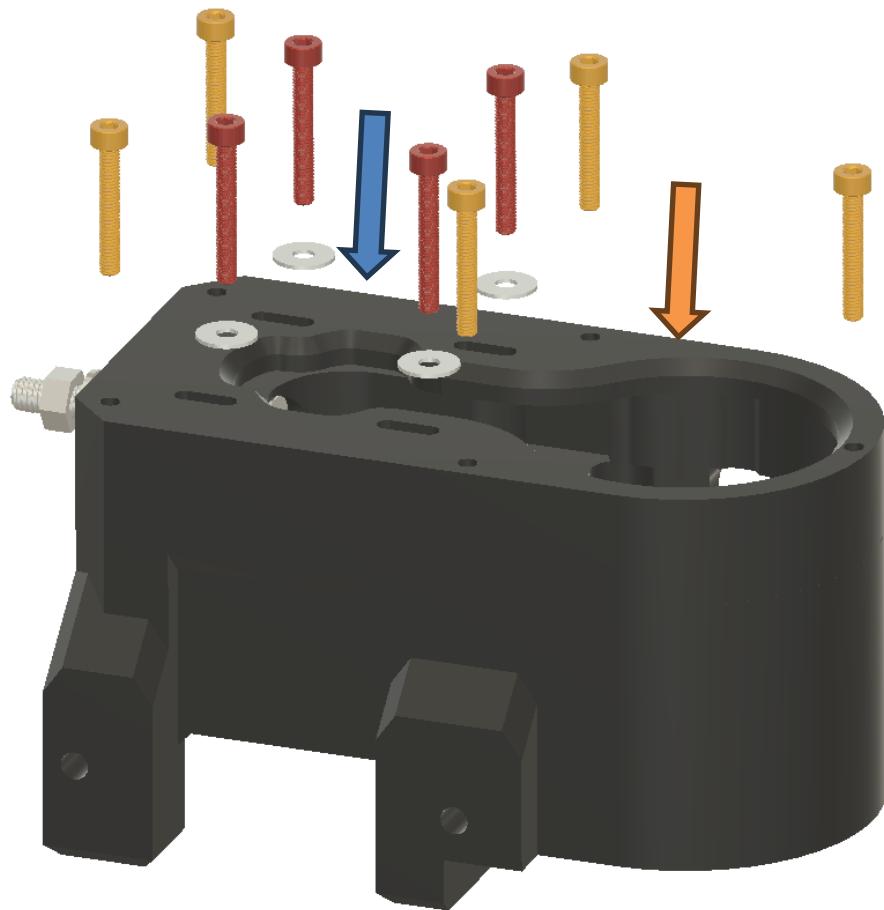
NOTE: (Before this steps you can place the belt and the 20T / 60T pulley to ease the process for later)



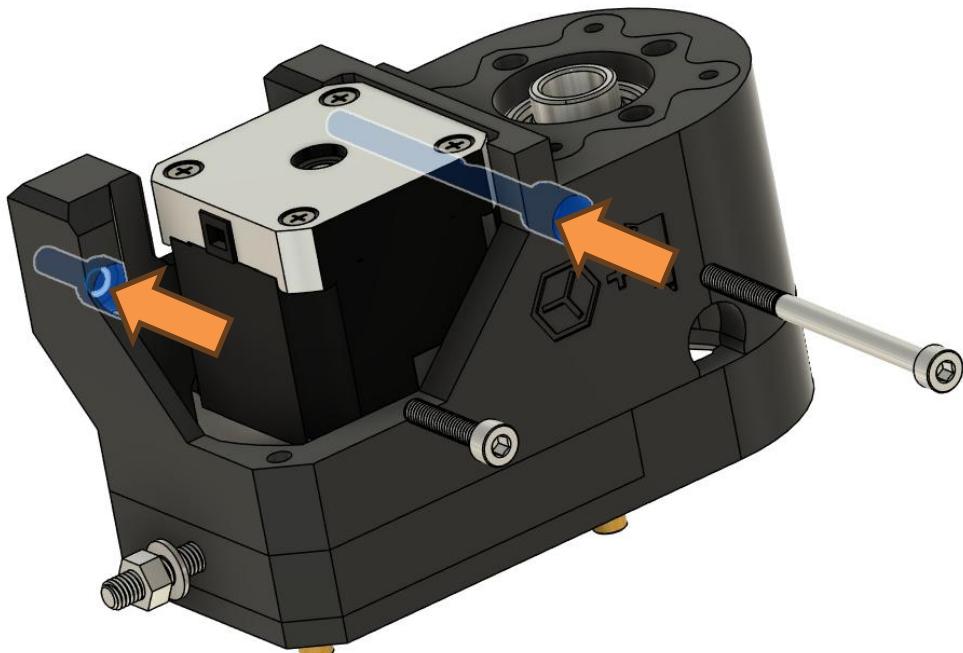
Z-Upgrade 3.x For VCORE 4.0

BRS-Engineering

Then close it with the **M3x22mm screw** and then the **M3x20mm** to close the bottom. M3 washers are not mandatory.

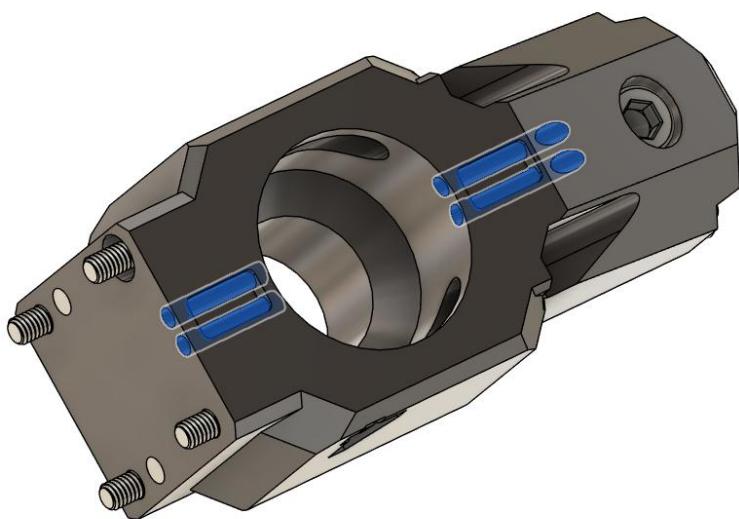


Add the retaining m4x20mm and m4x60mm bolts for the frame anchor. Add a M4 Tnut on each, Same logic for the rear part, but this time with a M4x90mm instead of the M6x60

**ARMS:**

For the arms, place m3 inserts at the same spots than a regular VC4.0 kit

Install the pins (From the Wobblex kit) or in the BRS Oldam packet (14mm pins)

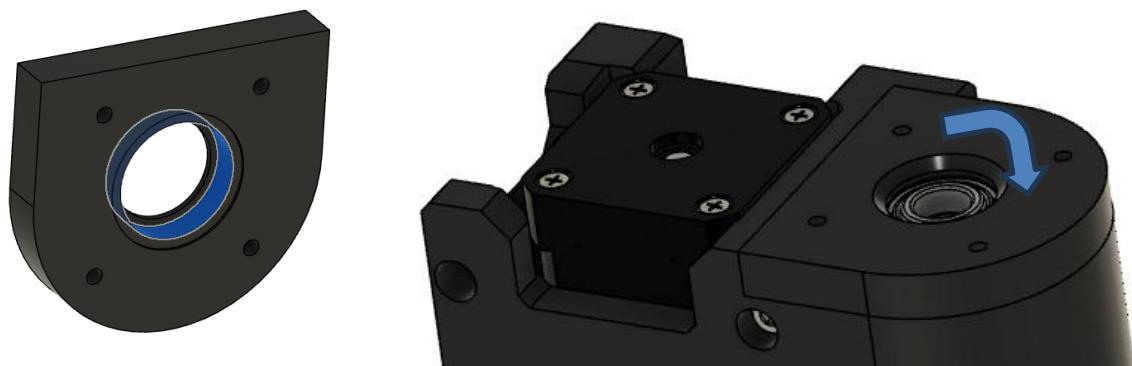


The rest is quite straightforward, install the bed grabber and the specific shortened custom Wiper from the kit.

