

# **MANUAL Kit Z-Upgrade 2.0 with Oldham 2.3**

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## **Suivi des évolutions**

Indice	Date	Description de l'évolution	Auteur
0.0	17/02/2023	Création	FBR
0.1	11/09/2023	MAJ + SFU1605 specificity	FBR
0.2	15/05/2024	MAJ + v2.8 DE (definitive edition)	FBR

Rédacteur	Responsable X	Qualité
FBR	FBR	FBR

## **Pre-check**

### **BEARINGS**

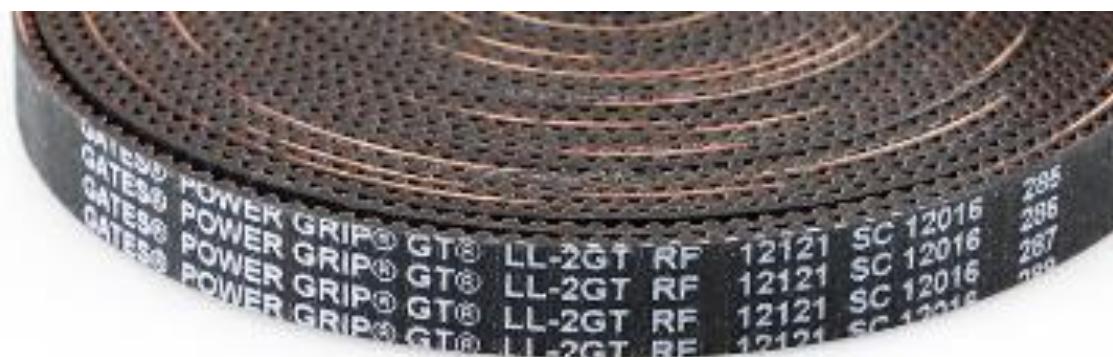


It is a good idea to check bearings health before assembly, it can solve issue before spending time on a painful full check.

- Choose a 2RS or a ZZ protection to remove the dust to be a future issue
- Check the bearing armor (ZZ) it should be flat, no pinch, no deformations
- Roll it by hand to check an eventual hard point, proof of an internal issue
- Check the presence of dark oil coming from a junction (used bearing), if present, change the bearing. ( Bearing are generally cover by a clean film of clear oil/lubricant that is normal)

The M1-M2 design has been made with not need and possibilities to compress the bearing, meaning there will be no issues relative to that.

### **BELTS**



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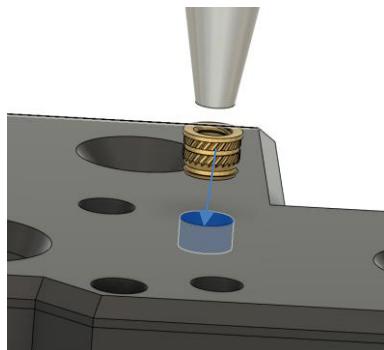
I always advised to use quality genuine Gates belts in order to have less issues in the future, be sure to have the good length (at least 15mm more on each side)

I personally experienced non straight belt with no-name ones, it leads to issue during printing by moving the belt path contact up and down the bearing leading to friction, loose of steps, and even rapid failures. Choose quality first 😊

## Part preparation (SFU1204/1605)

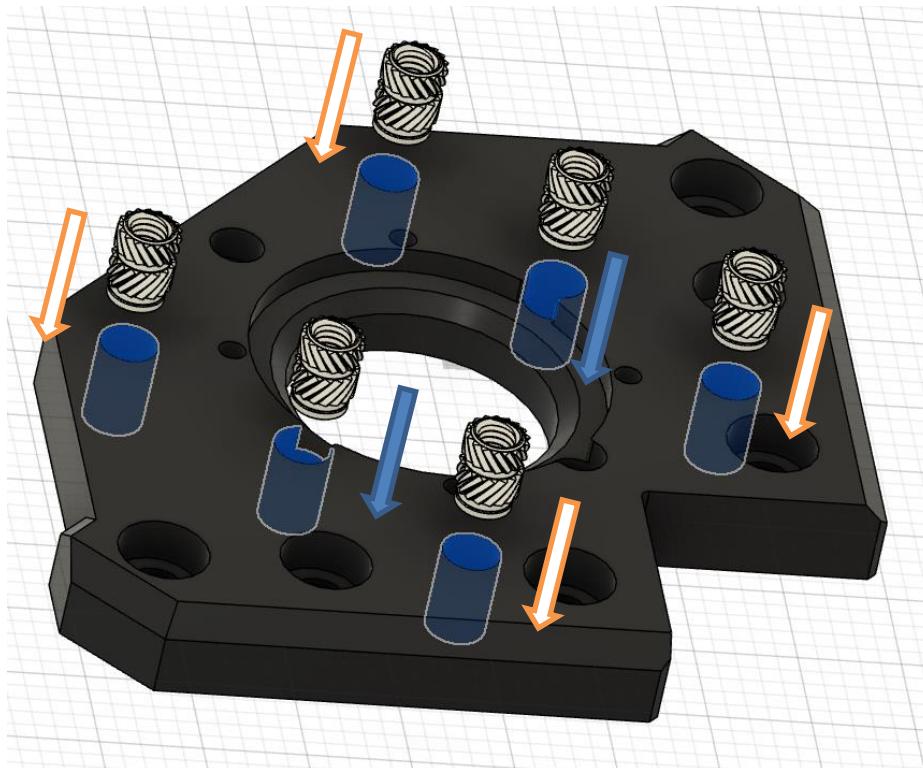
### 1/ HEAT INSERTS

Insert m4 Inserts in the required places with a soldering iron



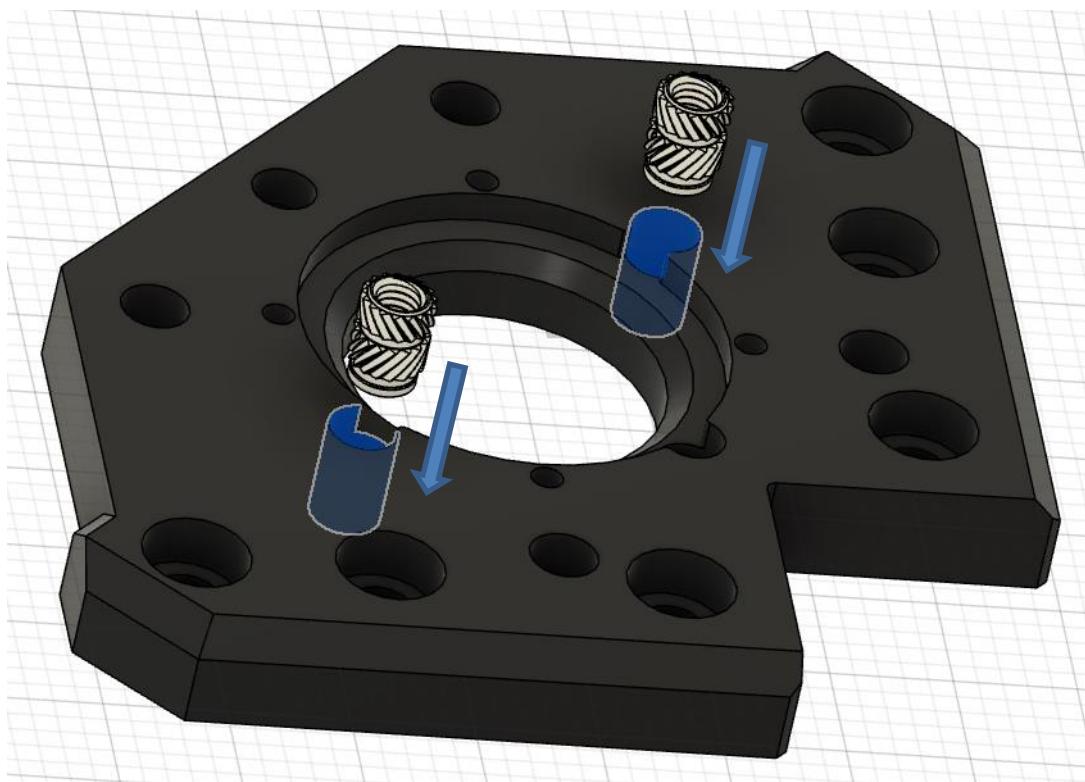
Exemple

### A/ LOWER PLATES



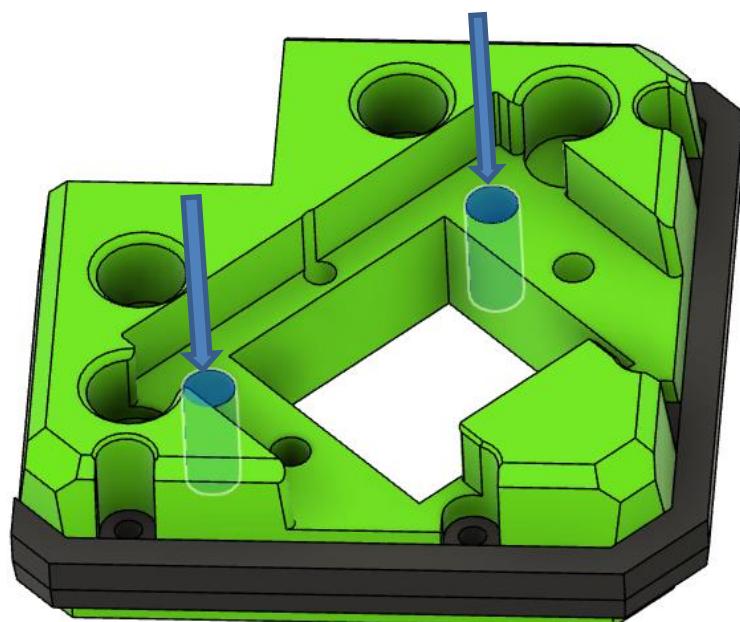
If you plan to use NEMA23, you will need to insert with M5 units the 6x holes like the previous figure

If you plan to only using NEMA17, the only the 2 next holes need a m5 insert like the next figure, ensure it flush the Nema23 ring recess. Both plate are symetric



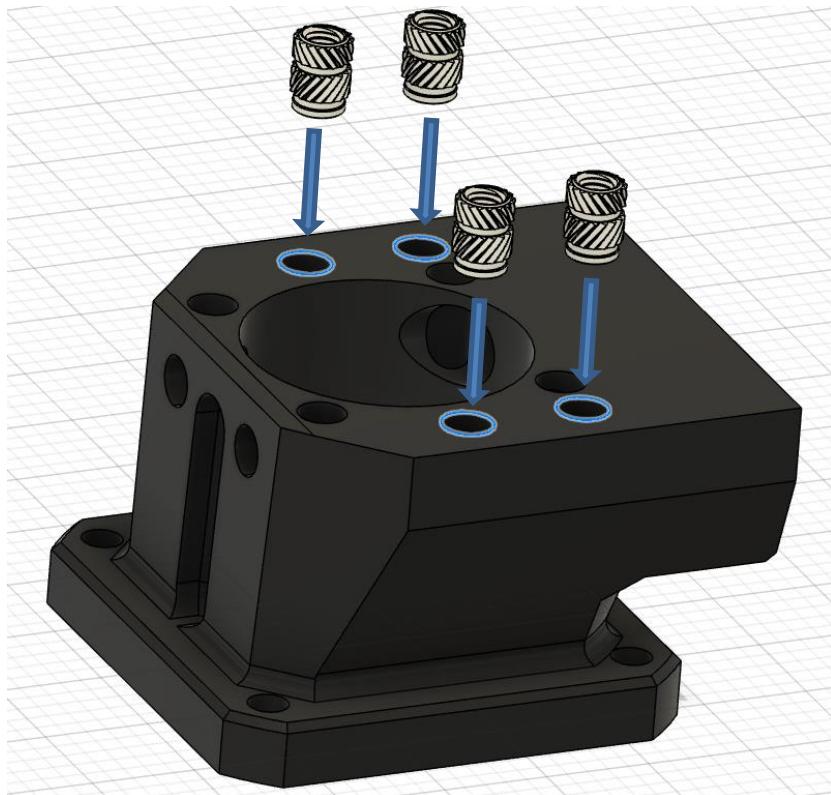
## B/ UPPER PLATES

Insert 2x M5 insert here

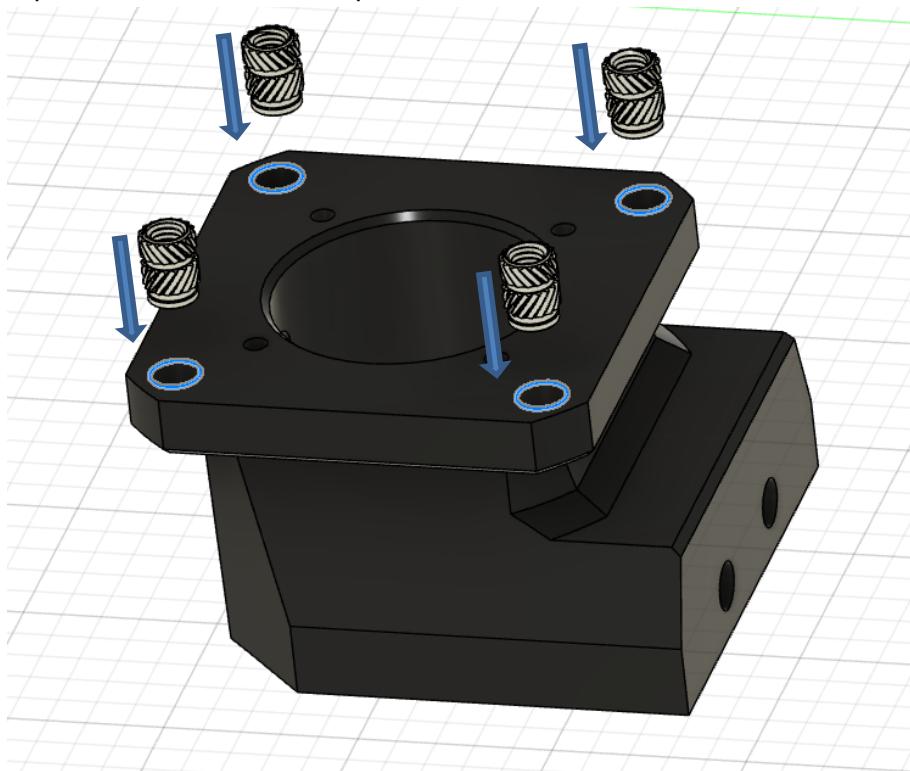


## **C/ REAR BLOCK**

4x M5 Inserts here

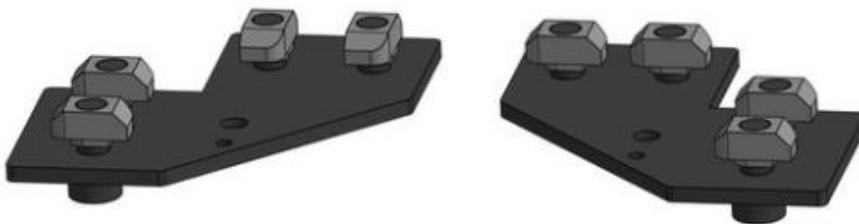


If plan is to use NEMA23, place 4 M5 inserts here



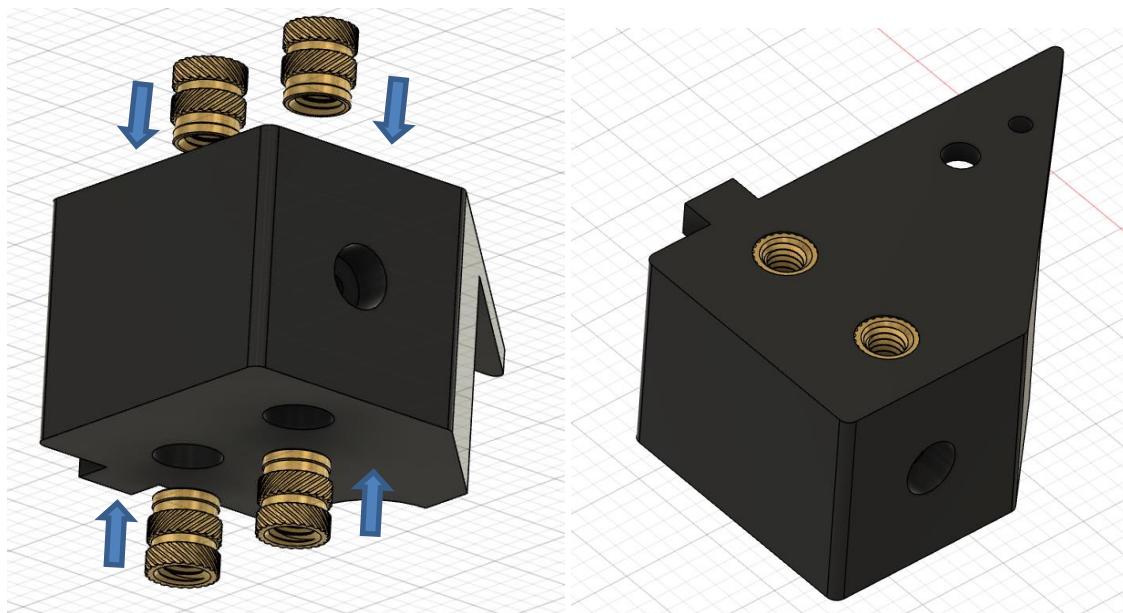
## **D/ OPEN FRONT IDLERS 2.0**

**I/ VCORE 3.0/3.1 early batch: If you have those plates**



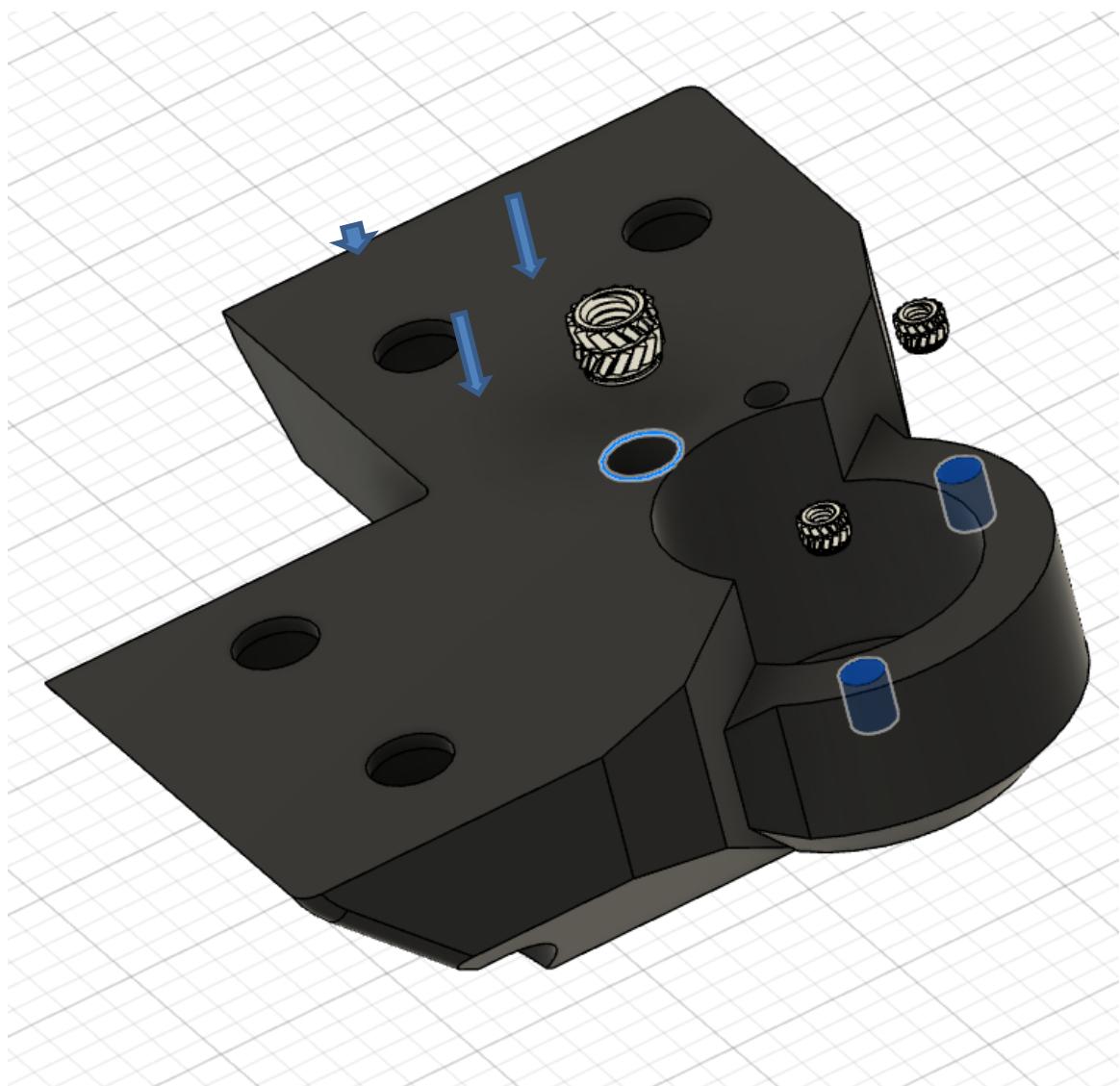
You will need to use this Open front idler blocks

Use 4 M6 insert here



The on the SFU relainers:

## Manual Z-Upgrade 2.0 + Oldham V2.3



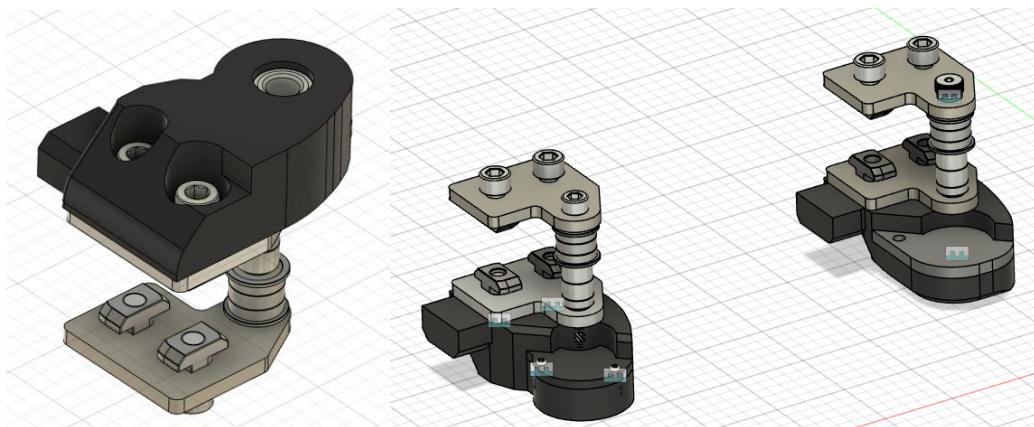
Insert 2x m2 and 1x m4 inserts here

!!! Do not insert 608ZZ Bearings now!!!

**II/If you have those plates, actual 3.1 batch:**

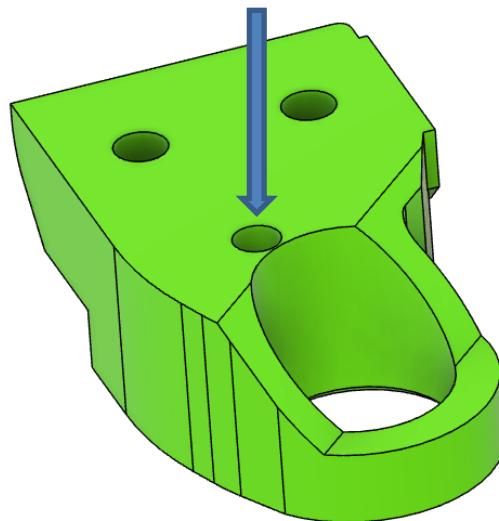


You will need to use thos module (1204 ballscrew has a specific block, an so the 1605):



## Manual Z-Upgrade 2.0 + Oldham V2.3

If you have the 2.8DE, this step does not exist anymore, the part is slightly different, the shoulder bolt D5M4x35 is needed here with a m4 insert



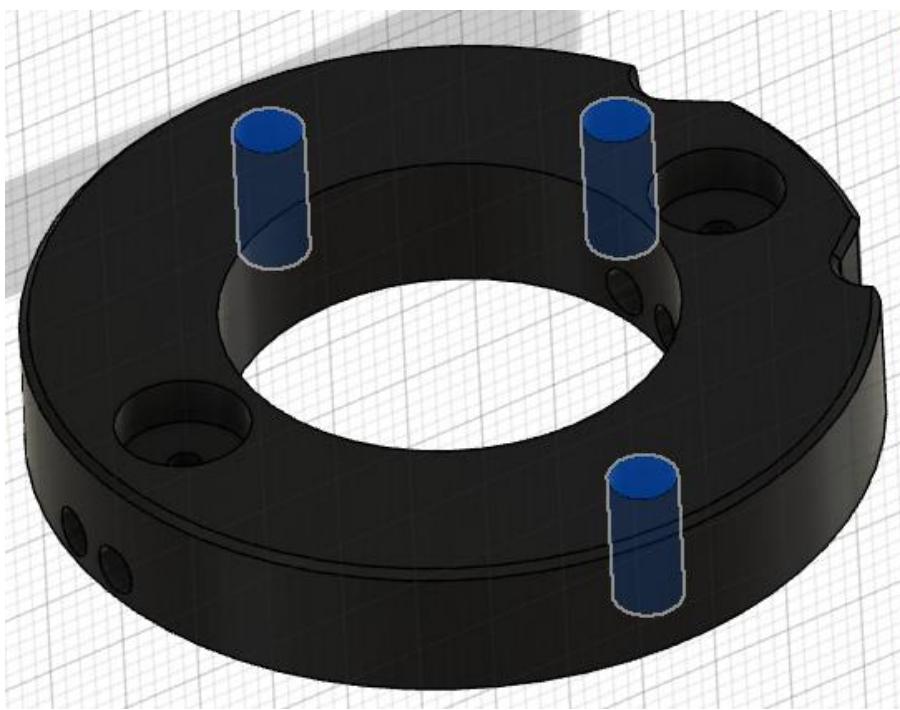
### E/ OLDHAM-2.3 for SFU1204

-BRS Oldham are not compatible with Wobble X

Install all inserts and all the dowel pins



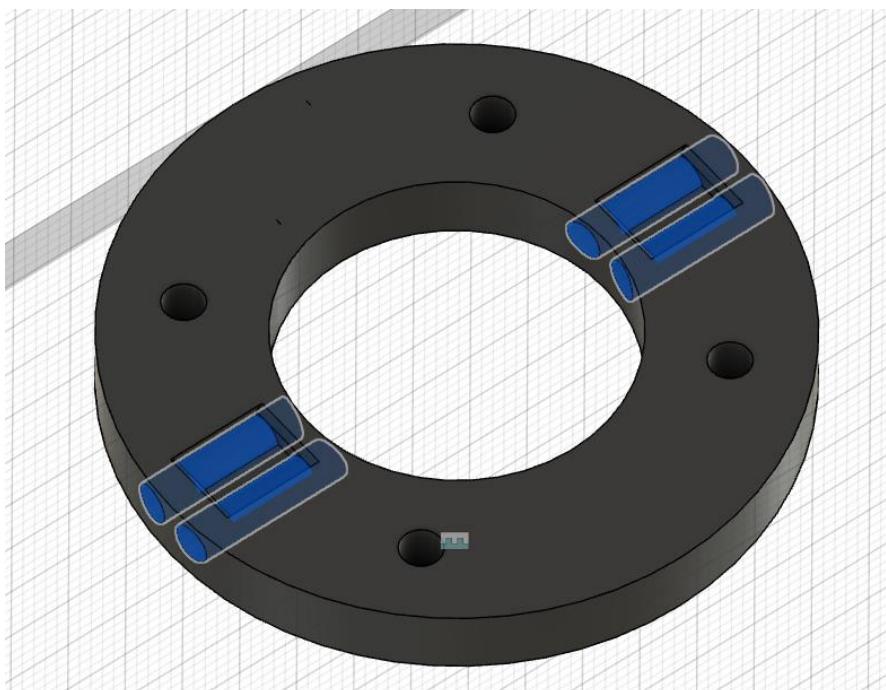
**M4 inserts here on the lower ring**



**M3 inserts here**

**The R and the left parts contains 3 slots for inserts, mirrored between R and L, the rear one is either a left or a right part, we only use the 2 laterals holes at 180° angle.**

**THE LAST REVISION IS REBUILD AROUND A UNIFIED CENTRAL DISK? ONLY INSERT THE DOWEL PINS ACCORDINGLY WITHOUT THE M2 INSERTS AND M2x8 SCREWS**



**Dowel pin on every 3mm holes**

## Manual Z-Upgrade 2.0 + Oldham V2.3



**8x3mm magnets here on the lower and upper parts.**

You can assemble the 2 middle parts / SINCE LAST REVISION THE CENTRAL RING IS UNIFIED

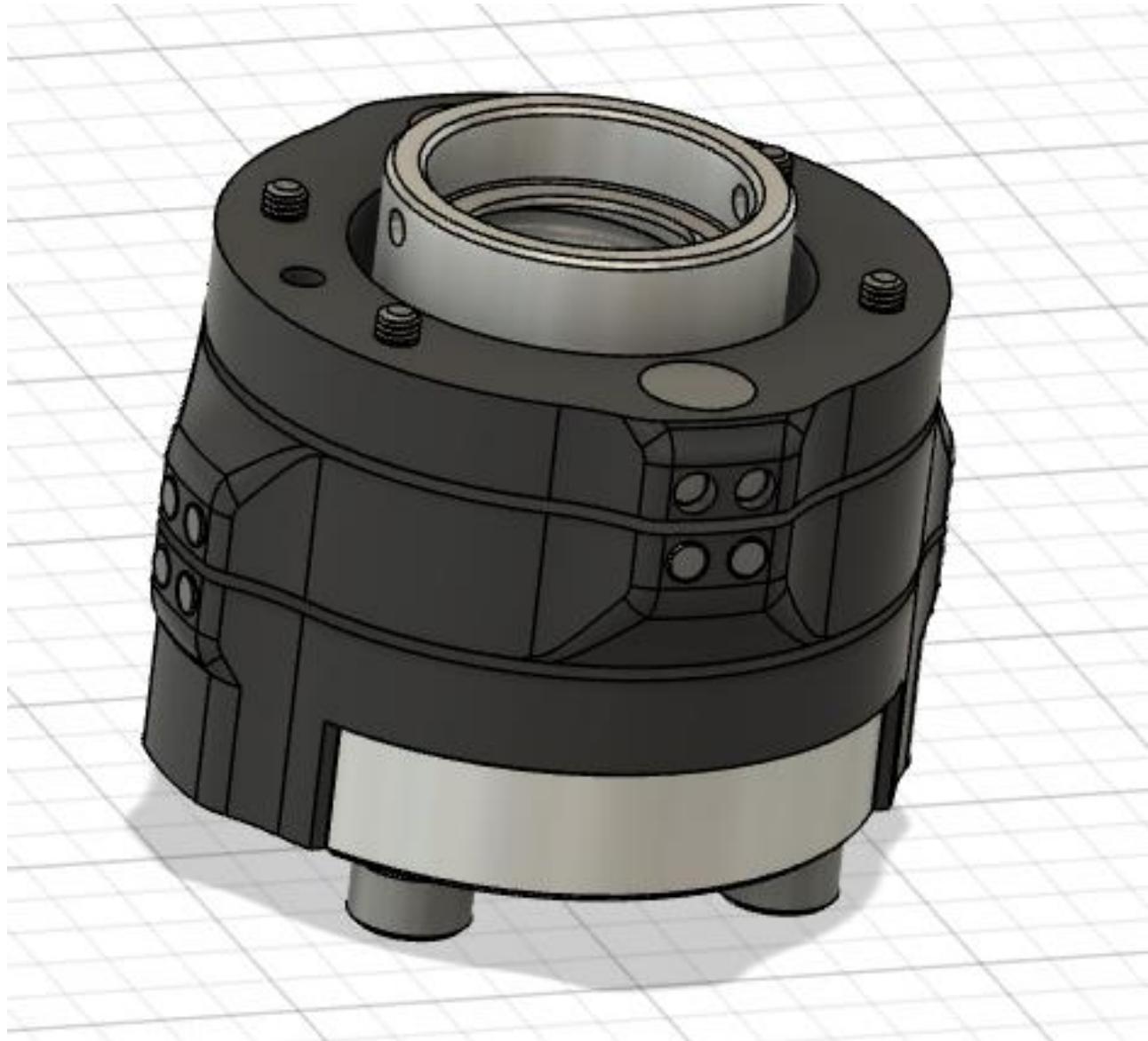
*EPAHT/PA12CF15 can handle 25Kg on each disc without issue with the specific concentric 100% print pattern*

*Other materials can see this number bellow, but we need less than a 2Kg resistance in a VC300. This design is made to last or be used in a very heavy solution, like 8-10-12mm bed for custom size VC 800+*

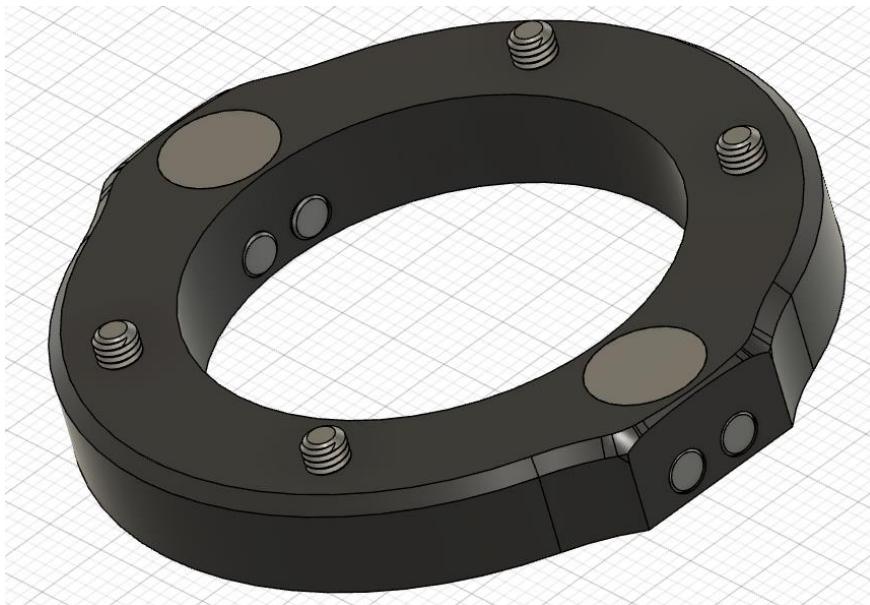
## **F/ OLDHAM-2.3 for SFU1605**

-BRS Oldham are not compatible with Wobble X

As the 1605 are way bigger than the 1204, a change is needed:



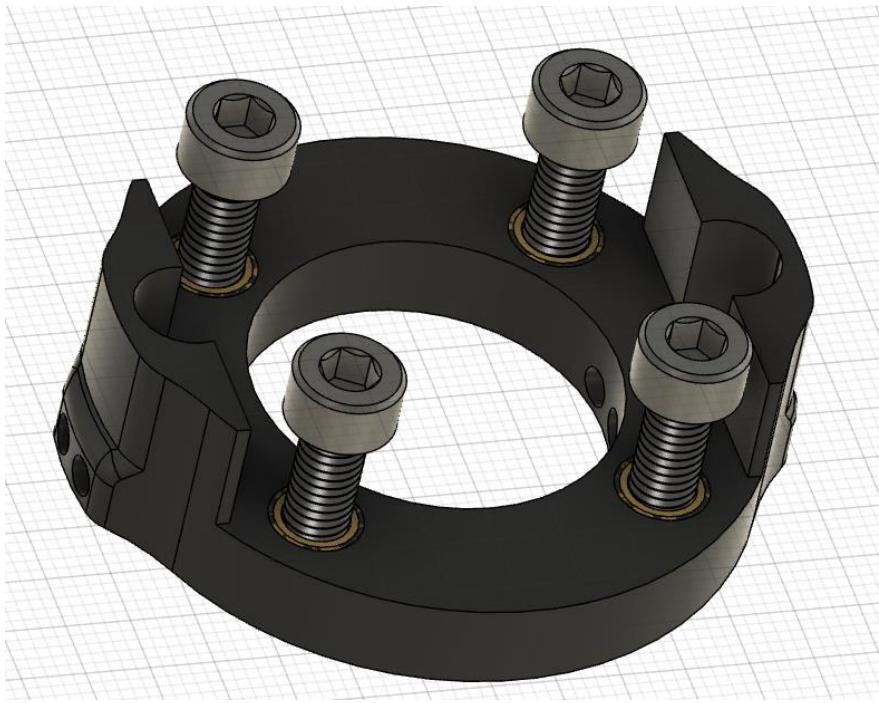
**1 Top Ring:**



Here only 2x 8x3mm magnets are needed plus the 4x m3x5mm  
Install the 3x10mm dowel pins