3 Assembly

The easier way to do it is to lean the machine on the back or the side, but that is completely up to you depending the status of the machine (Kit or already assembled)

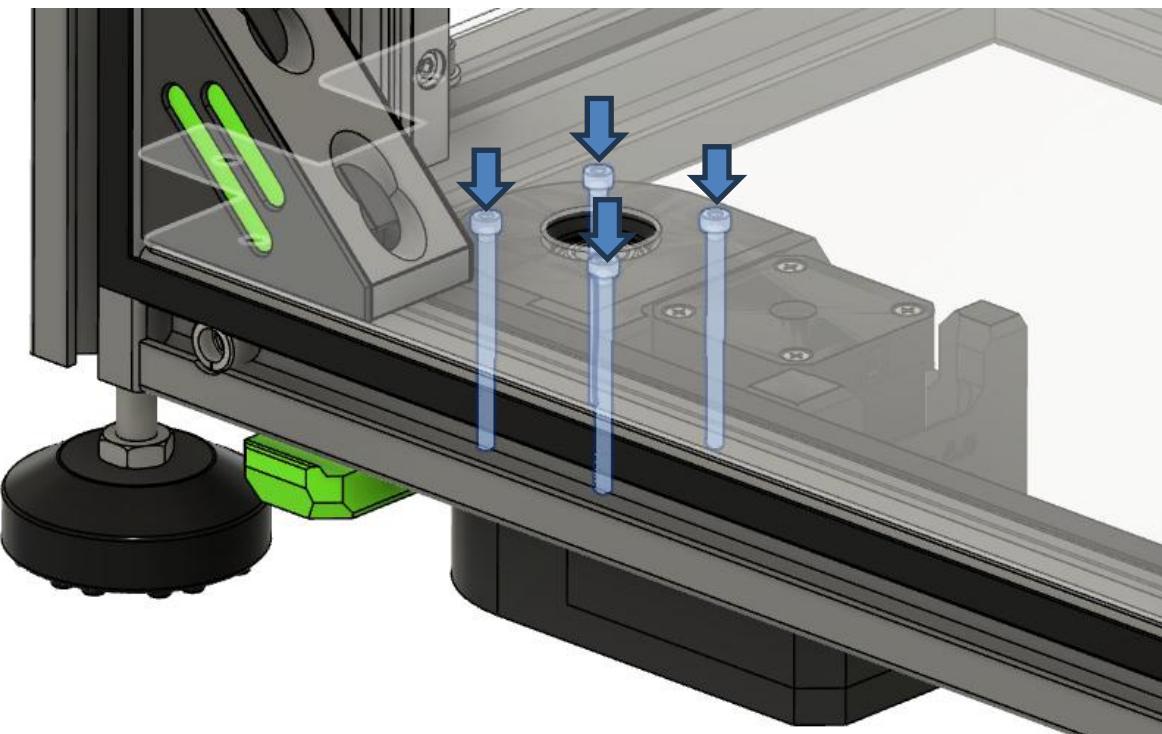
Here the SPI join is not used

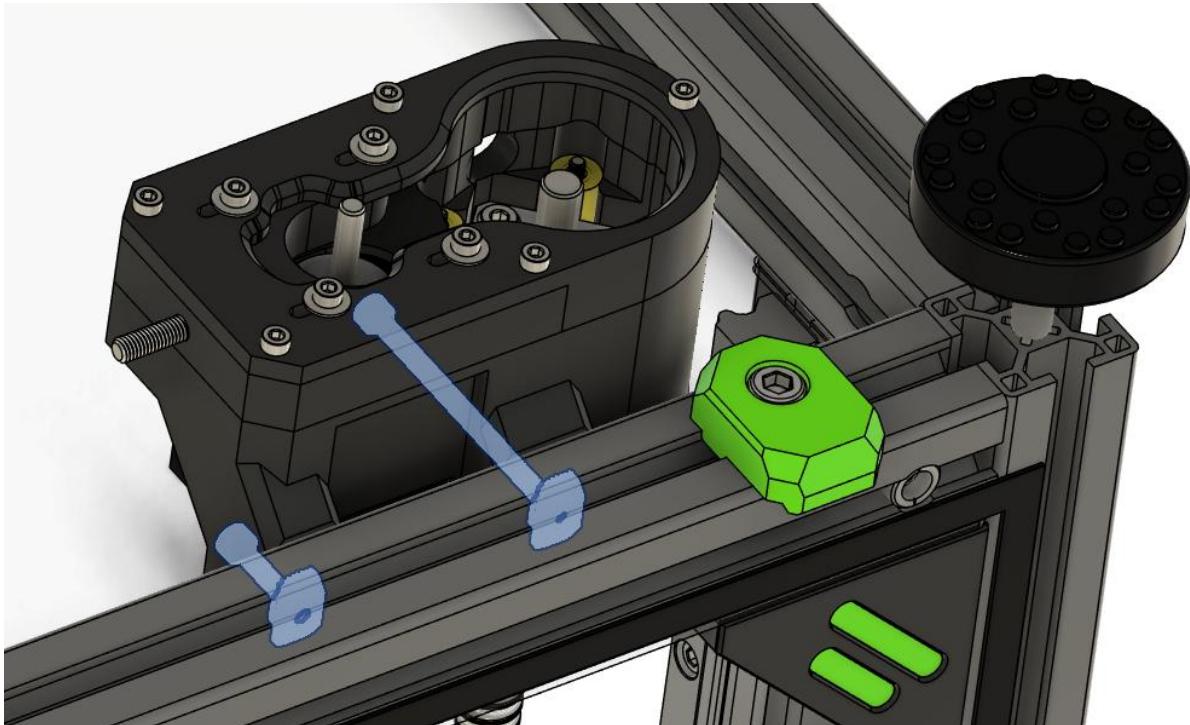


You can now place it on the M3 plate hole and add the 4x M3x45mm to retain it

Don't forget to tight the anchors points (2x per blocks)