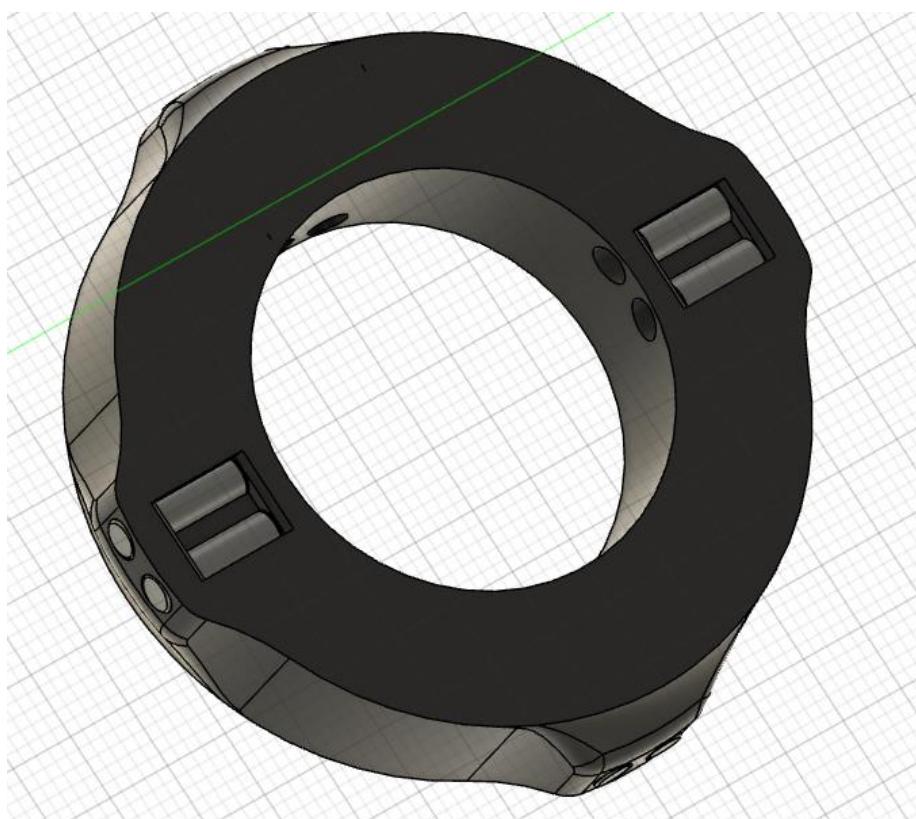
**2 Bottom ring:**

Here only 2x 8x3mm magnets are needed. You need to install 4x m5 short inserts  
The M5x16mm displayed here are for the bigger nut holes  
Install the 3x10mm dowel pins as well



### 3 Middle ring:

Here only dowel pins needed



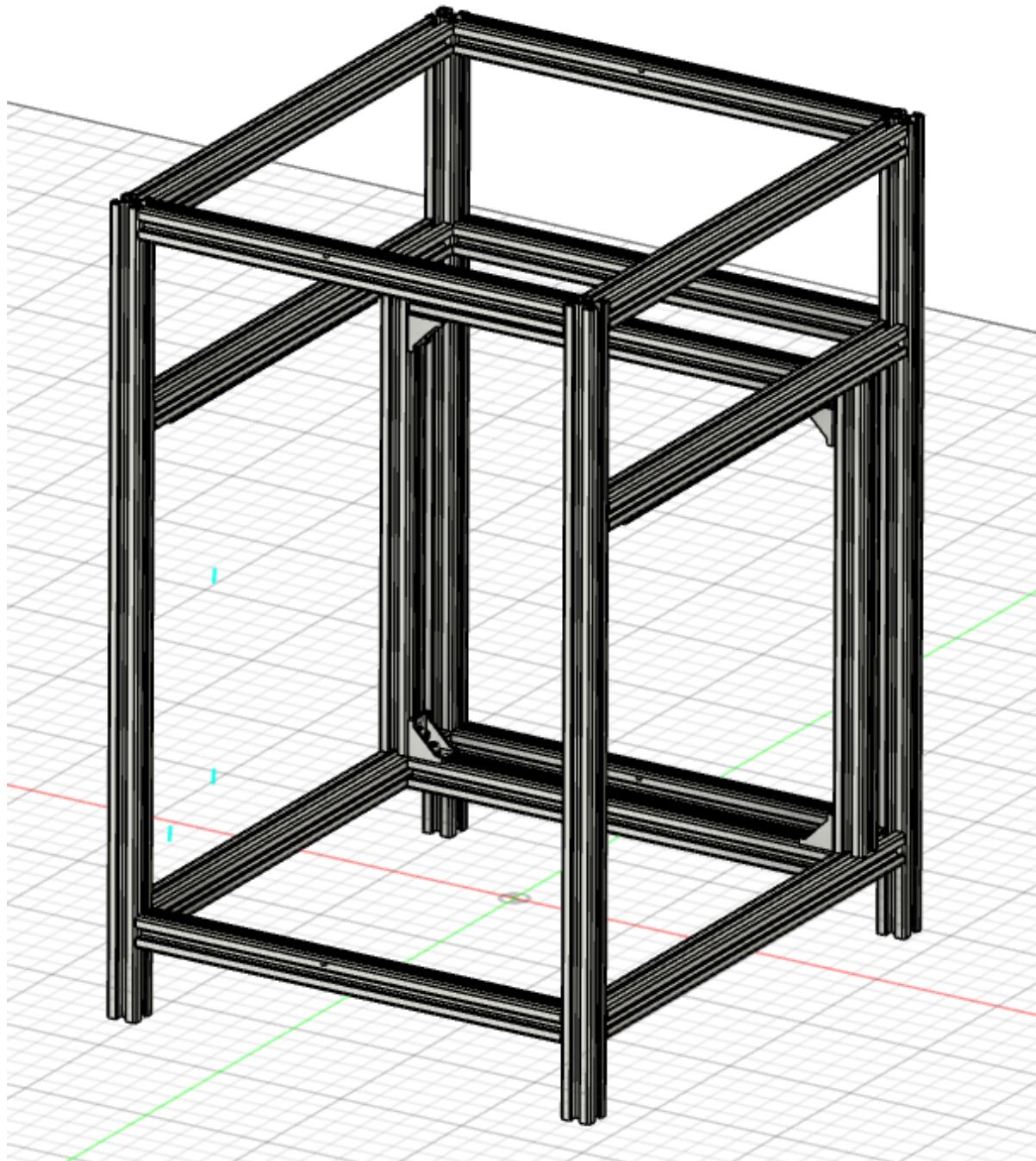
EPAHT/PA12CF15 can handle 25Kg on each disc without issue

Other materials can see this number bellow, but we need less than a 2Kg resistance in a VC300. This design is made to last or be used in a very heavy solution, like 8-10-12mm bed for custom size VC 800+

## **-Motor Blocks Assembly : 1605 and 1204**

I assume you should have the frame preassembled already at this point

***This section here concern the 1204 and the 1605 version, parts are slightly different but assembly is the same.***



-The frame here got feet to accommodate the motor Block, If you have a RR 3.x standard Frame kit, I have released some custom feet for it on the git . The CAD of this frame is available on my GIT if you want to deep look into it.

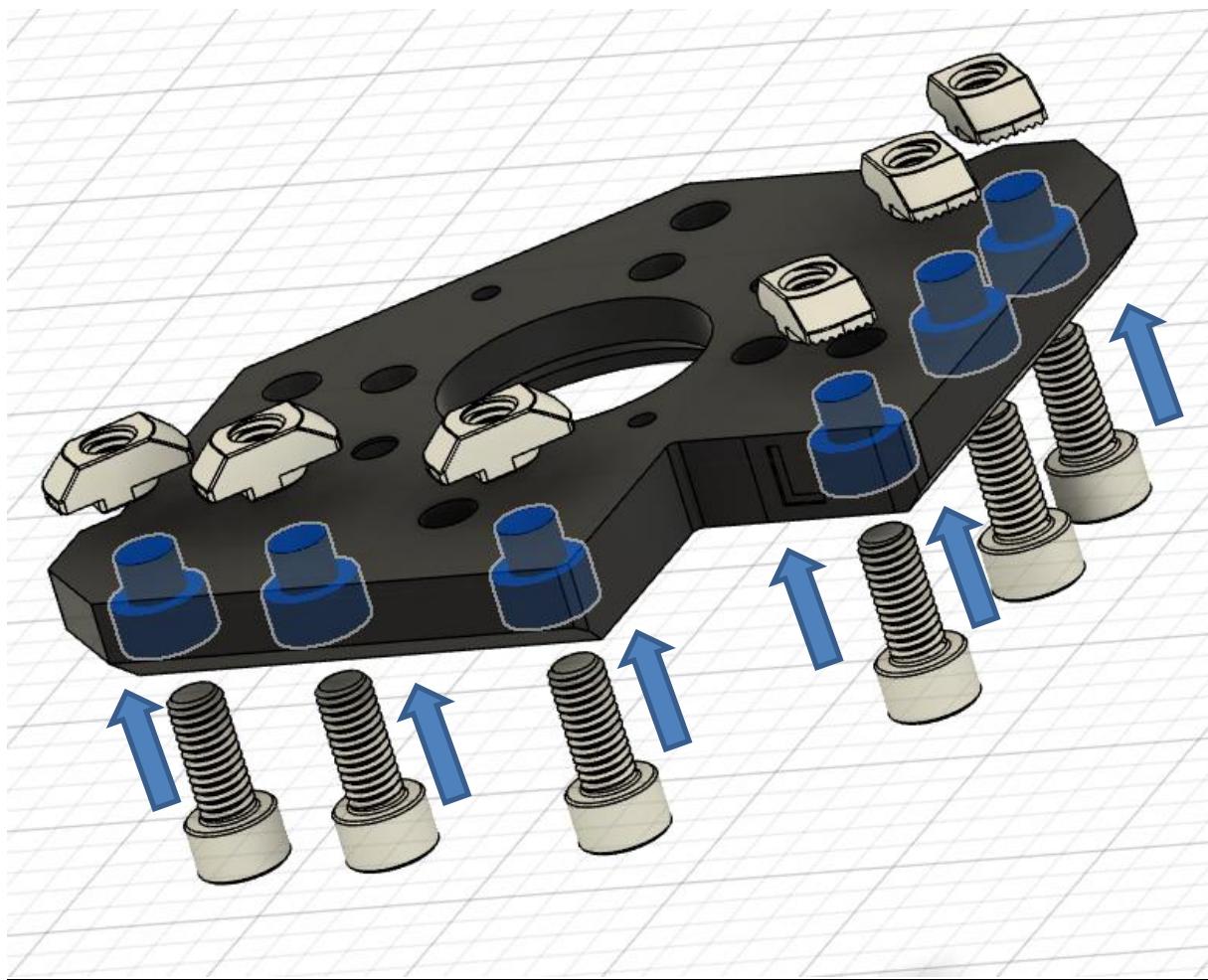
-The Z-Upgrade 2.0 use the Open Frame front idle 2.0 design with a new plate. For thos who already have the Open front 2.0, work is already done 😊

-The 2.8DE use the stock bottom plate! No need for a new one.

## **A/ FRONT**

### **1/Lower plate**

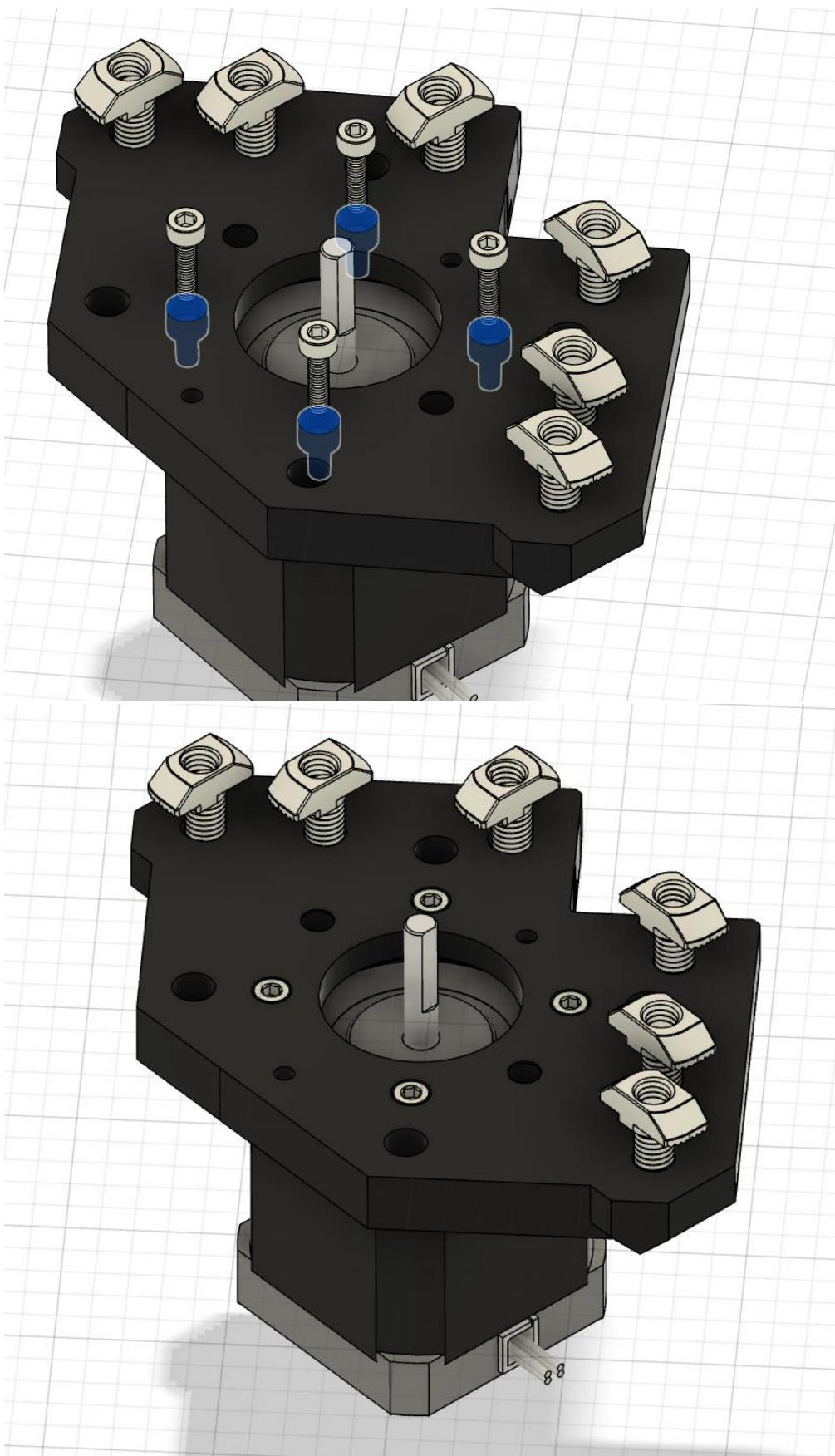
Install a M6 screw with a T nut for each 6x holes on both R and L underplate



If you plan to use NEMA17, Install it now with the according M3x12 screws

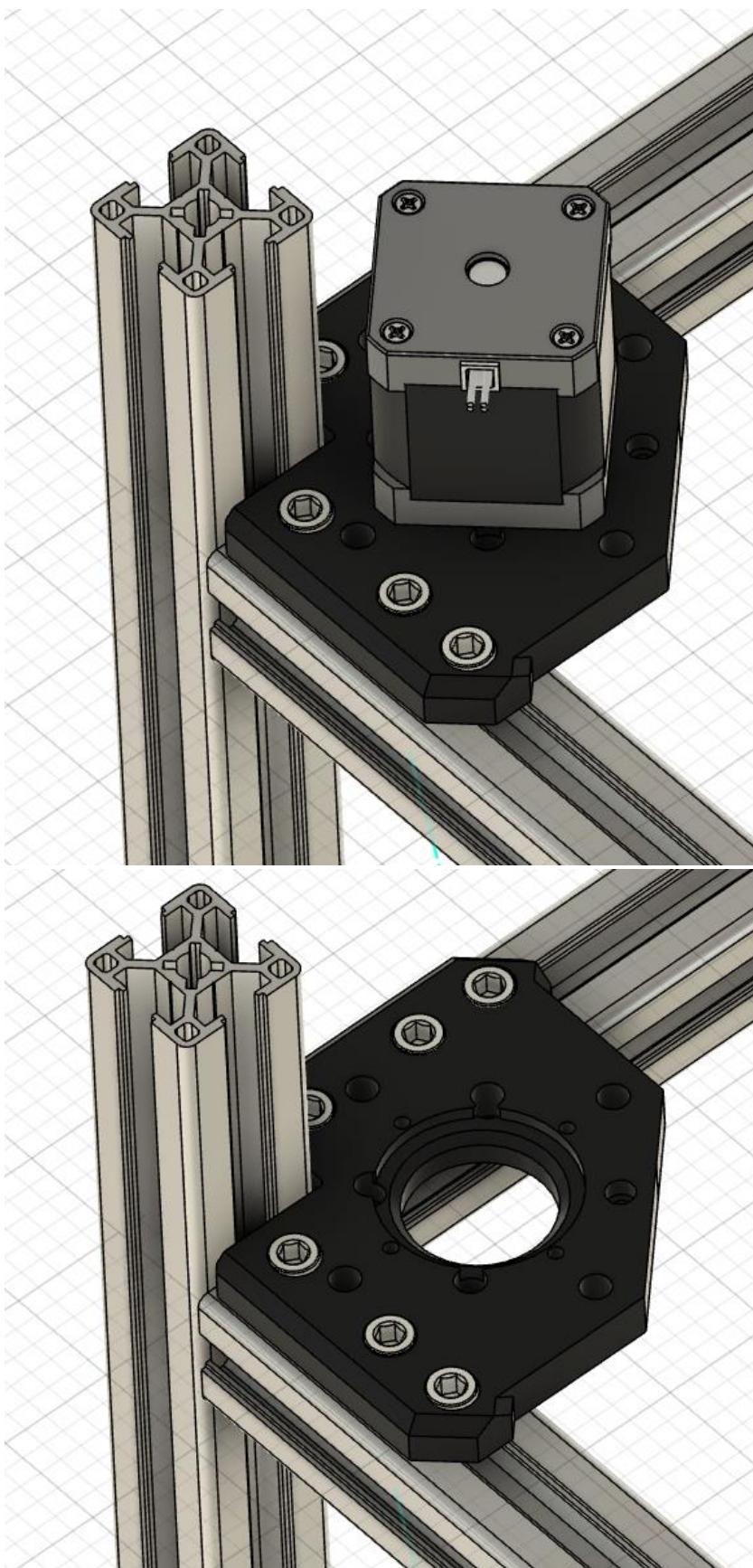
For NEMA23, we will install them a bit later

## Manual Z-Upgrade 2.0 + Oldham V2.3



Then install the bottom unit to le the front lower section

## Manual Z-Upgrade 2.0 + Oldham V2.3



For NEMA23 you have the second figure

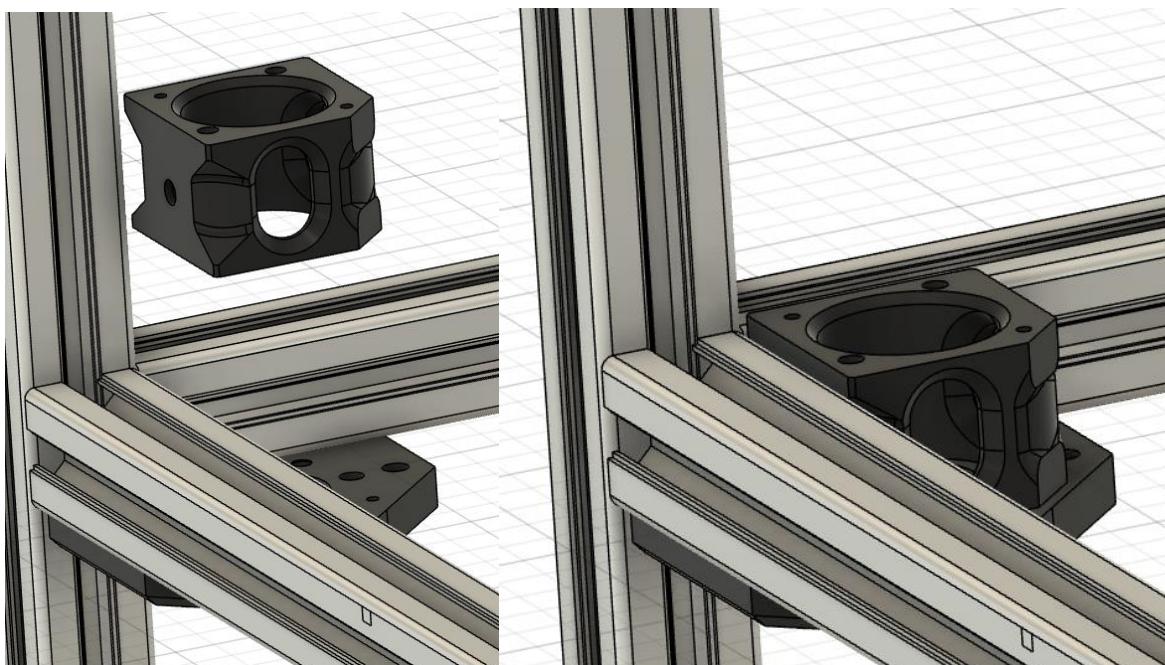
## **2/ Middle Spacers**

Z-Upgrade 2.8 DE:

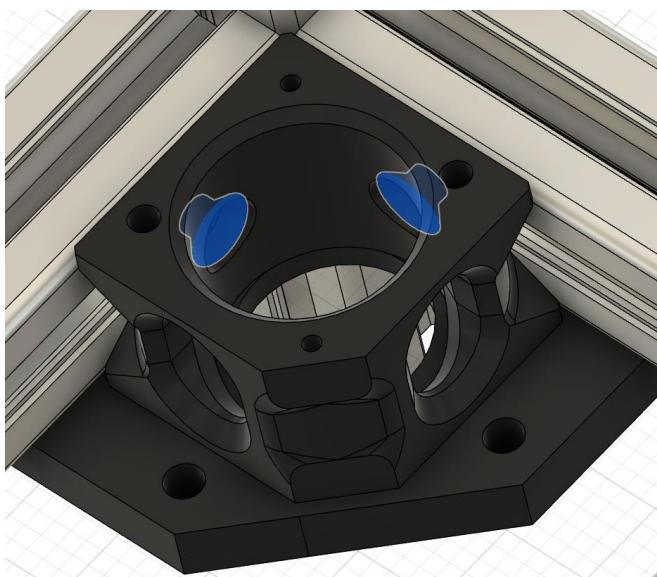
The 30mm middle spacer are used to fill the gap in the Block mechanism.

Z-Upgrade 2.0:

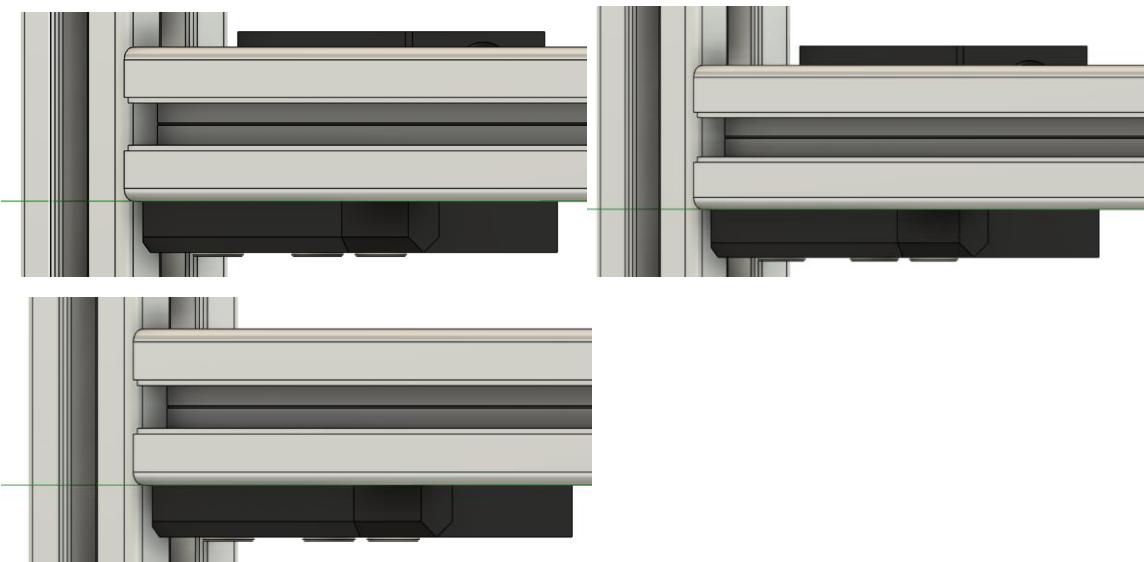
It is here to accommodate the height you have, or if your not using a bottom plate to close the machine. By default, the 3mm is used, you are free to modify the part, to flush with a system without plate, or increase it if



You can fix this part with a countersunk M6x12 and a Tnut here but that is not mandatory



# Manual Z-Upgrade 2.0 + Oldham V2.3



Depending your setup in a 2.0 version, you can adjust this part or use the space included in the kit

+3mm, +4mm, +0mm

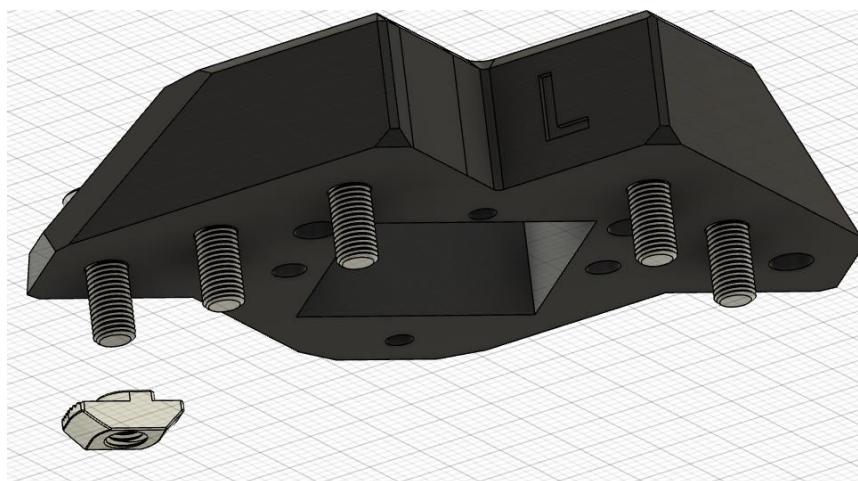
For 2.8 DE, the standard size is 30mm.

## 3/TOP Plates

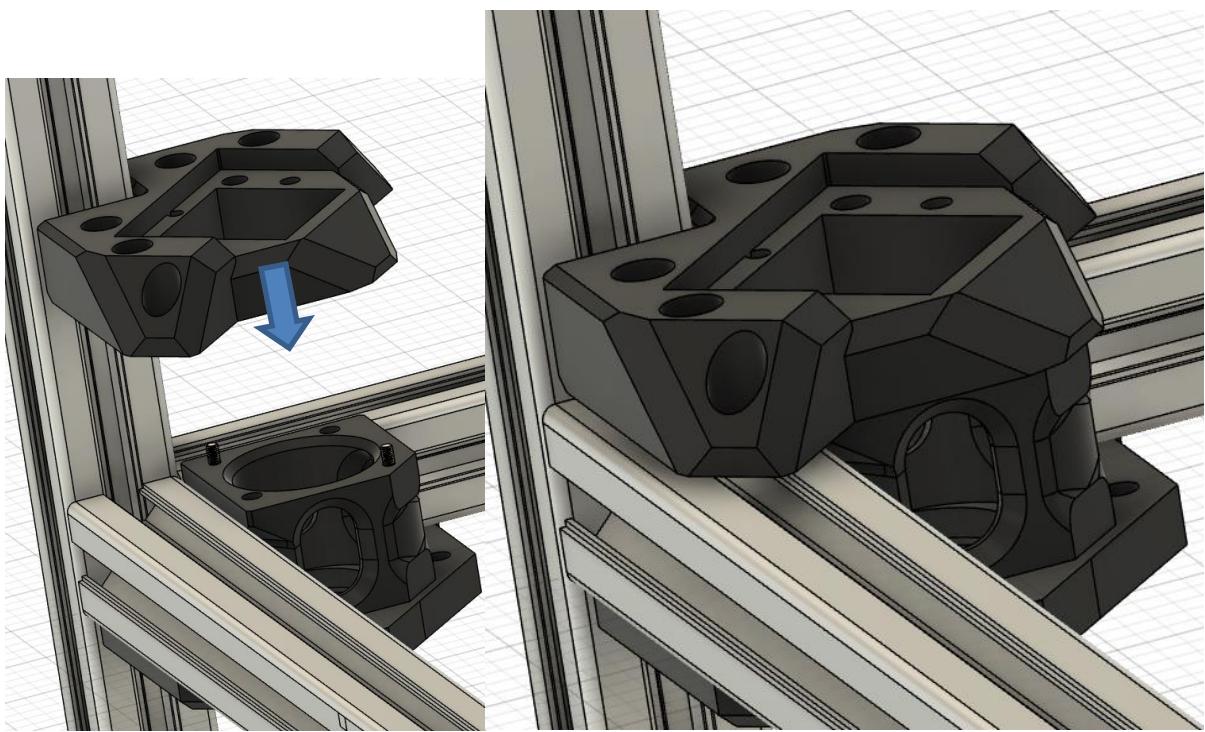
### **Z-Upgrade-2.0:**

Here what you should have to the top

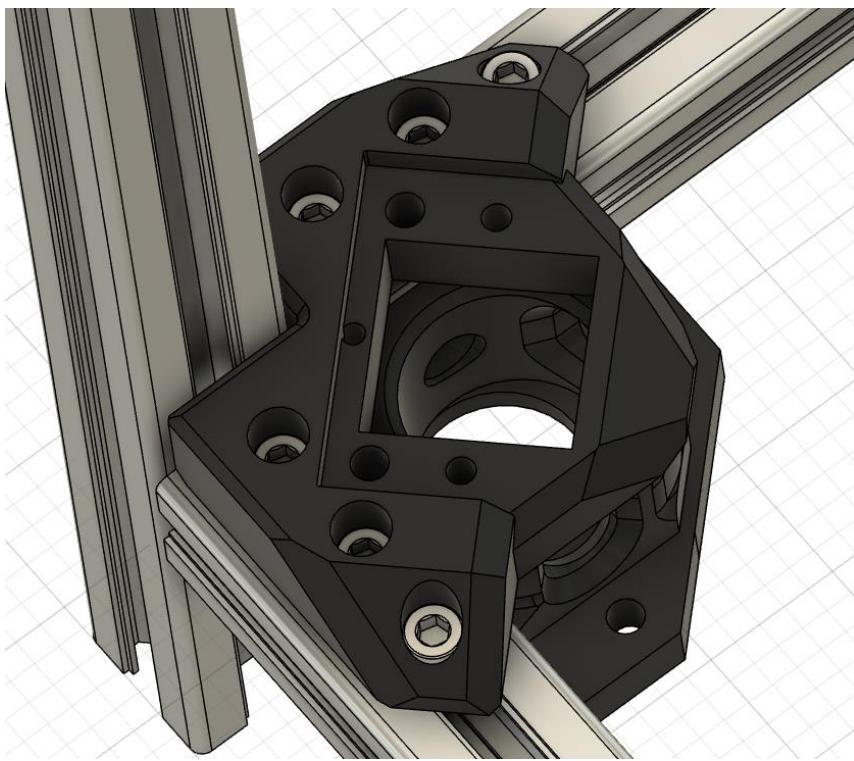
(In the NEMA 17 assembly, a hole is blocked, just ignore this screw)



Install the M6 screws with the T-nut the same way than before with the bottom plate



Place the top part and tight a bit only with the m3x45



Do not tighten everything now

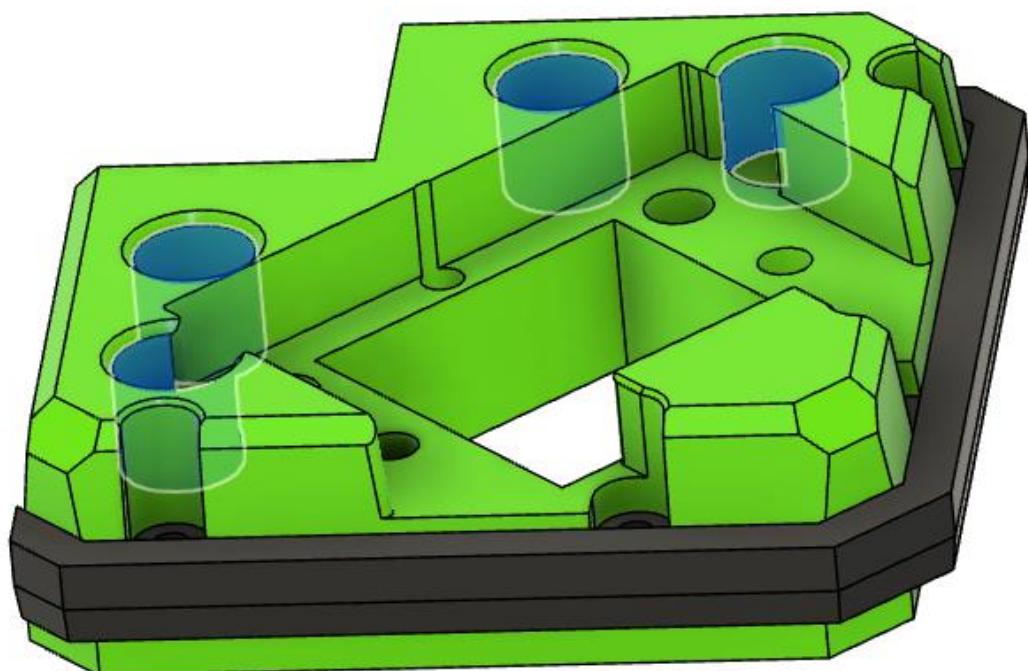
**FOR NEMA17:**

Slide the coupler on the shaft of the NEMA from the top and secure it

**FOR NEMA23:**

We will slide the coupler on the shaft of the NEMA from bellow at the end and secure it