In the H revision, M3 are swapped for M5x50 screws

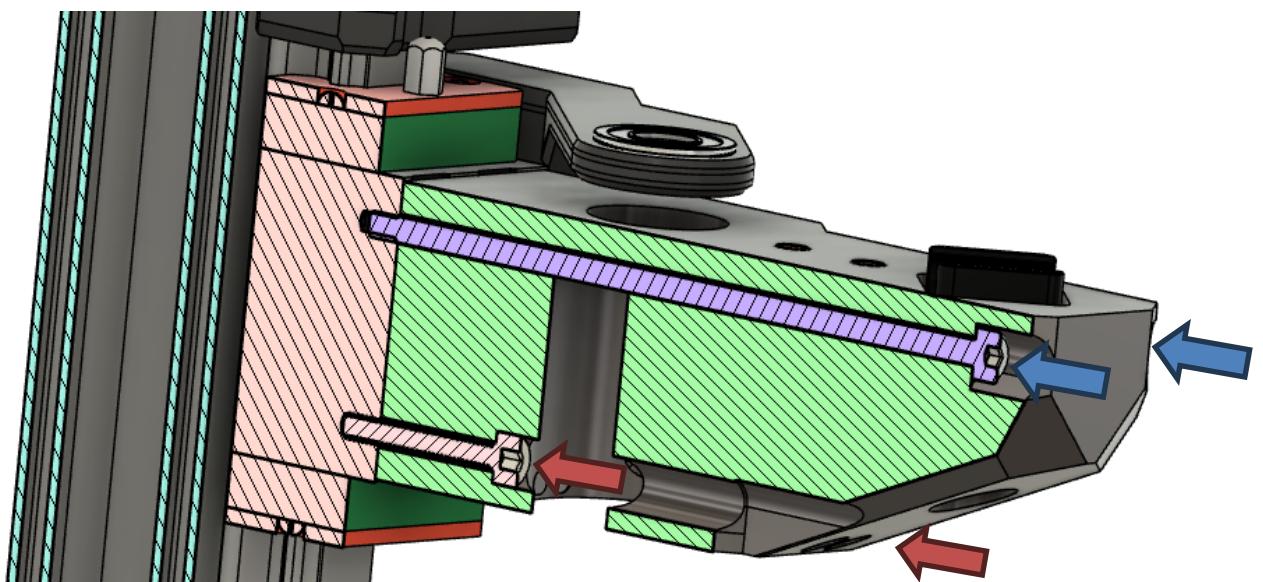


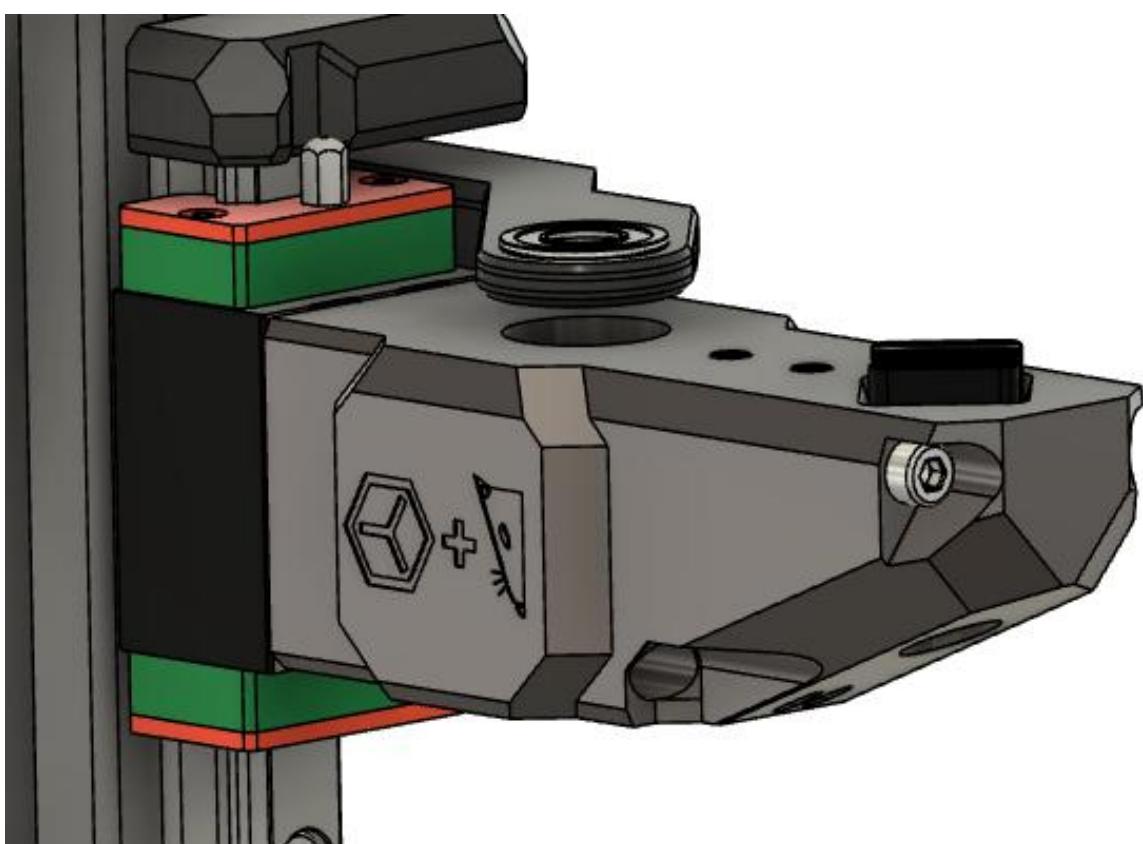


Repeat this process for the 3 blocks

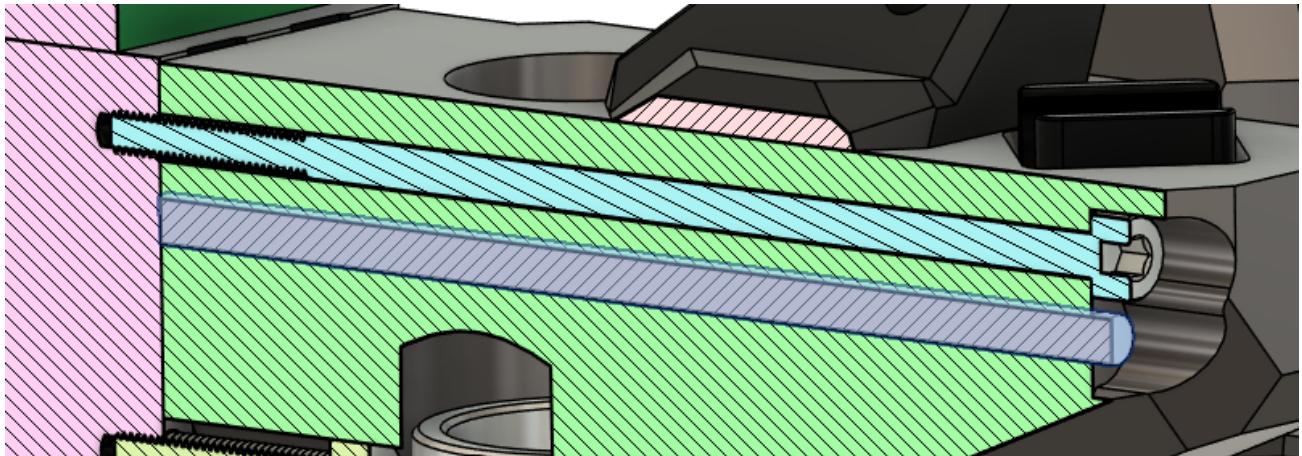
We can now install all the arms

Same logic than the stock ones, but this time we use the **2x m4x100mm** and **2x M4x20mm**





1605 Reinforced version need some 5x100mm steel rod in the holes



I personally glue them and pressfit them with a hammer

Once done, depending the Oldham / WobbleX choice made, you can prepare the ballscrews

4 WobbleX

3.2C revision (DEPRECATED revision):



For the WobbleX (12/16), same logic: Add some M5x20 to fix the BS nut to the lower ring, add the WobbleX middle ring and install it the same way with the spindle motion seen above.

Be careful: 1204 and 1605 version got some differences:

-Discs are larger, and use a different layout, 1605 and 1204 are not compatible between each others

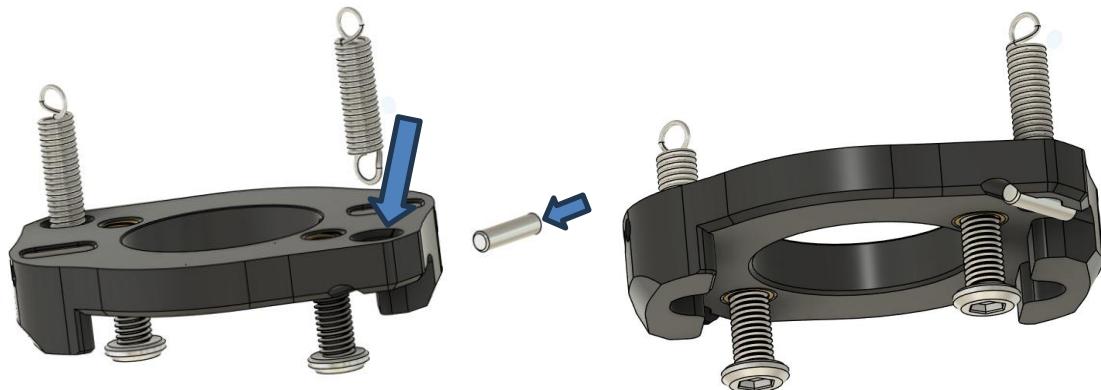
-Arms got a different hole layout and dimension as their pins position

-In some case scenarios, you may need to remove the arm partially to insert the BS spindle

At this point you can change the methods, as few exist to get to the same objective.

Use the pins for the WobbleX Kit which are included

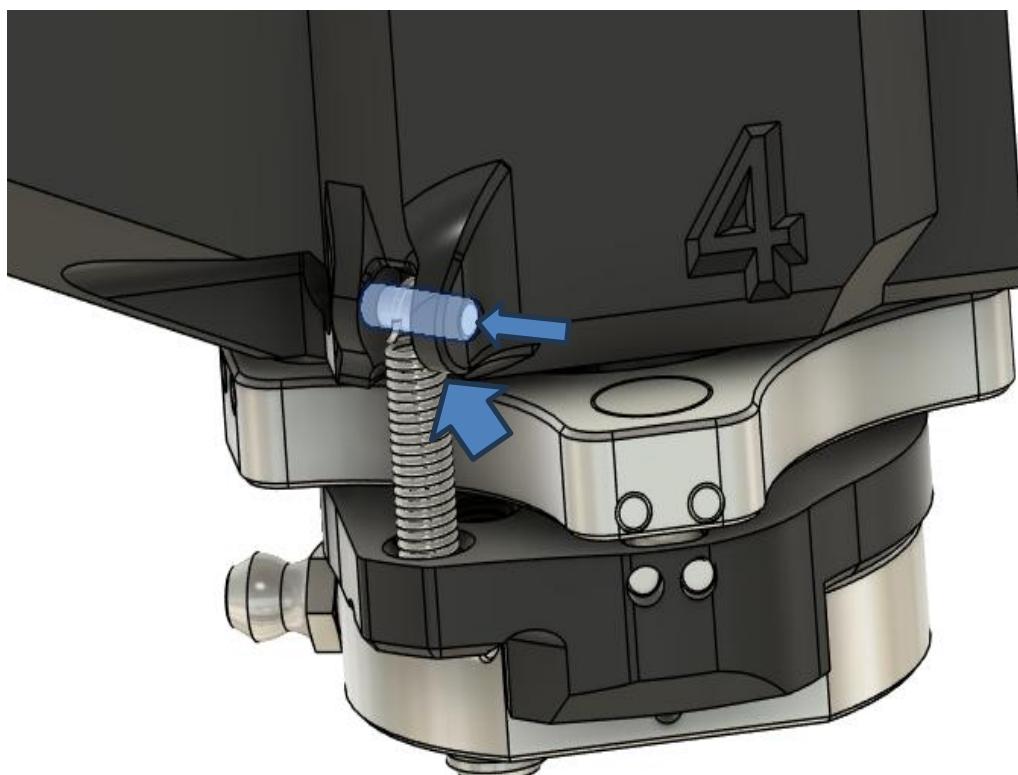
3.2D revision (LAST revision) :



The last revision features a spring retainer to avoid lifting the full assembly and loose the ball from the WobbleX

Insert the spring in the hole, secure it with a pin

This under ring feature only 2 M5 screw new, proved to be enough in this case.

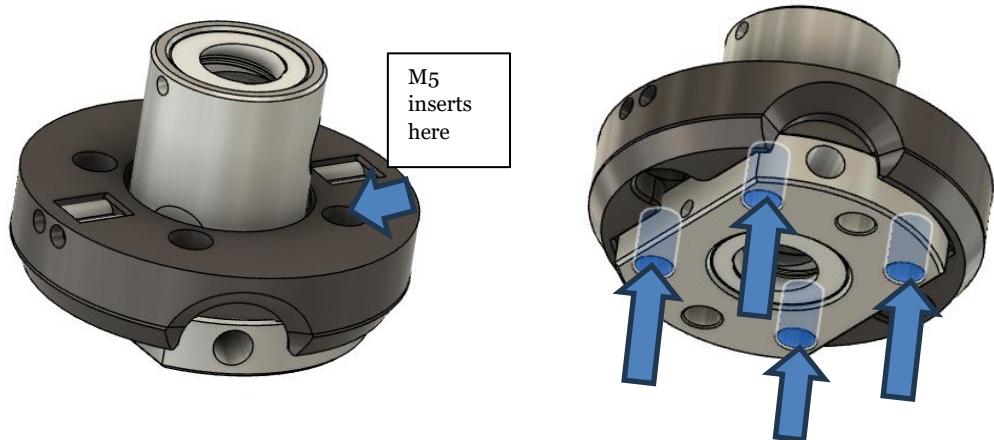


Later at the end of the unit assembly, use a plier to tension the spring and reach the arm mount point, secure it with a 3x6mm pin on each side

NOTE: The springs are not mandatory, you can remove them if you prefer a pure motion