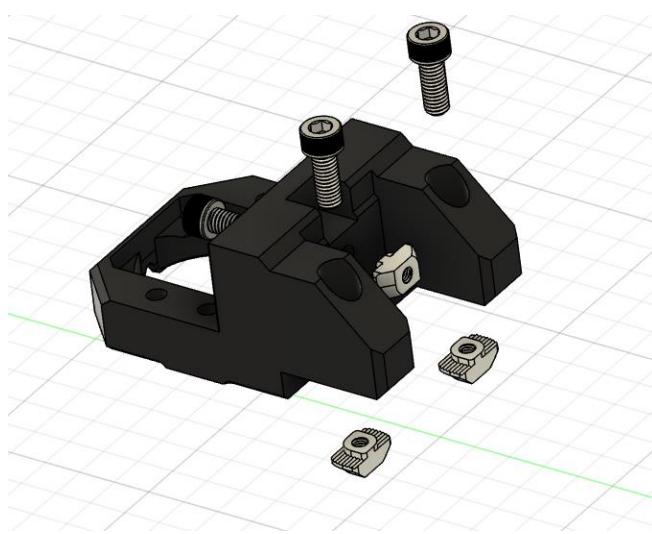
**Z-Upgrade-2.0:**



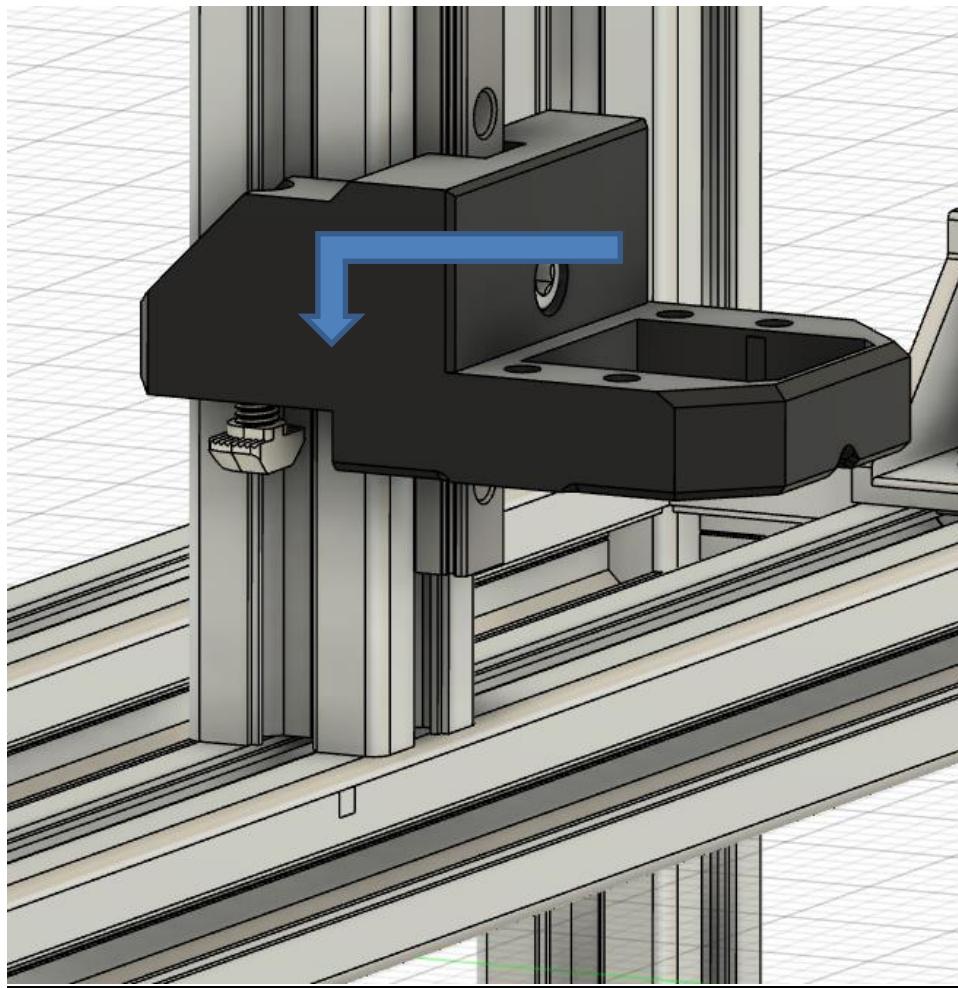
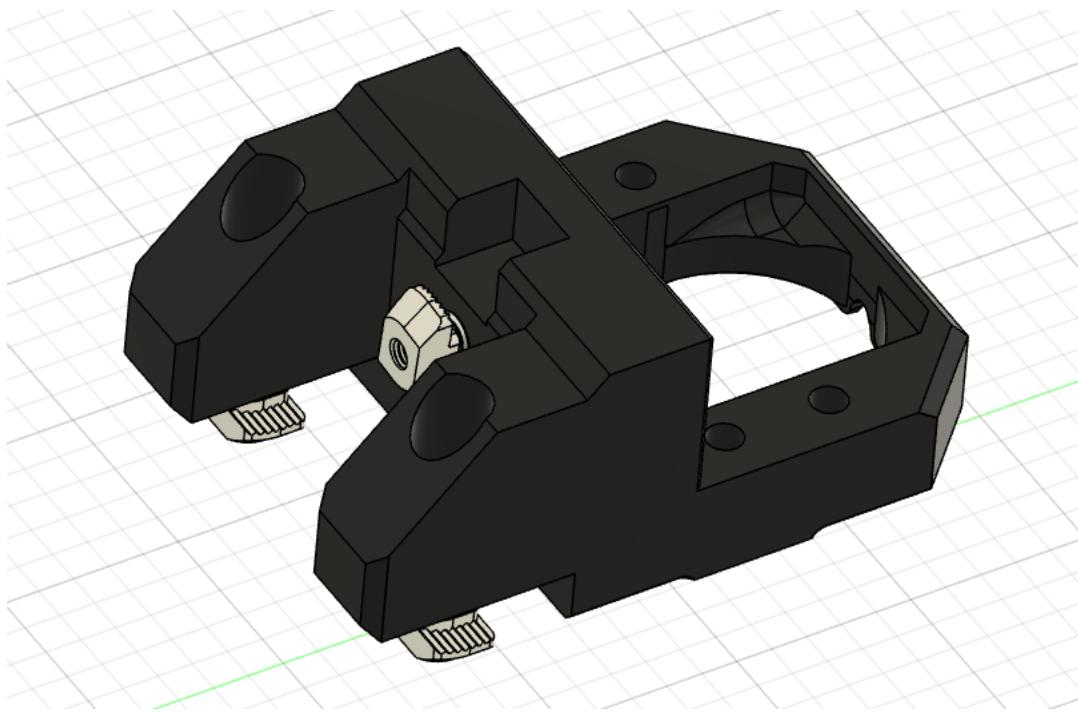
Same story, this time with the stock modified block.

## **4/ REAR BLOCK**

**Z-Upgrade-2.0:**

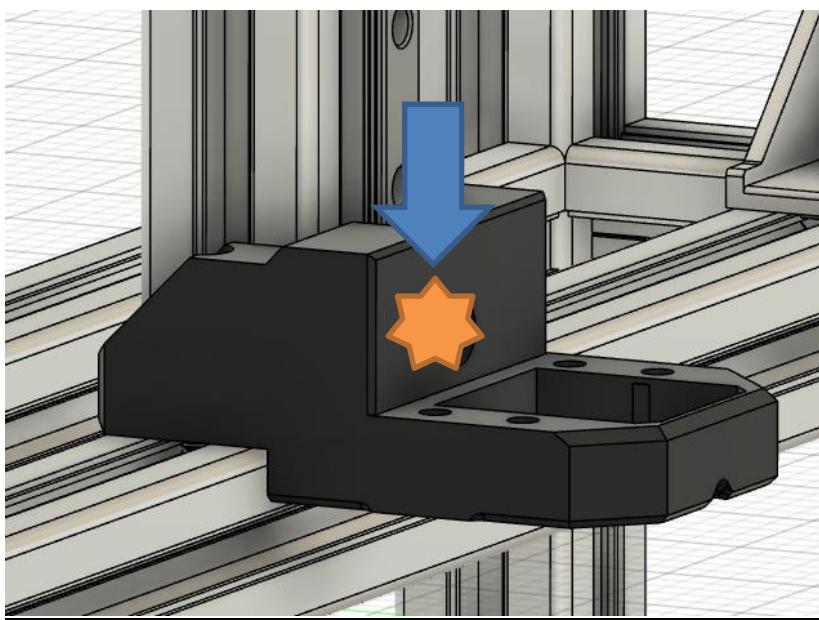


Install M6x14 screw with M6 Hammer T-Nuts

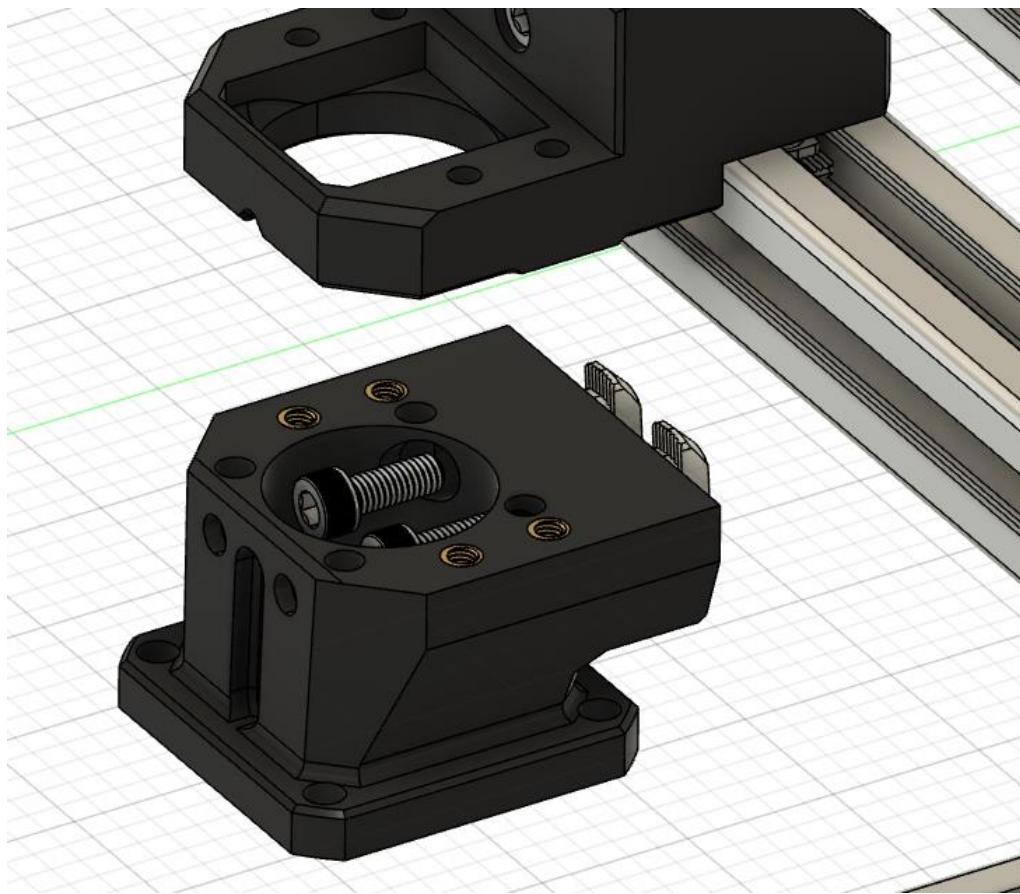


Position it for the center T-nut to go in the vertical 3030, then glide it to reach the bottom 3030, you can tighten everything up, this part is centered if the middle 3030 is centered.

## Manual Z-Upgrade 2.0 + Oldham V2.3



**1/ NEMA23**

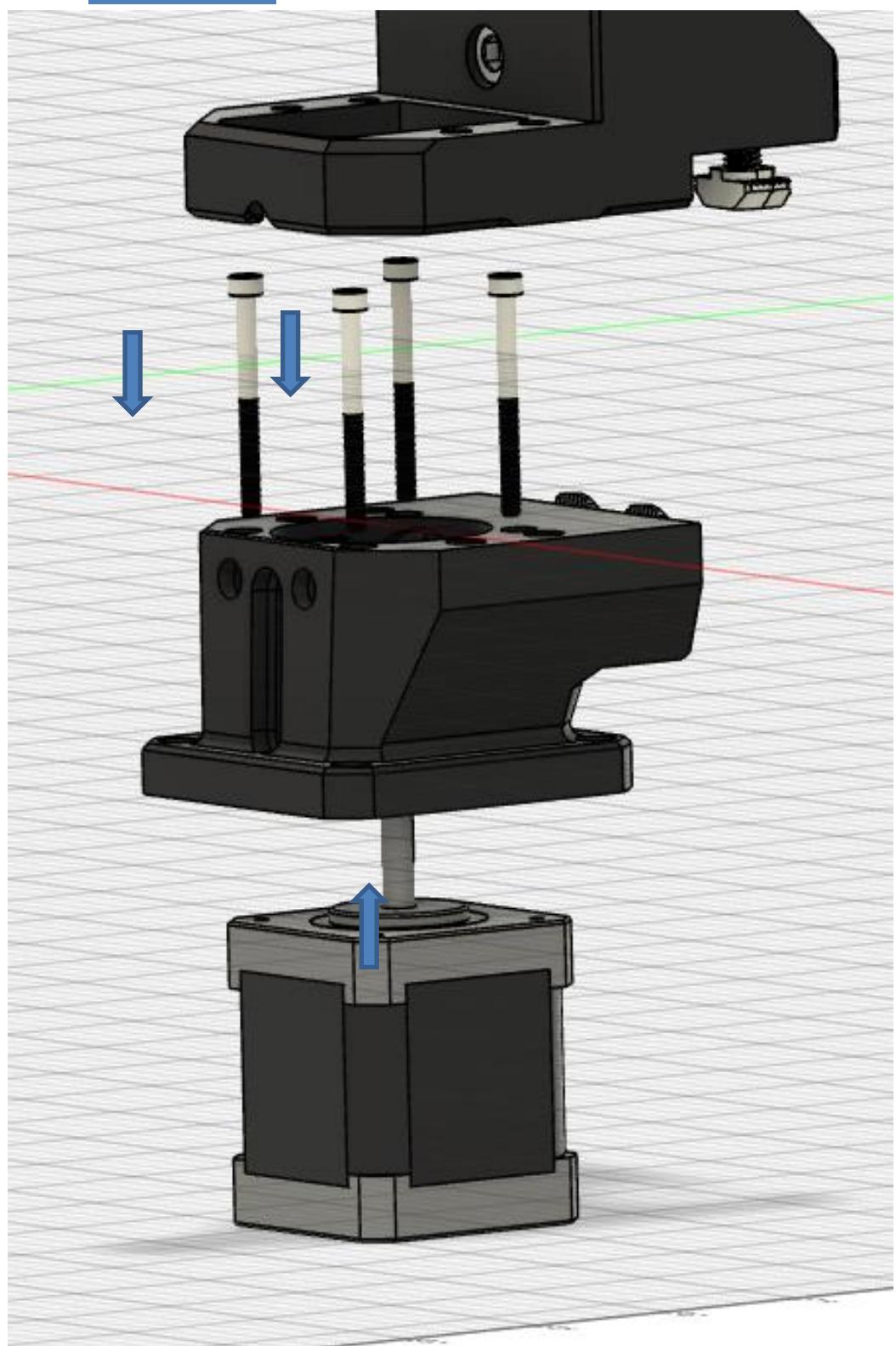


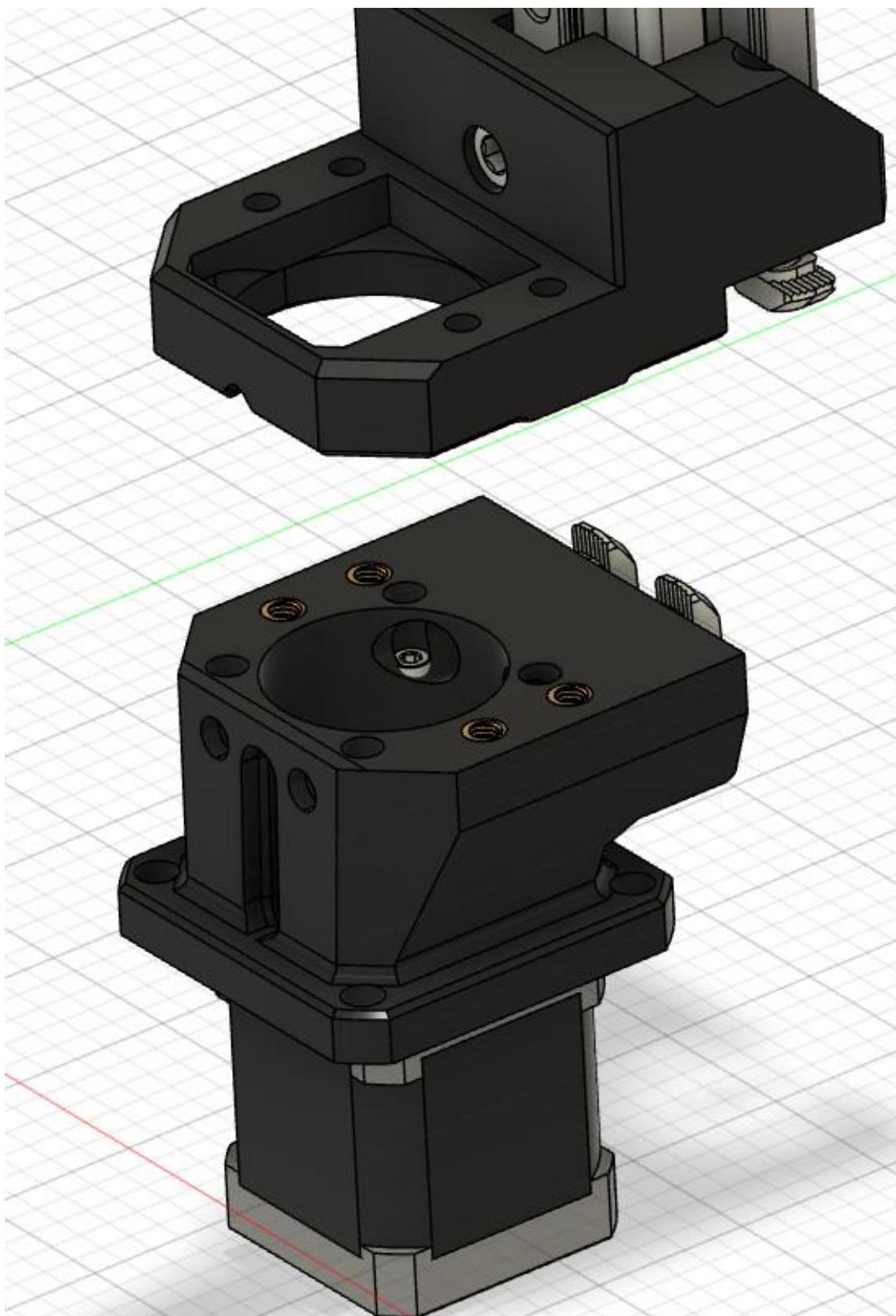
Preinstall 2x M6x14 screws with 2M6 T-Nut

**The Lower support is a Nema 17 / 23 combo, meaning it can fit either of those**

**In some order, a slightly different lower part can be found, with only Nema 17 compatibility, since N23 are rarely used/**