5 BRS-Oldham

You need to assemble the lower ring on the Ballscrew Nut first

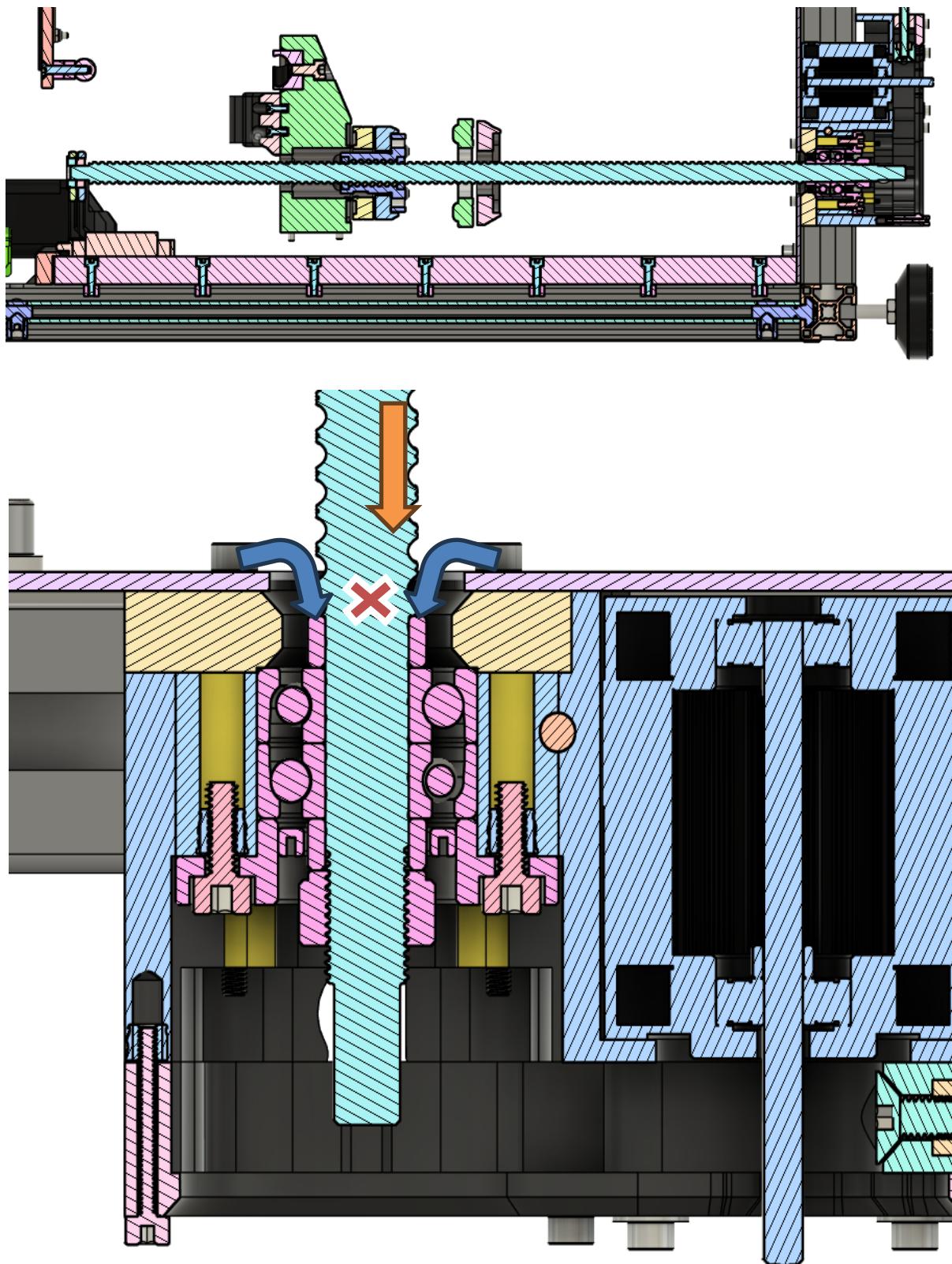


Then [M4x16mm](#) (1204 version) or [M5x16](#) (1605 version)

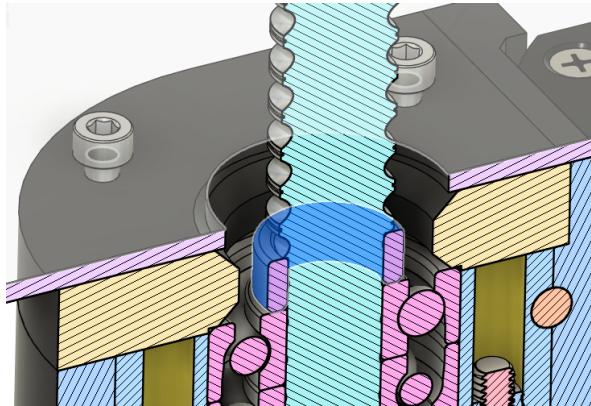
6 Spindle assembly



On this picture, the Nut and the Oldham are not represented, but should be positioned on the middle of the ballscrew BEFORE. **NEVER REMOVE THE NUT FROM THE SPINDLE**

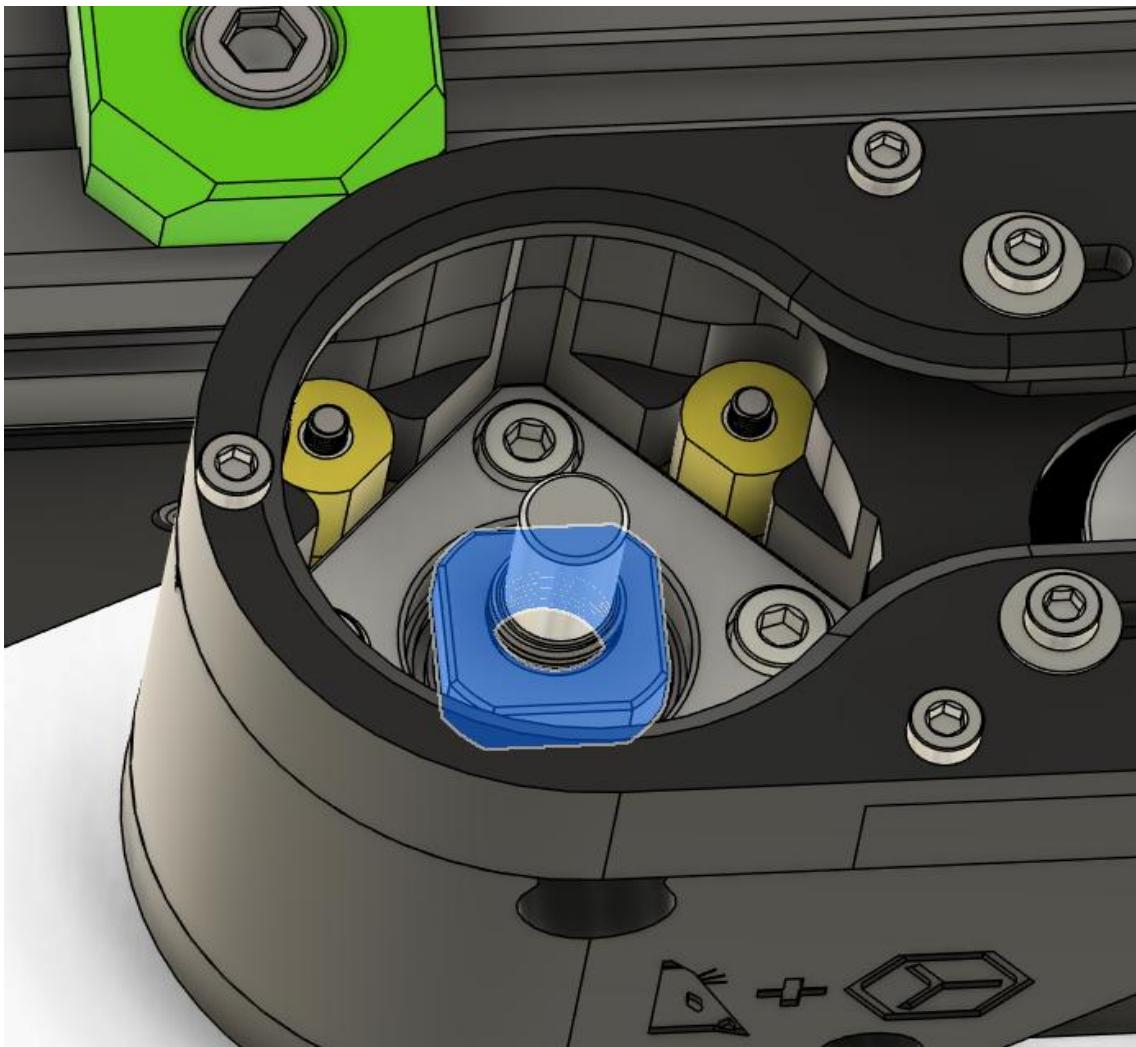


Assemble the ballscrew to the maximum position, against the first spacer.



You need to first insert it in the arm hole, you may need to remove the top retainer to give you clearance, and then place the machined end in the lower motor block through the BK10 Internals

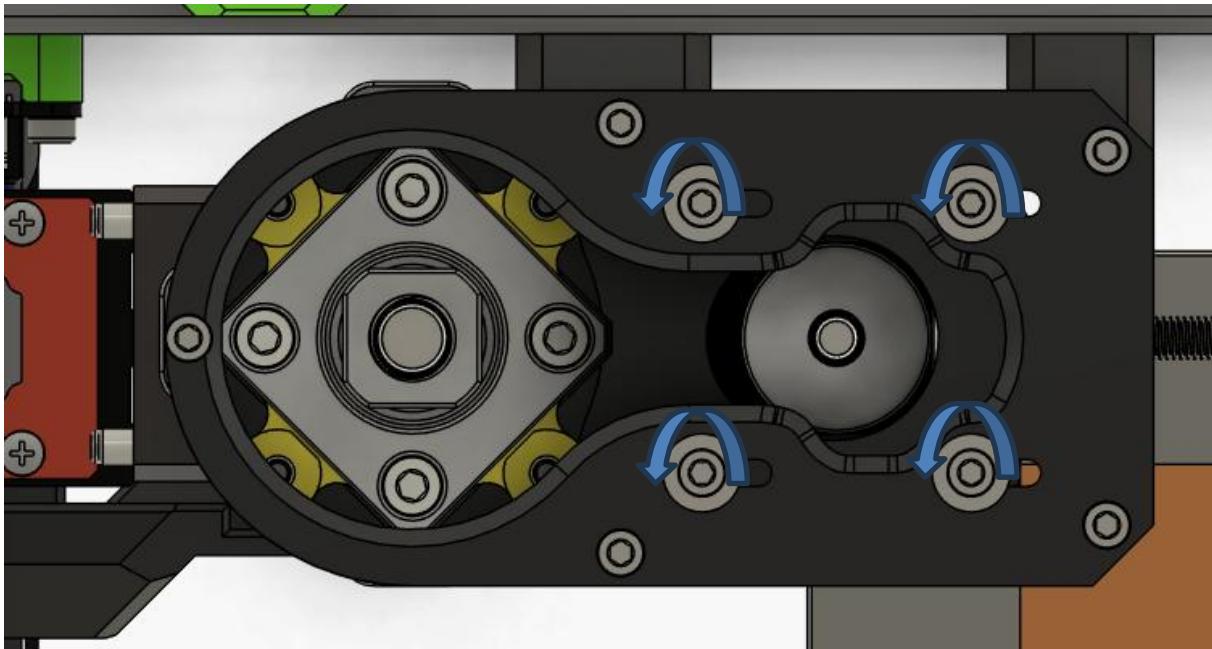
When the spindle is inserted in the BK10, be sure it goes against the black spacer, and add the retaining nut (don't overtighten it)



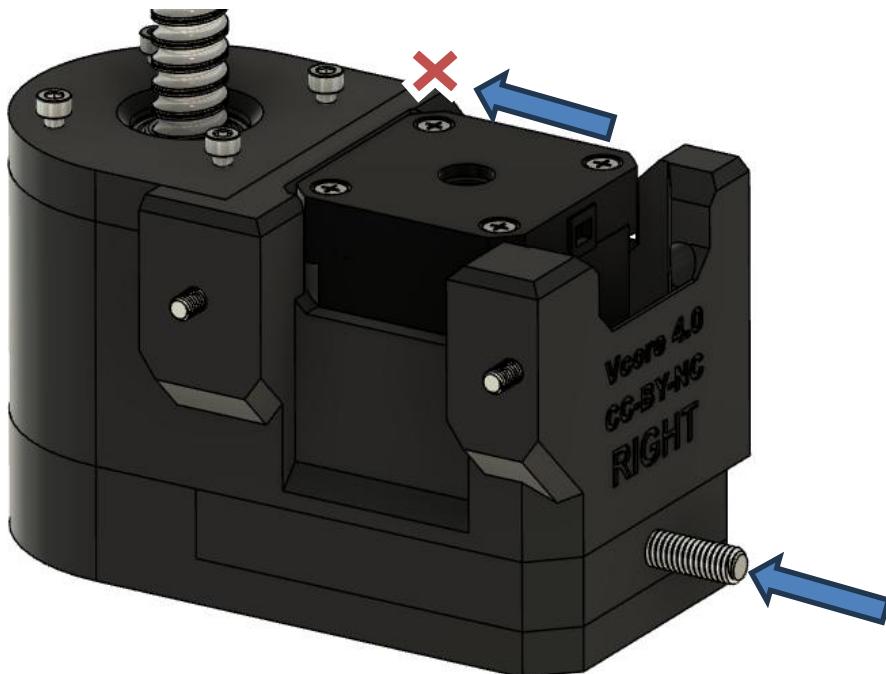
7 Z-Belts

For the purpose of the exemple, let's isolate the next pictures of the full frame.

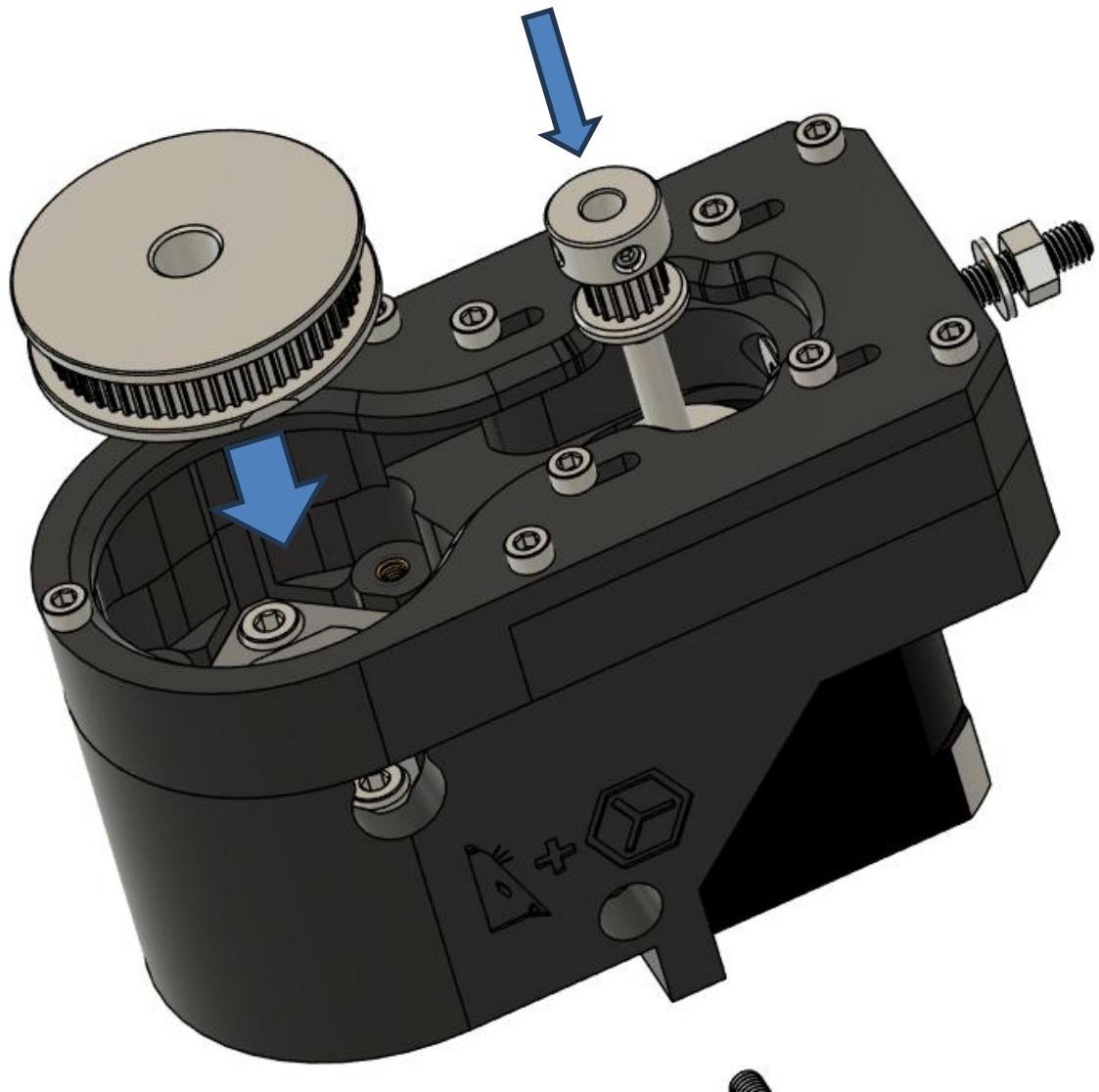
To insert the belt and the 60T pulley, we need the motor the closest possible from the spindle



Unscrew a bit the 4 NEMA retainer screws



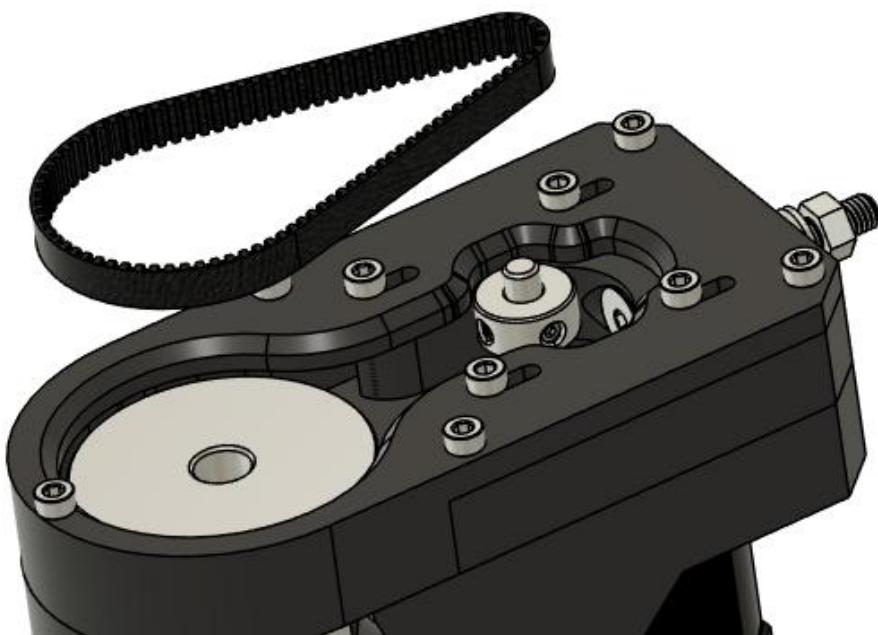
Push the M5 bolt to gain the minimal position.