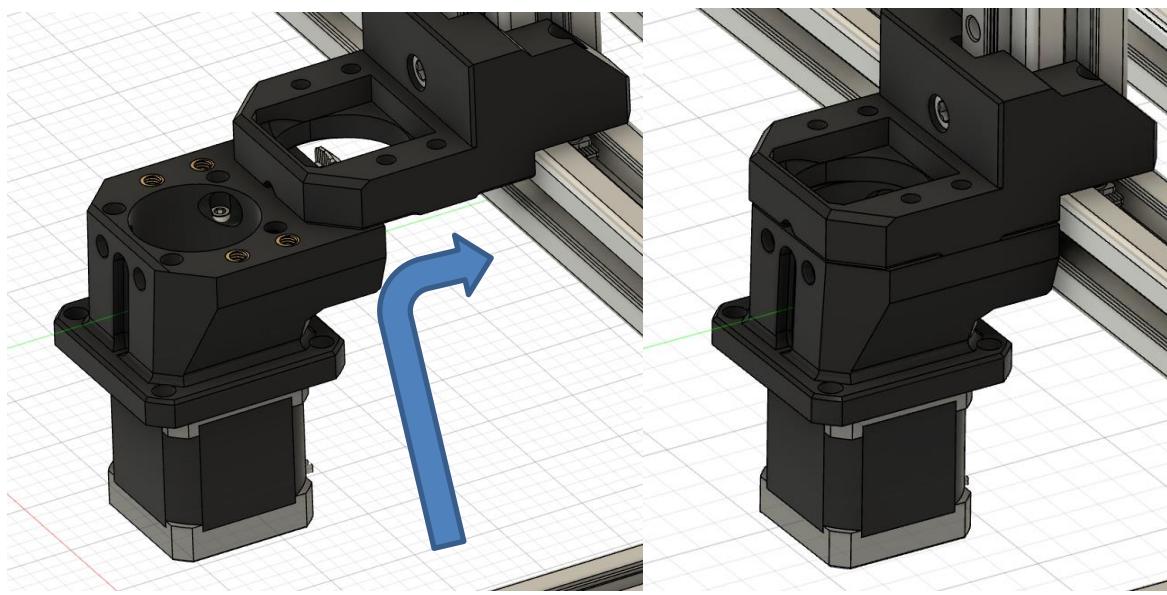
2/ NEMA17





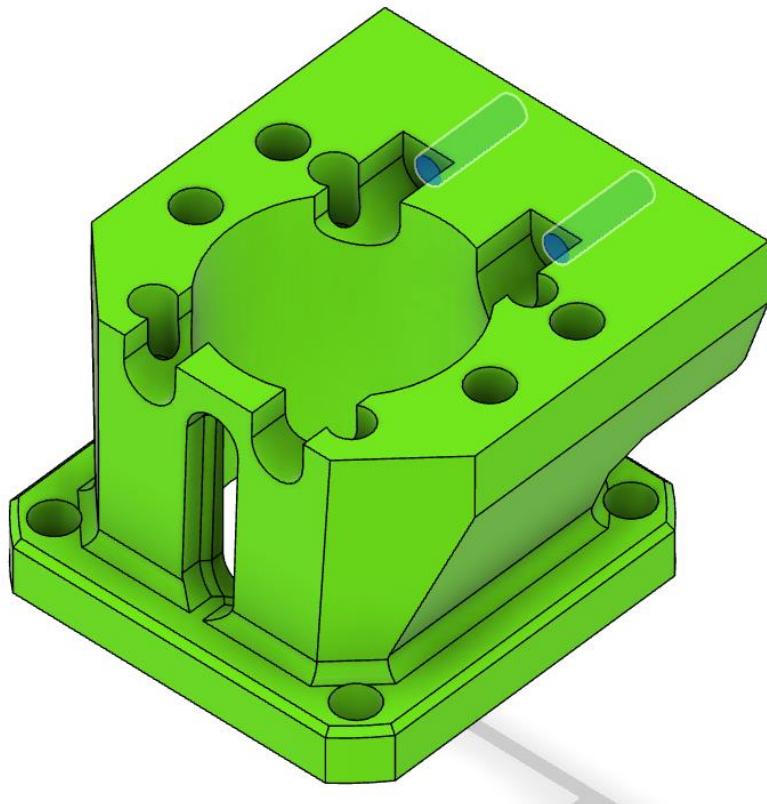
Insert 4x M3x35mm to secure the NEMA17

**Depending your bottom plate offset, you will need the rear offset plate included**



Insert the lower assembly on the top assembly, you can tighten the 2 back M6 to hold the structure for the next step

## Z-Upgrade-2.8DE:

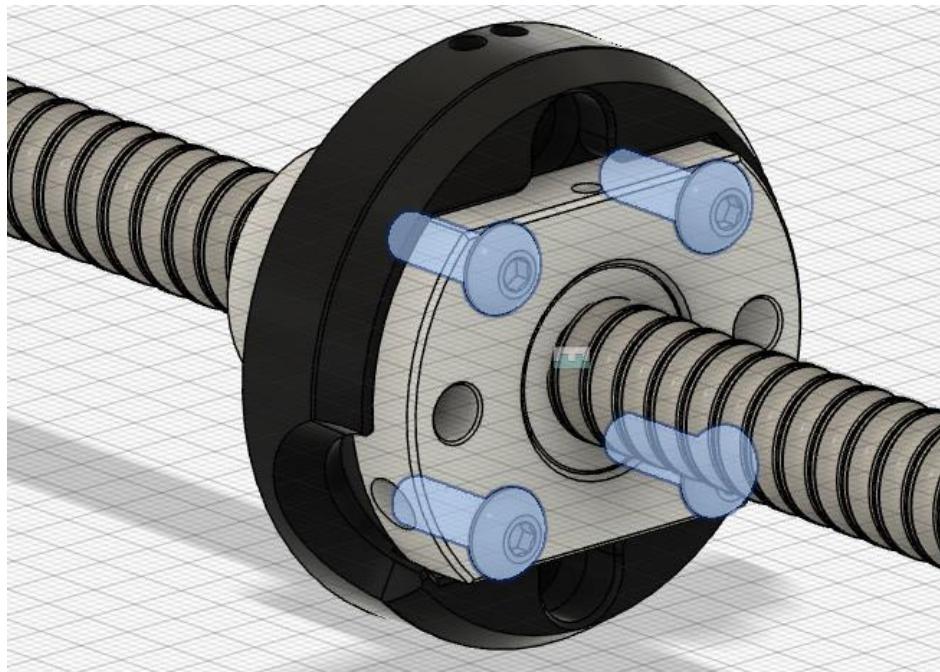


The 2.8 version is slightly different, you will need 2x M4x20mm and Tnut in place of the 1x m6x12mm. This is the only difference

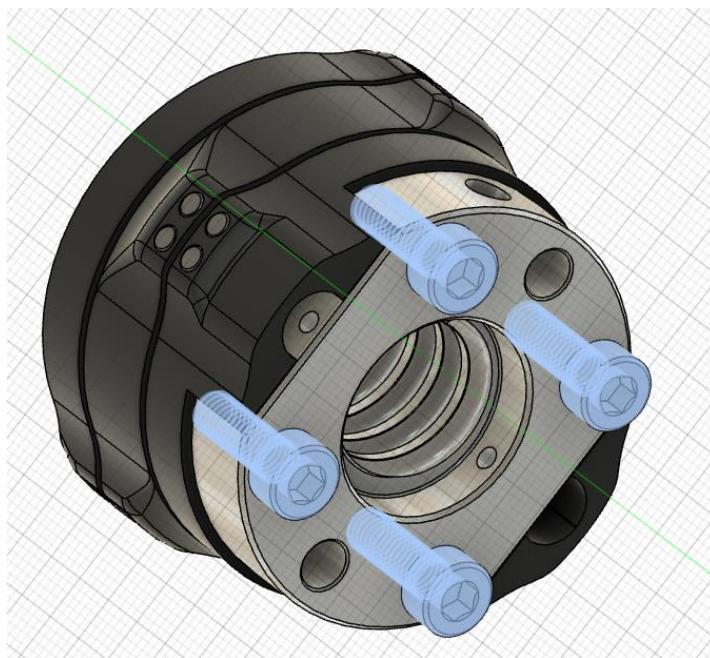
Depending your bottom plate offset, you will need the rear offset plate included

## **-SFU Assembly :**

SFU 1204 version, we use the M4x12mm

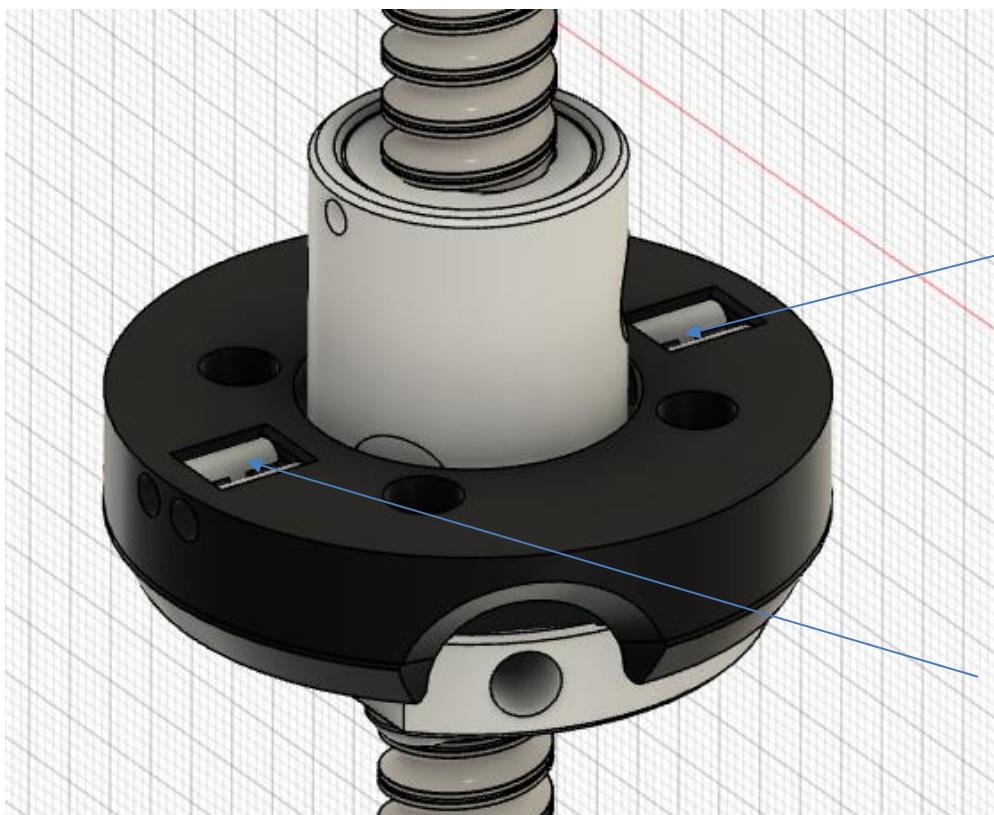


SFU 1605 version, we use the M5x16mm



For the next step, bearing balls are 4mm for either SFU1204 or SFU1605

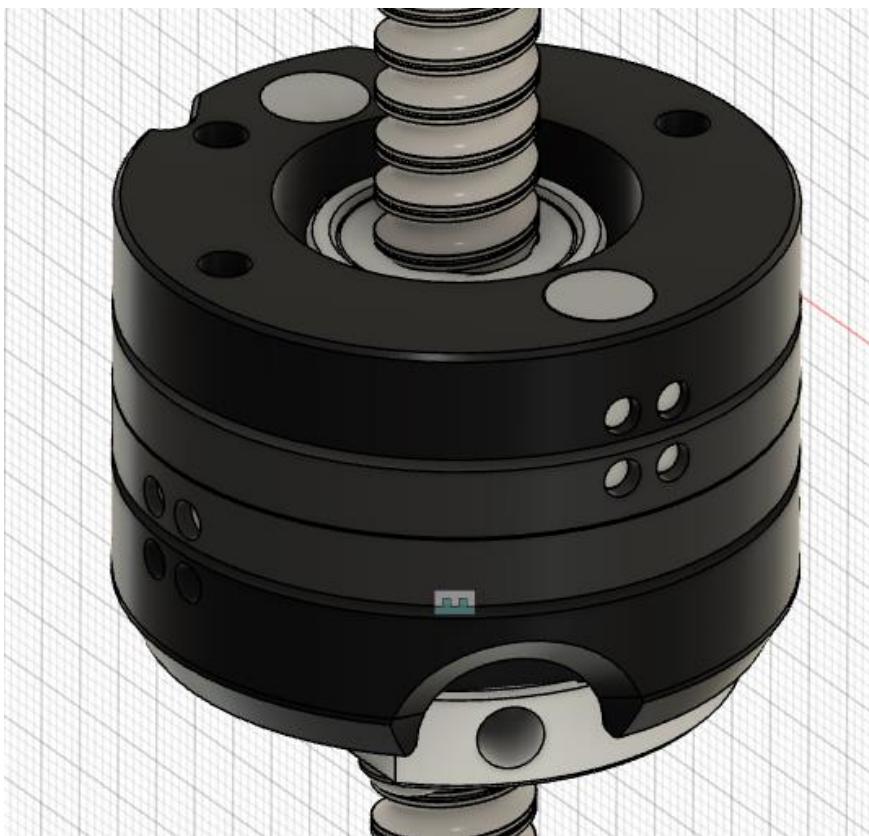
( balls placement can be done at the end of the assembly process)



Install 2 ball bearing on the dowels. (4mm nominal diameter, but you can go for more)



Stack the assemble central disks and install the 2 other balls bearing



Stack the upper disk

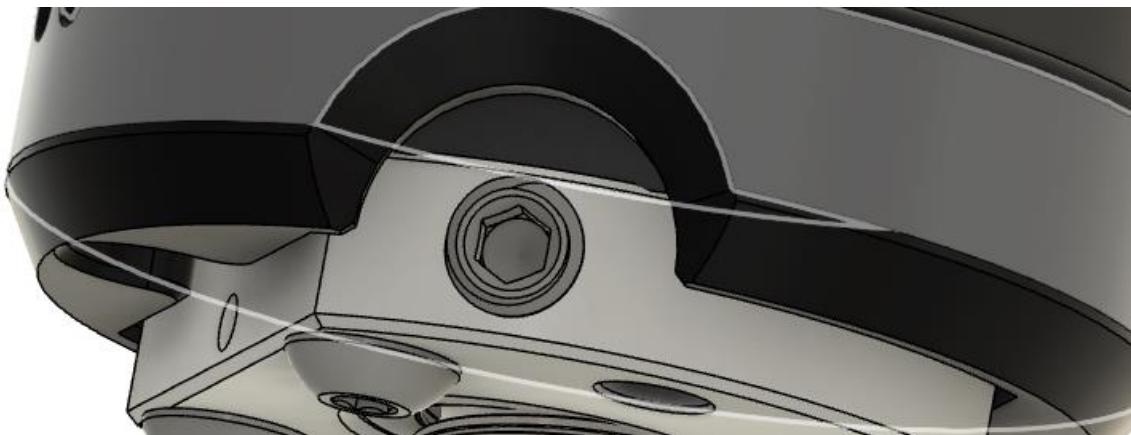
Before fixing the top to the Arm, make sure everything is in place and can wobble without any hard point. The ball bearings can be a bit unstable, the load of the bed will secure it in place.

### -Grease it !

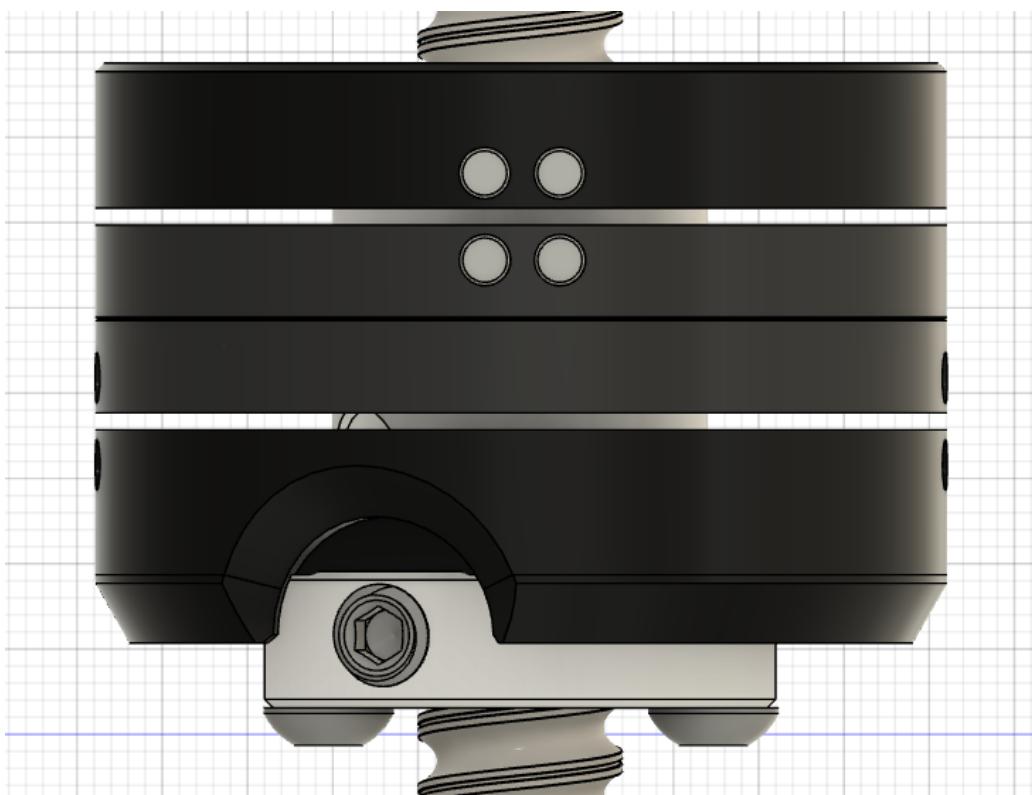


## Manual Z-Upgrade 2.0 + Oldham V2.3

Apply grease un the nut, you can know if it's full by looking for grease presence under at the seal of the ballscrew, half a mm of it should appears. Close the hole with a grease nipple or a m6 headless 5mm screw