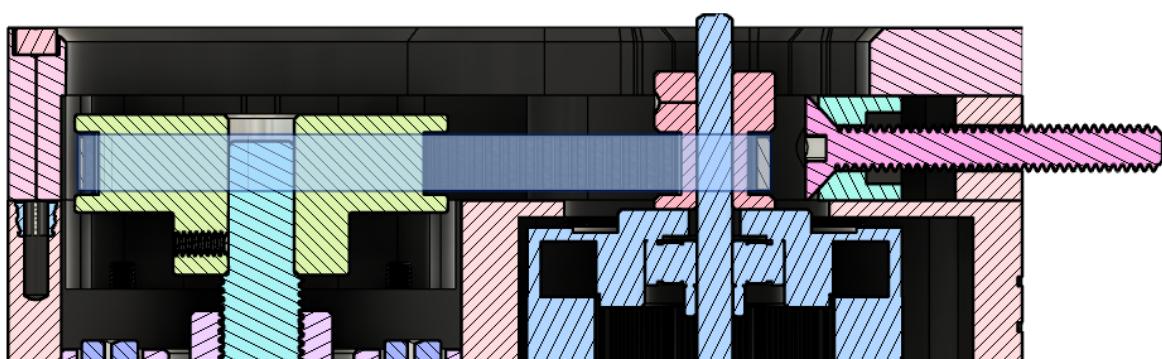
Place the 20T and the 60T, there is few options to install the reduction here, everything can be placed in the same time! (remove the top if necessary)

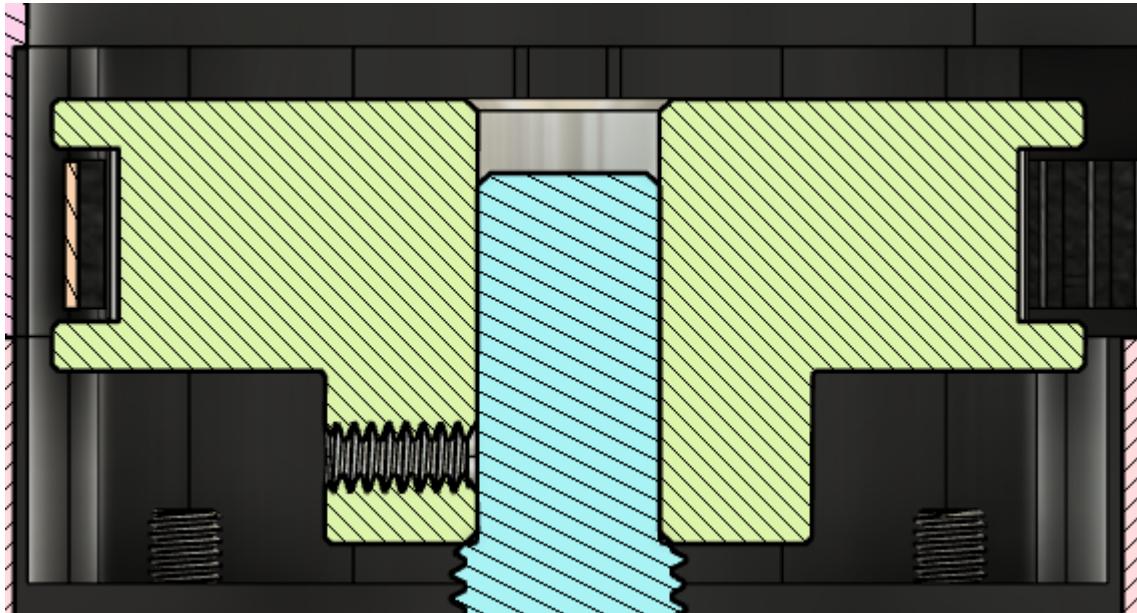
BE CAREFUL WITH THE 60T INSERTION, DO NOT FORCE IT, ALUMINIUM CAN BE DEFORMED BY THE STEEL SPINDLE

Then install the 180-190mm Belt and the 60T pulley. Wiggling it a bit to fit the 20T.

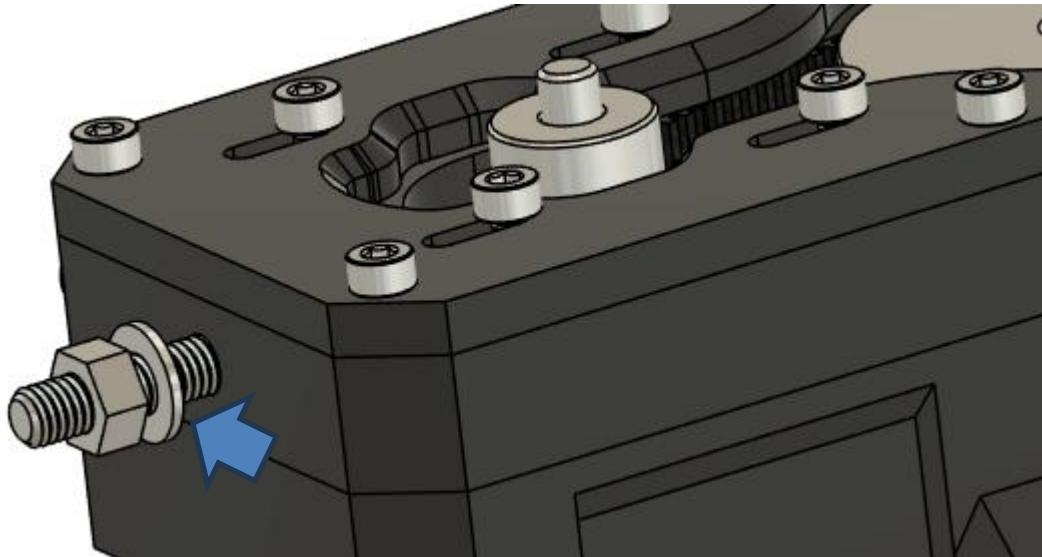


Control the alignment from the top, belt must be centered on the pulleys





You can now tighten the 60T headless screws



Now tune the belt tension through the M5 Nut + washer here

We need it to be tight but do not overtension it either, we want a ferm flex on the belt.

Repeat the process with the 2 other remaining block

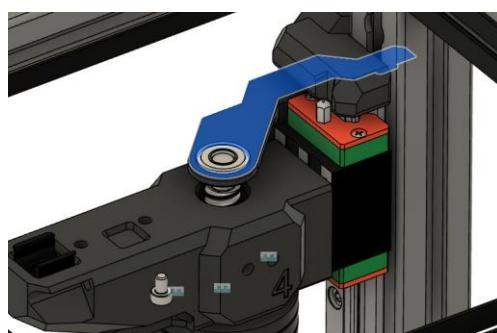
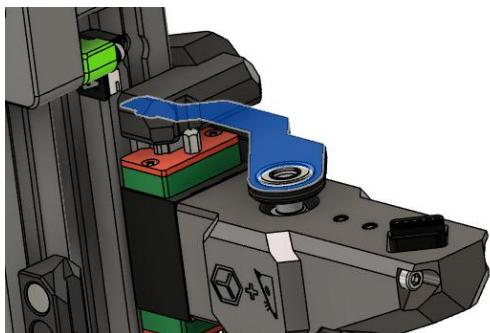
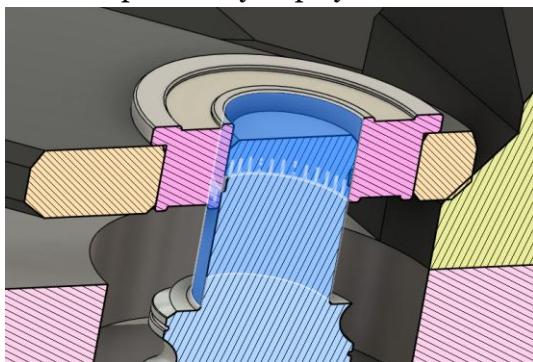
OVERTENSIONNING here can misalign the 2 shafts, and result a terrific spindle motion leading to a lot of issues, and do some definitive damages, be reasonable 😊

8 Final assembly

For the 1204 version, simply keep the standard stock LS/BS retainer at the top, we use the same ID 8mm bearing

If you are using the 1605 variant, use the compatible bracket designed for 10mm ID bearings (6000-2RS)

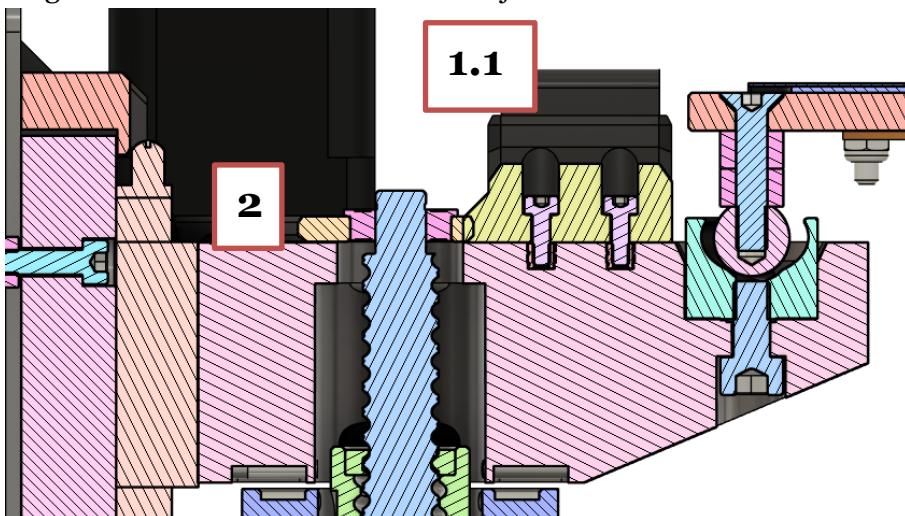
In order to get some safety for potential collision, place the retainer with 2mm margin, you have the possibility to play with the retainer Z position



You can adjust a bit the height of them if necessary.

You can at this point add the bearing balls into the OLDHAM/WOBBLEX assembly

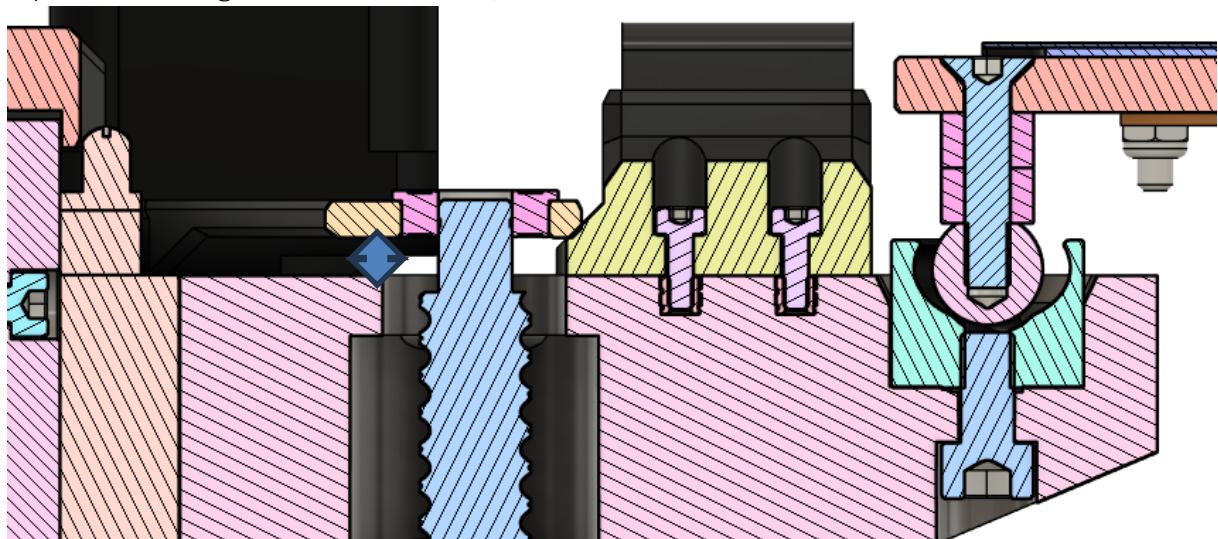
-Depending the Hot end you will use (Rapido, Magnum, Goliath, ...) or a custom bed, the max height can be different. There some adjustments that can be done to maximize it



-1/ Add some M5 washers on the bed feet, to add the necessary height missing

-1.1/ Elevate the wiper if necessary

-2/ Tune the height the the retainer: 4mm are available



9 Config cfg

The first thing to do is to correct the **rotation_distance** of all Z sections

1204: **4, transformed with the 1/3 ratio to +-1.3333**

1605: **5, transformed with the 1/3 ratio to +-1.6666**

Then we need to reverse the Z motors since they are inverted (pointing to the bottom)

Simply add a “!” in front of the “**dir_pin**” (ex: **dir_pin: !PC12**)

Use a secure TMC profile: we don't need speed here, we need precision and control

For LDO - Model: LDO-42STH48-2504AH(S37) (stock) 1.8°, use those TMC settings:

TMC2209

```
[stepper_z]
rotation_distance: 1.3333 or 1.6666
full_steps_per_rotation: 200
microsteps: 64 (or 32)
position_max: <max z>
position_min: -12
homing_speed: 10
homing_retract_dist: 0
```

```
[tmc2209 stepper_z]
uart_pin: <pin>
interpolate: false
stealthchop_threshold: 0
run_current: 1.6 - 1.7675 (max)
sense_resistor: 0.110
driver_TBL: 2
driver_TOFF: 3
driver_HSTRT: 6
driver_HEND: 0
driver_TPDFD: 0
```

Do it accordingly for Z, Z1 Z2 motors

The microstepping can be set high here; Yes we will lose torque, but the Z-Upgrade is already multiplying the force to the bed by rotaring a screw, with a 60:20 ratio

That leads to a slow but very powerful force in the arms

We will prefer the lowest torque here to avoid damaging the machine if you forgot a part and starting a new print by exemple, motors will skip steps on collision and being protected by the low torque applied

You can use Klipper AUTOTUNE for Z here :

https://github.com/andrewmcgr/klipper_tmc_autotune

This can make the machine more silent, with a good tuning of the motors

Z-Upgrade 3.x For VCORE 4.0

BRS-Engineering

Follow the step of the mod, then add in your printer.cfg:

```
TMC2209 + Autotune
[stepper_z]
rotation_distance: 1.3333 or 1.6666
full_steps_per_rotation: 200
microsteps: 64 (or 32)
position_max: <max z>
position_min: -12
homing_speed: 10
homing_retract_dist: 0

[tmc2209 stepper_z]
uart_pin: <pin>
interpolate: false
stealthchop_threshold: 0
run_current: 1.6 - 1.7675 (max)
sense_resistor: 0.110
driver_TBL: 2
driver_TOFF: 3
driver_HSTRT: 6
driver_HEND: 0
driver_TPFD: 0

[autotune_tmc stepper_z]
motor: ldo-42sth48-2504ac
tuning_goal: silent
```

Do it accordingly for Z, Z1 Z2 motors

If Autotune behave strangely, you can still go back to the base settings listed above.

If 64 or 32 microstep are bothering you, you can use 16, **but keep in mind the force of the system will be tremendous; if my negligence you have a defective Z-Probe, or forgot a printed part on the bed, the collision can likely bend the X gantry, bend the X rail, damage the toolhead, the PEI, the hotend, the top retainers and even can destroy or deform the Z bottom block and bottom aluminum panel.**

Some people use to get issue on Z-Tilt “out of attempt because of a too high RUN_CURRENT As I never encounter this issue on the model, I don't know the cause of it, but lowering it to 1.2 or 0.9 solved the issue

Make sure the pulley are fixed with the grubscrews, and nothing is slipping

NOTE: If you use other motor model or driver type, please do your setup accordingly.

You can ask me directly if needed

10 Maintenance

Not a lot of thing to tell here:

- Once a year, clean the spindle with a clean fabric, use WD40 to remove dust or contaminants
- Use Lithium based grease inside the Spindle nut, you can use a small syringe to do so via the m6 hole on it inserting it and moving it to the bottom on 40mm, this will fill the ball path
- Control the belt, to see if there is damage (normally none)

The system is not likely to fail, ballscrews are heavy duty hardware and we are barely using it here

The Z-Upgrade from 2021 is still behaving perfectly

A backlash test with a Beacon or Cartographer probe will give you a value so small, that it will speak for itself 😊

Here some examples I have already used, the list is not exhaustive



11 Photo details



Z-Upgrade 3.x For VCORE 4.0

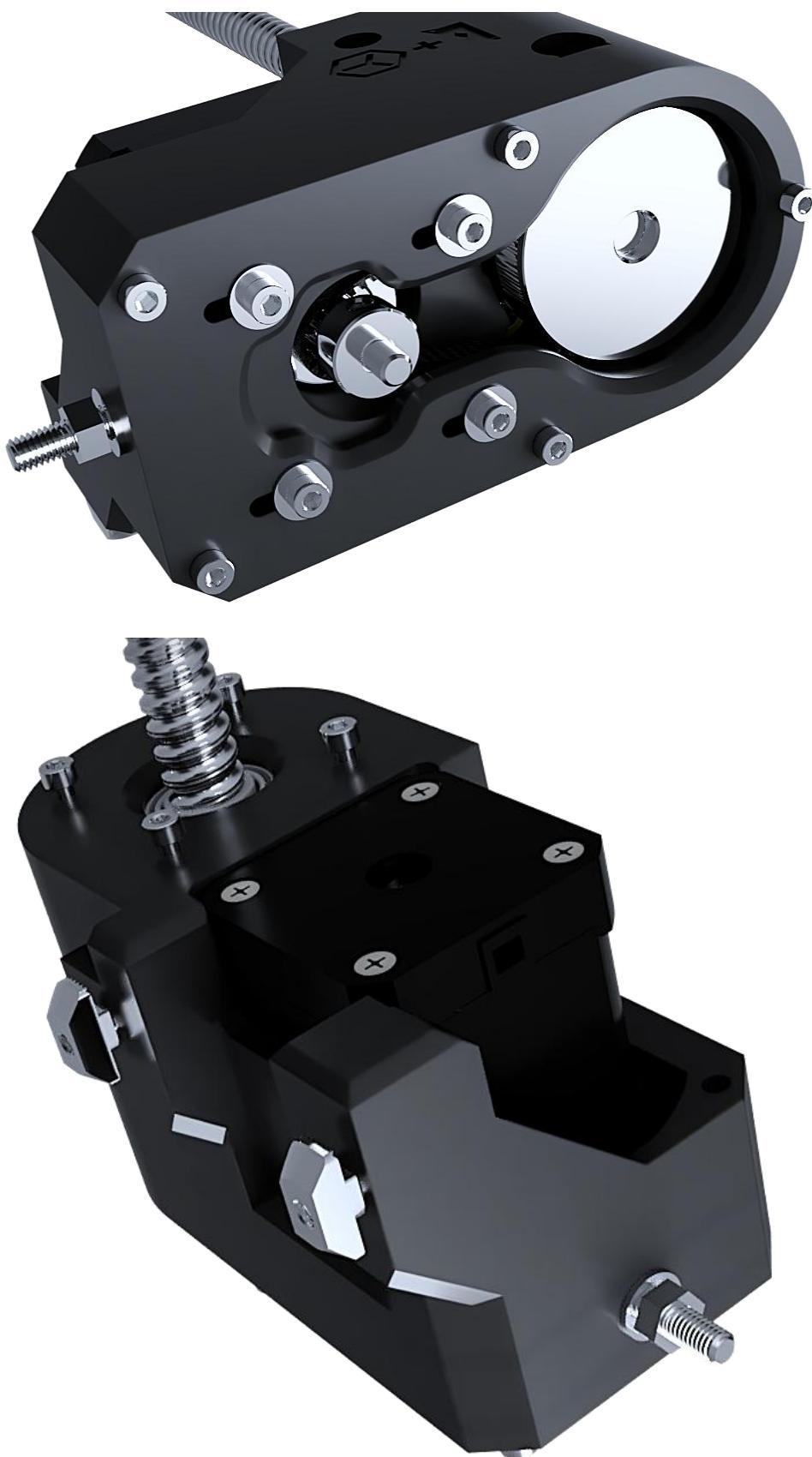
BRS-Engineering

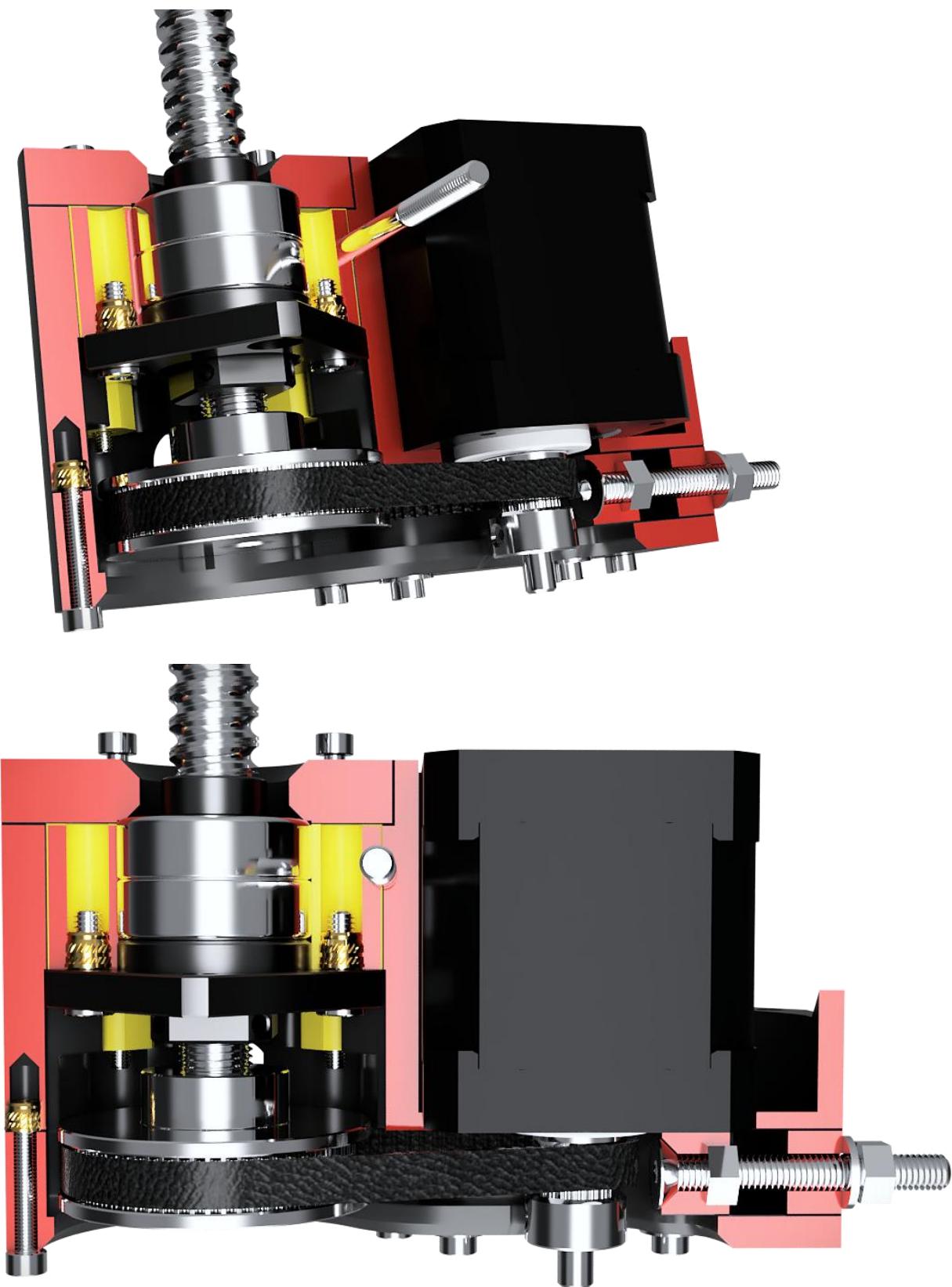


	Z-Upgrade 3.x For VCORE 4.0	BRS-Engineering



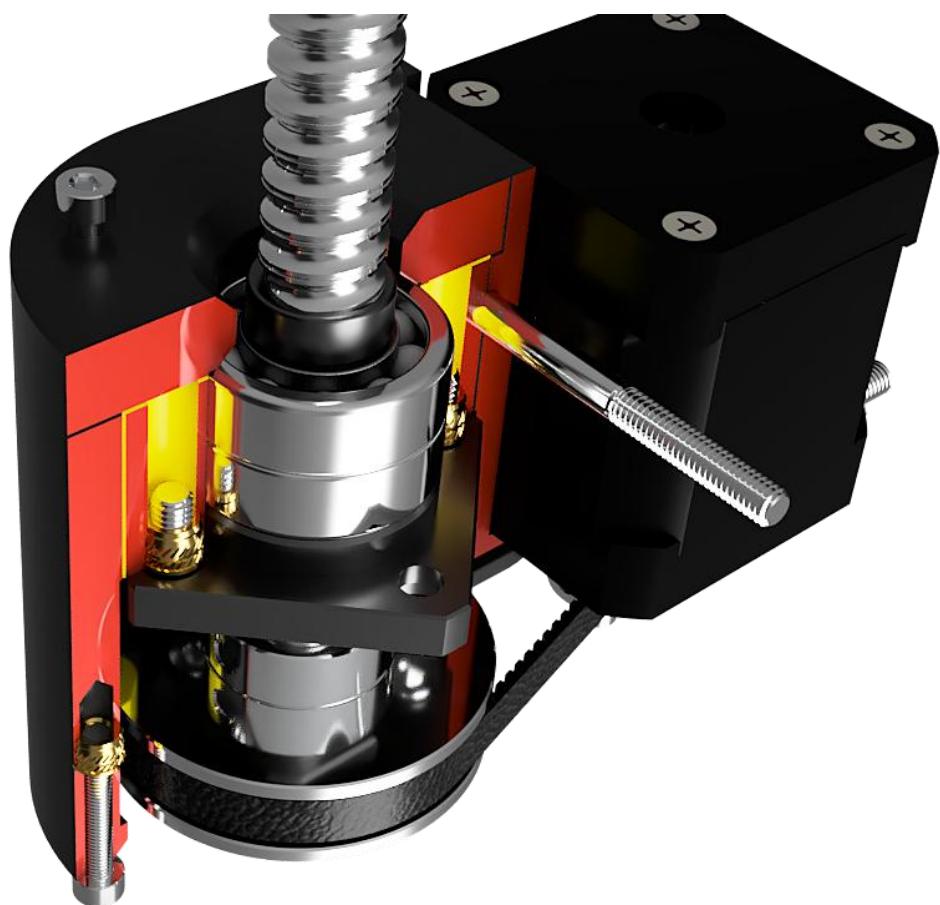
	Z-Upgrade 3.x For VCORE 4.0	BRS-Engineering





Z-Upgrade 3.x For VCORE 4.0

BRS-Engineering



Z-Upgrade 3.x For VCORE 4.0

BRS-Engineering



Z-Upgrade 3.x For VCORE 4.0

BRS-Engineering



	Z-Upgrade 3.x For VCORE 4.0	BRS-Engineering

12 Assistance

If you need assistance ; I can help on:

Mail : contact@brs-engineering.com,

Discord: [BRS-ENGINEERING-Florent Broise](#)
brsengineeringflorentbroise_3873

Meta Messenger: BRS-Engineering