### -Final oldham checks



Check that the disks are paralells to each others

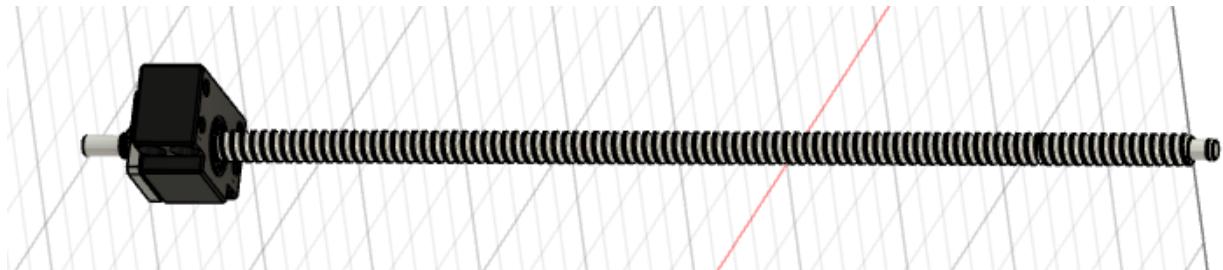
Check the balls bearing still in the dowel chanel

Make the kinematic works a bit: try to simulate a wobble by hands

DON'T FORGET TO TUNE THE Z\_MAX distance in Klipper

## Z Axis assembly on the Frame

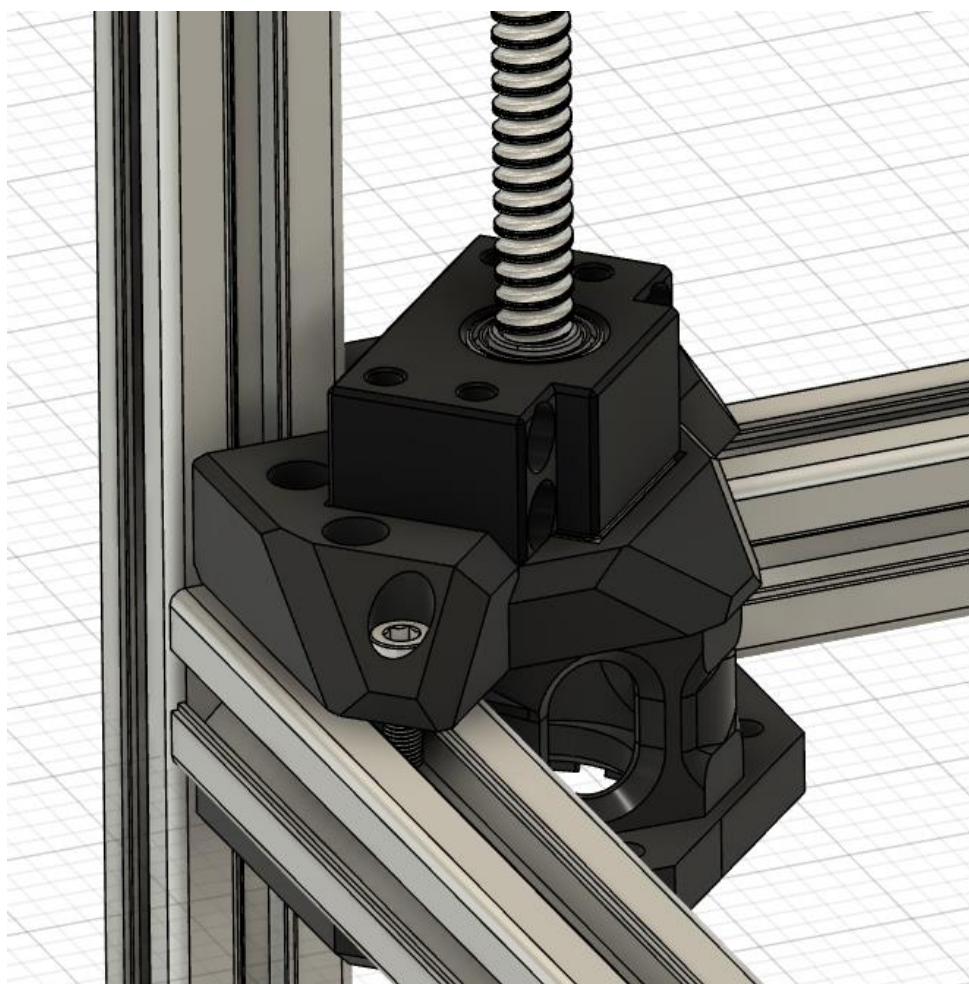
### 1/ Base block Fitment



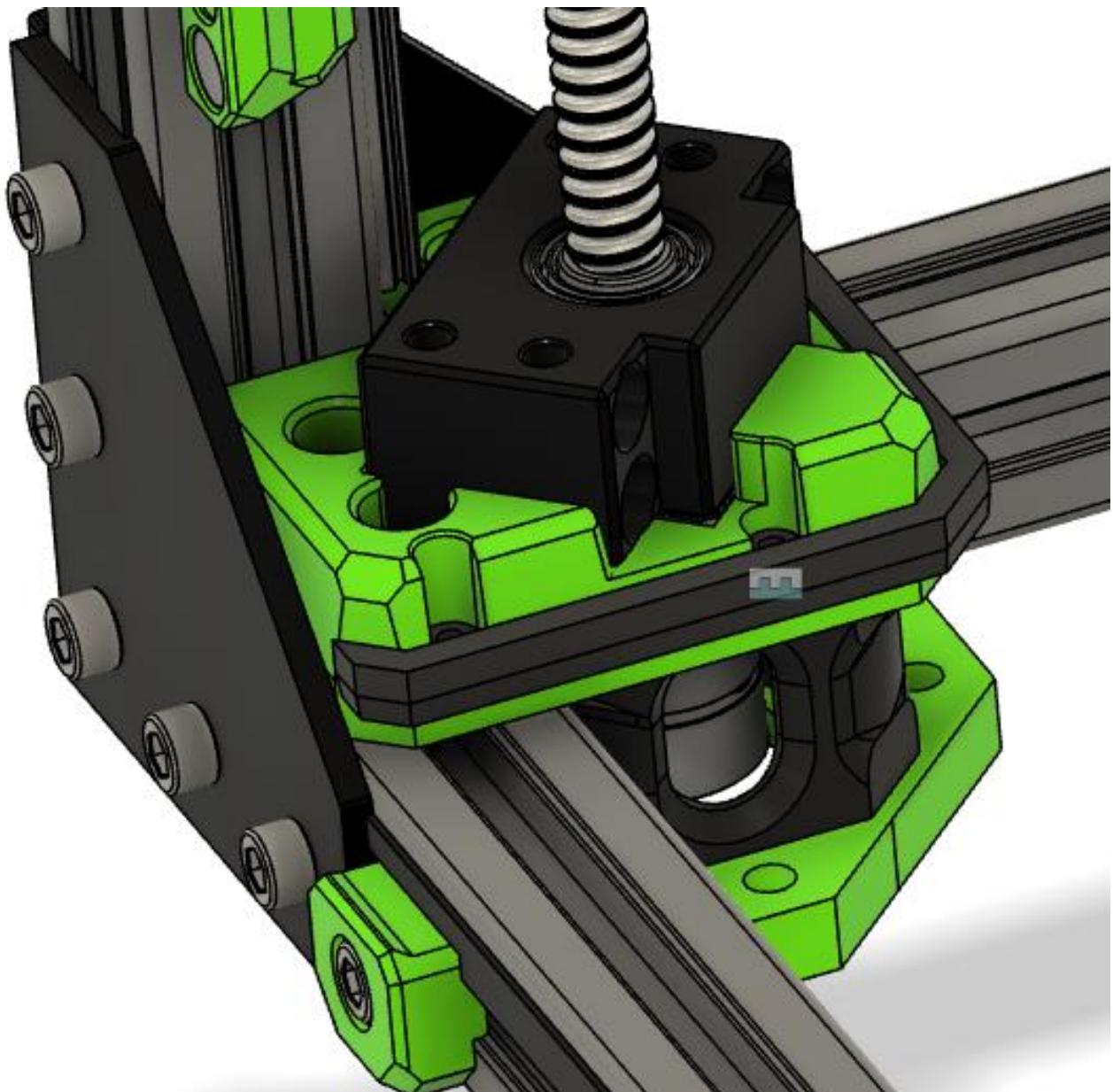
Install the BK10/12 on the Spindle, Add the nut locker, secure it half a mm below the block

Install the Rails, On the internal 3030 face (3.0 style) or on the rear 3030 face (3.1 style)(You will need to print the ARM31 from the git for this one)

Place the BK10/12 on the motor block and secure it with 2 M5x80 through the whole block, and two m5x30 on the rear holes:

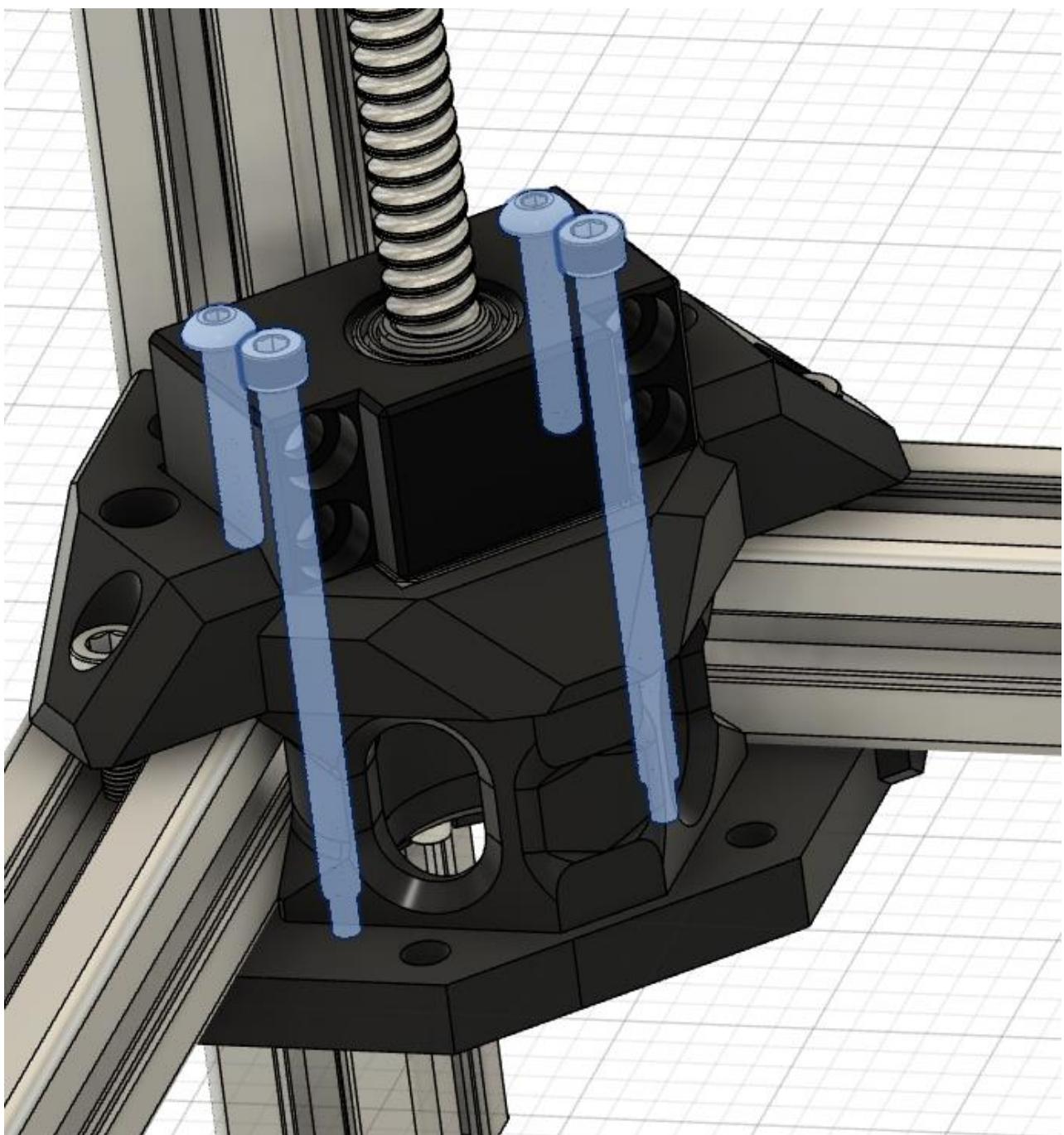


ZU2.0

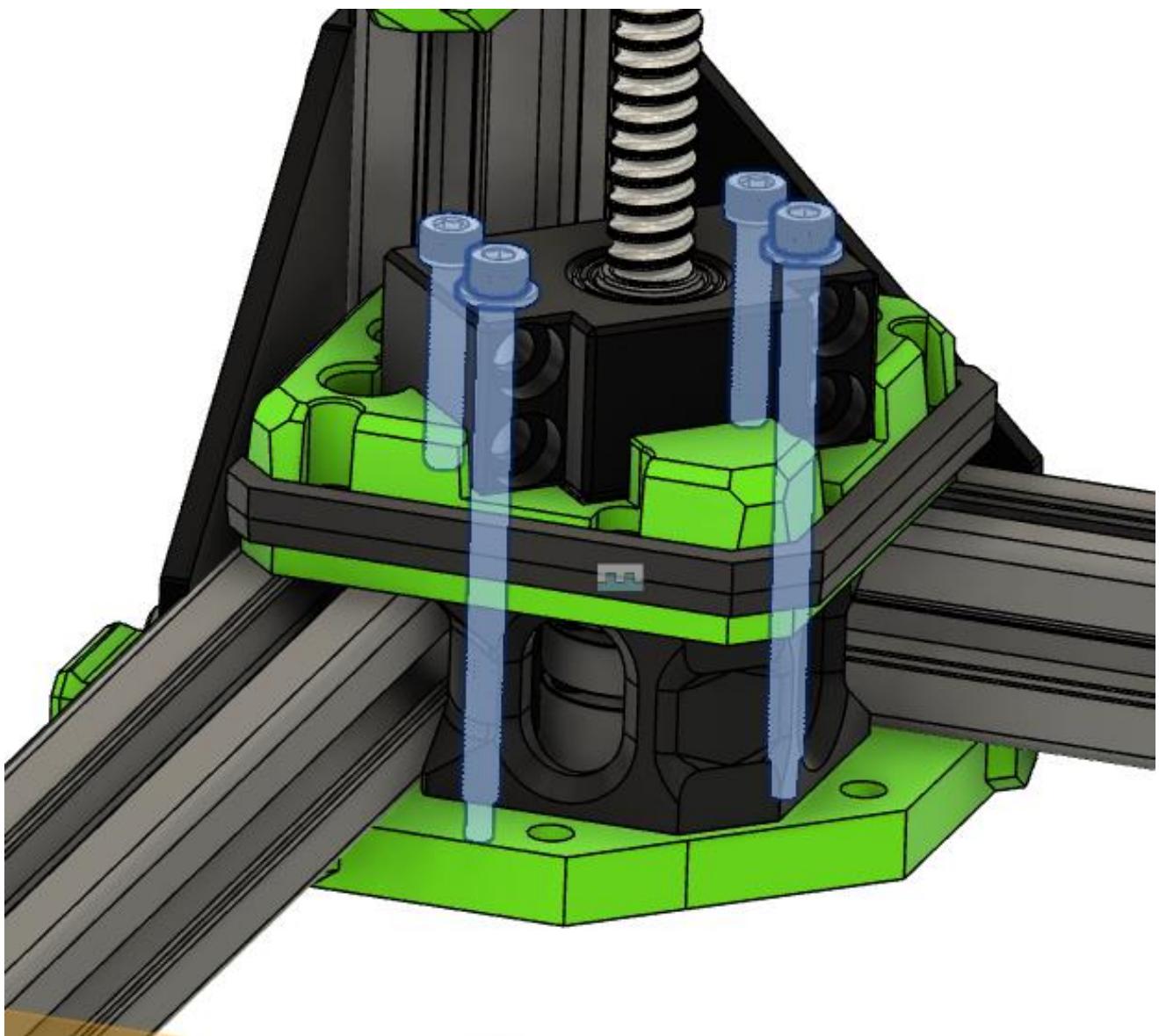


ZU 2.8DE

## Manual Z-Upgrade 2.0 + Oldham V2.3



ZU 2.0

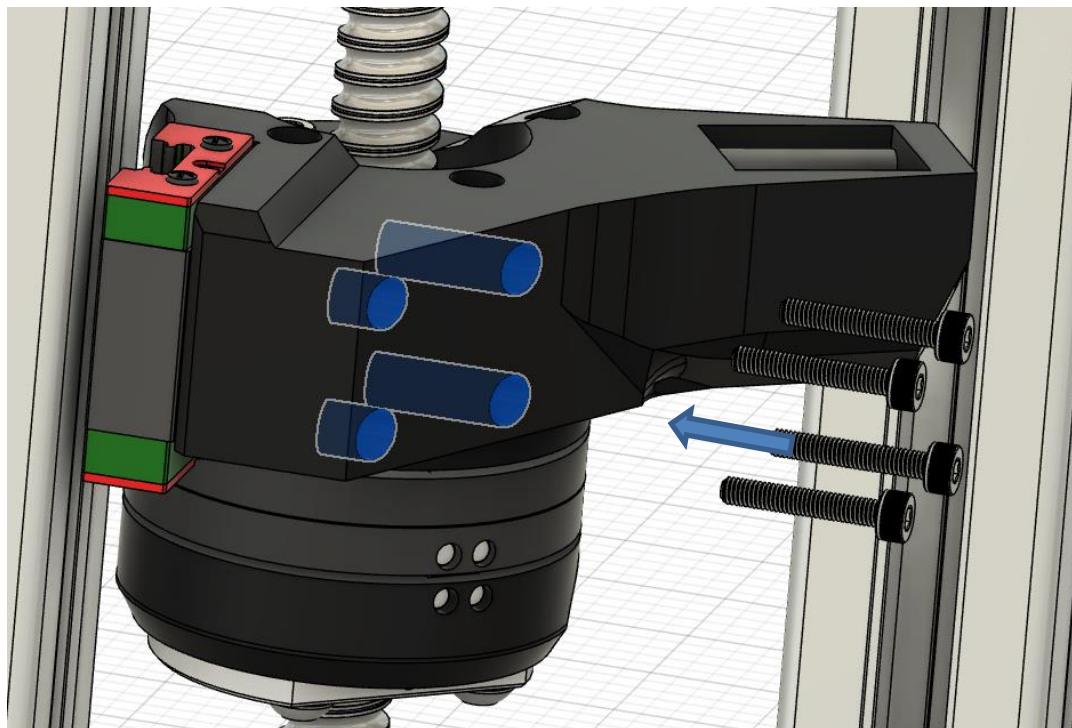


ZU 2.8 DE

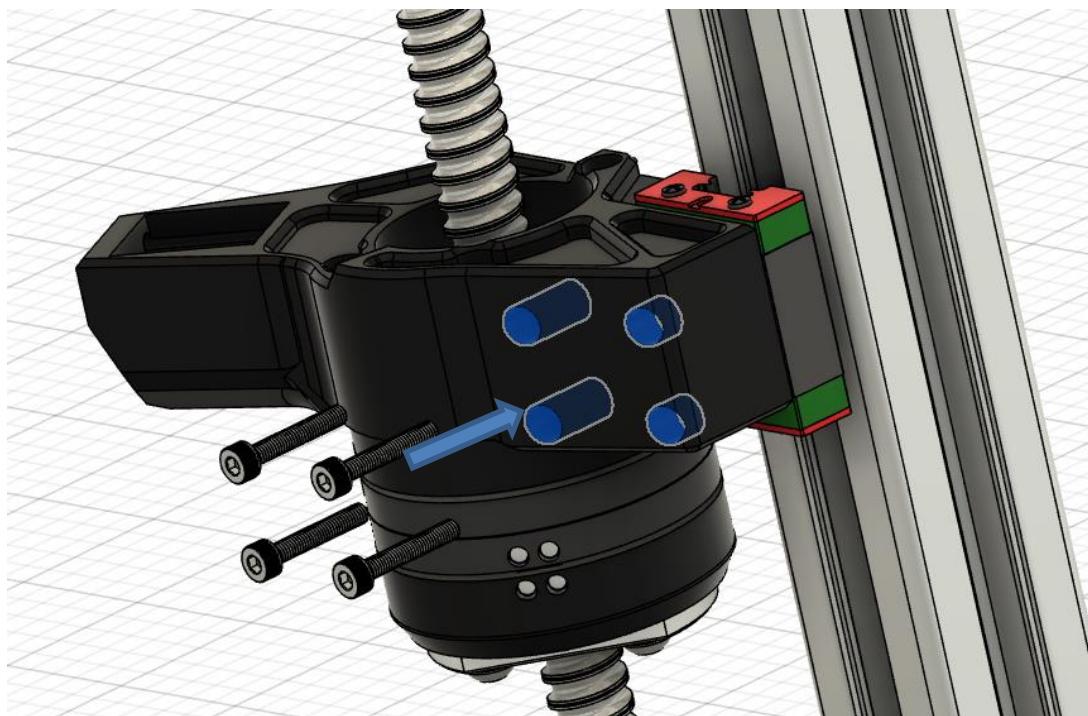
Don't tighten it fully yet

## **2/ FRONT ARMS**

### **A/ For SFU1204**



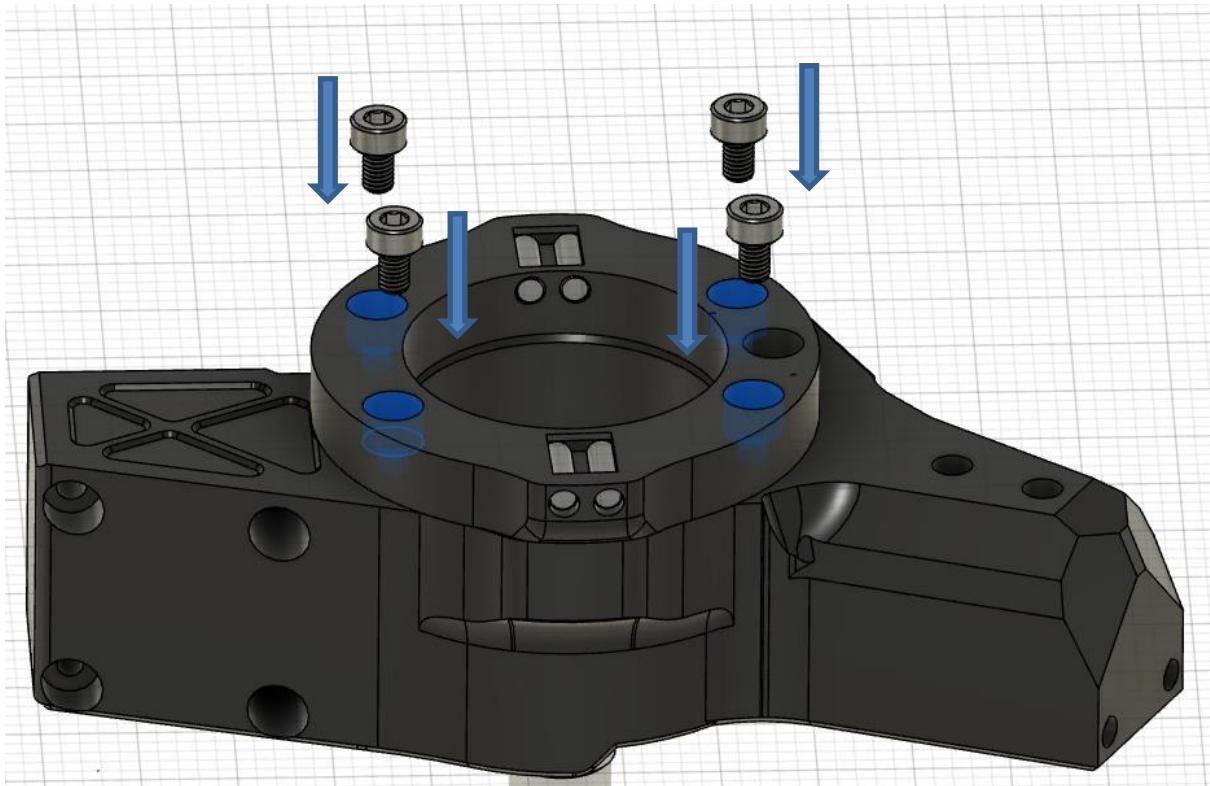
Install the front Arms sfu1204 (old 3.0 orientation here) (This version is rare today)



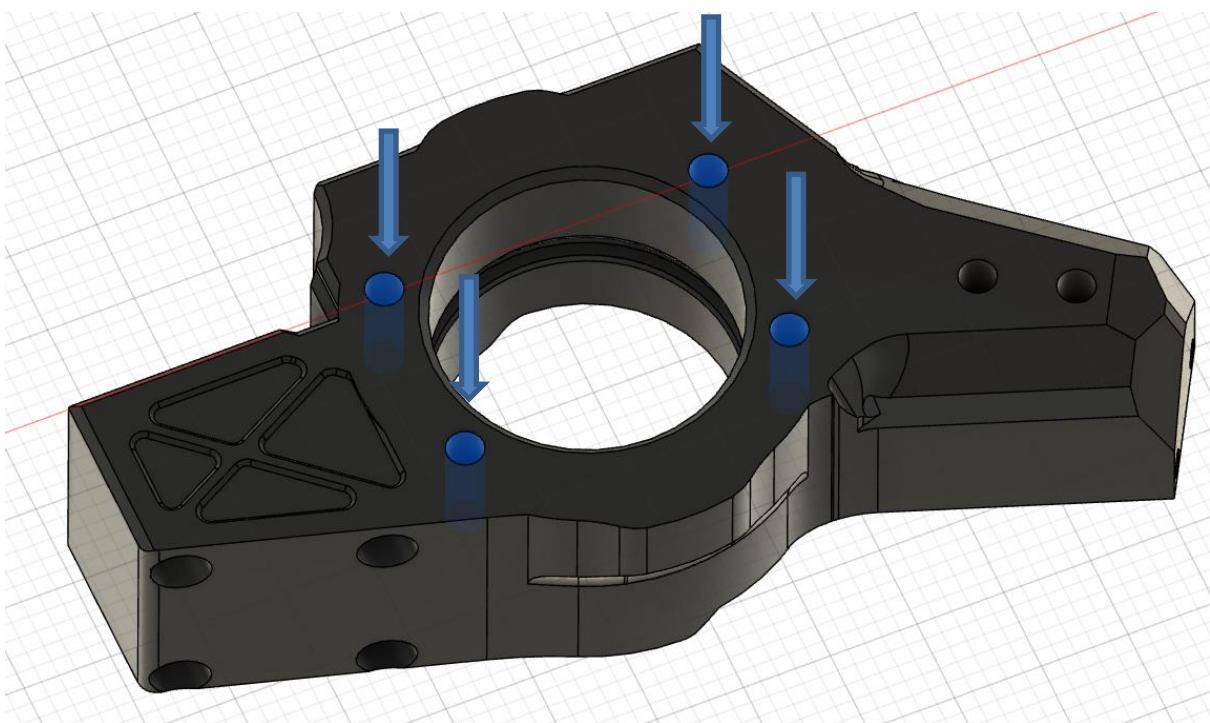
(3.1 arm version here) This version is the general use, You will use the same screws that the stock arm

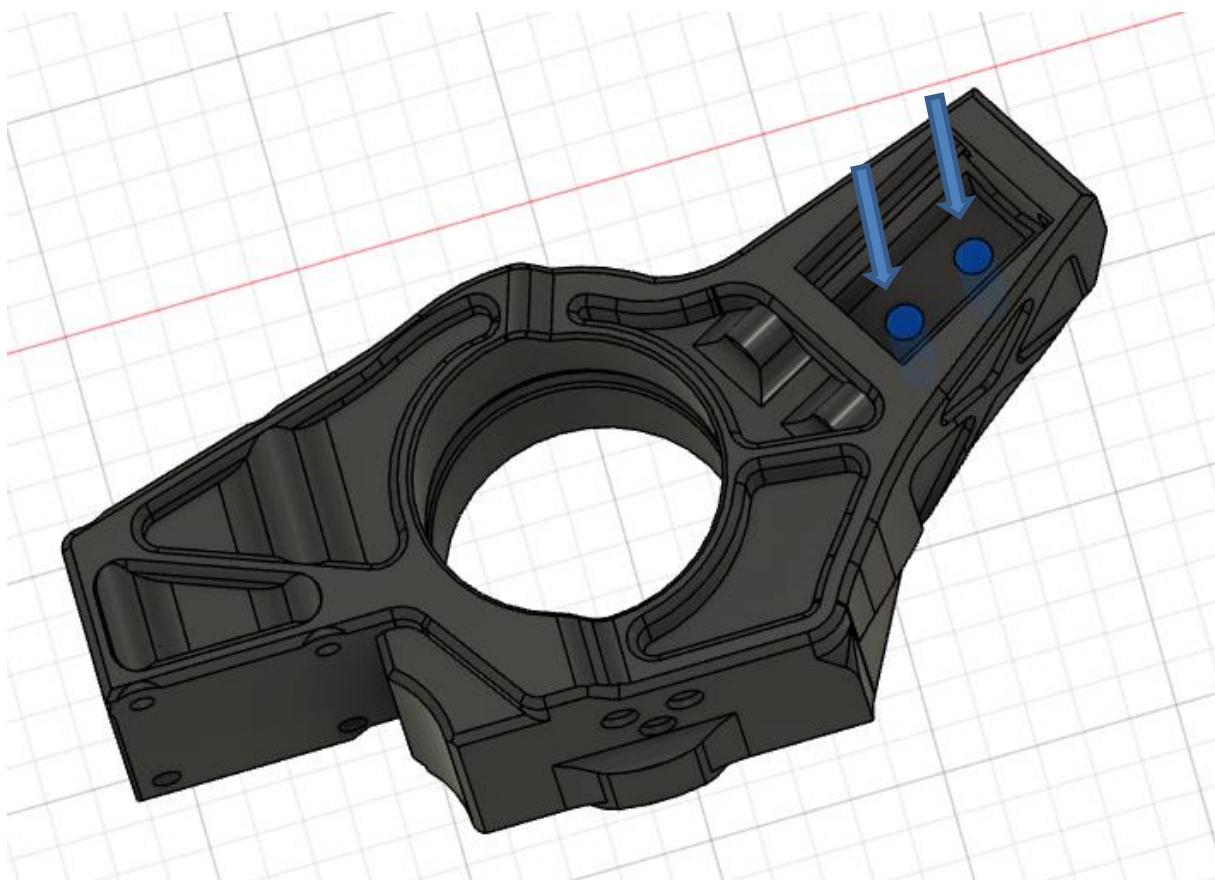
## B/ For SFU1605

Same method, only the upper ring fixation change you must preinstalled it with 4x m3x5 on the 3 arms before putting it in place. (Same holes for the 3 arms)



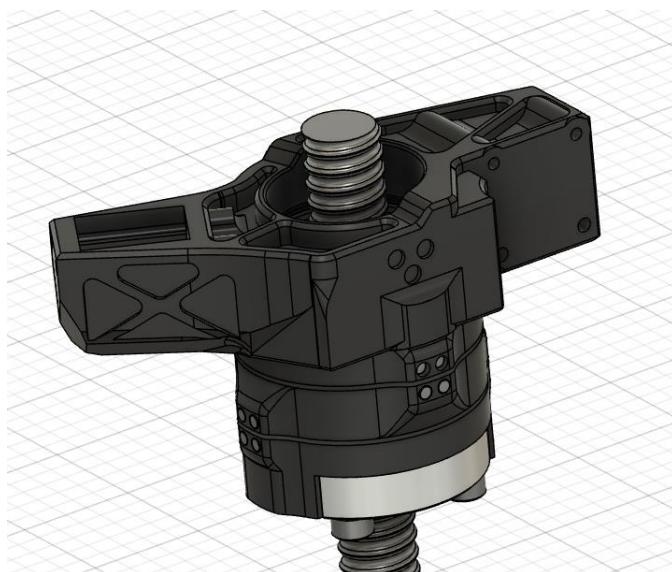
If you make the part yourself, don't forget to put m3x3mm inserts in those positions

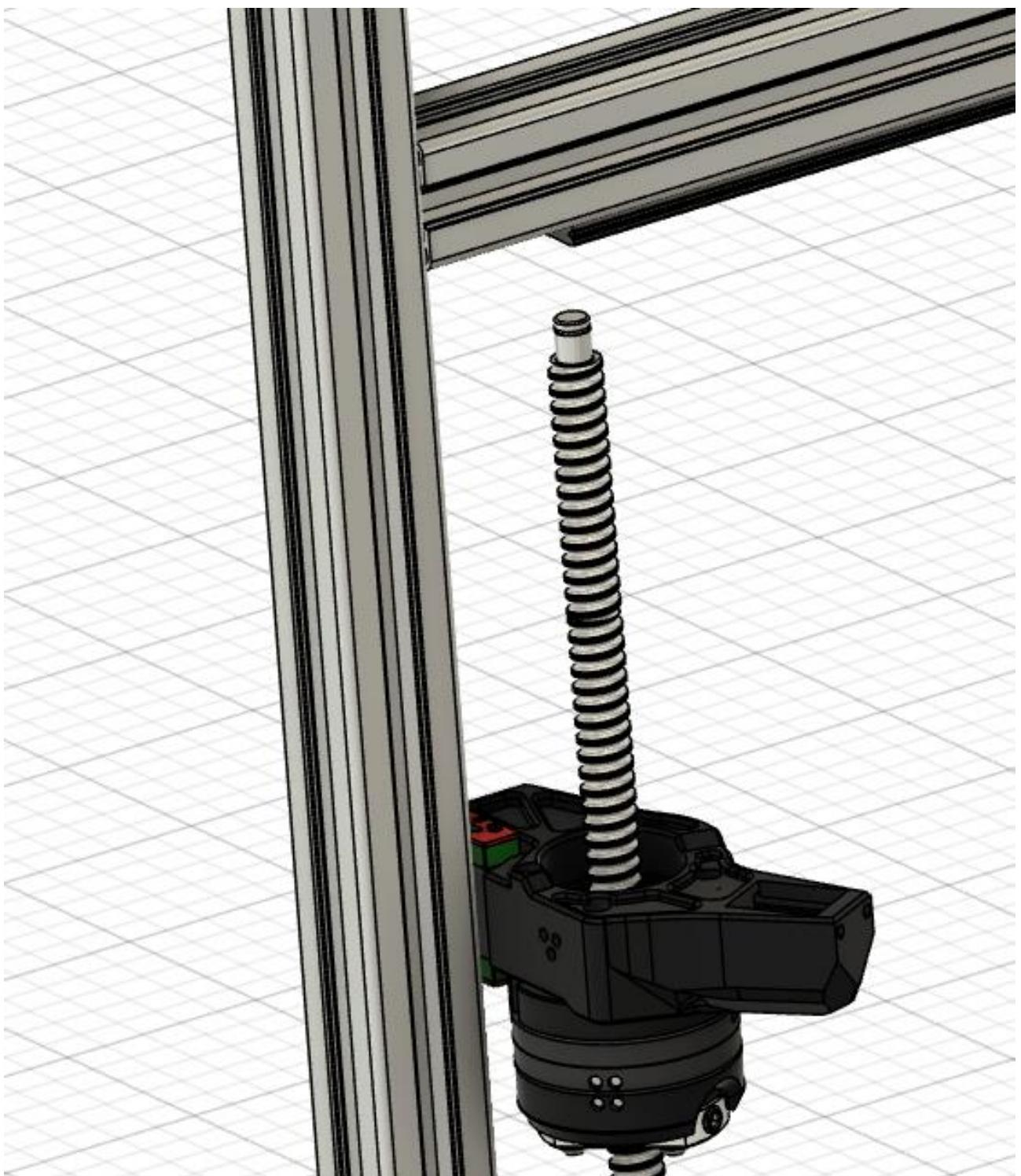




You should end with this results for 1605

Some kit sent have been modied for 1605 with a specific Oldham for a specific adaptation asked, basically it uses the 1204 arm, the fixation fallow the same logical that the 1204 version



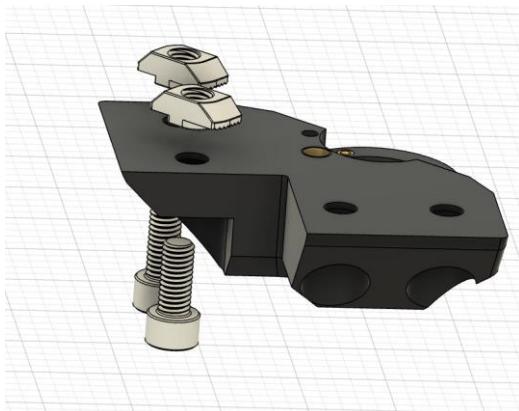


This should end like this for 1204; you can see some flexibility, and that will help for the next steps.

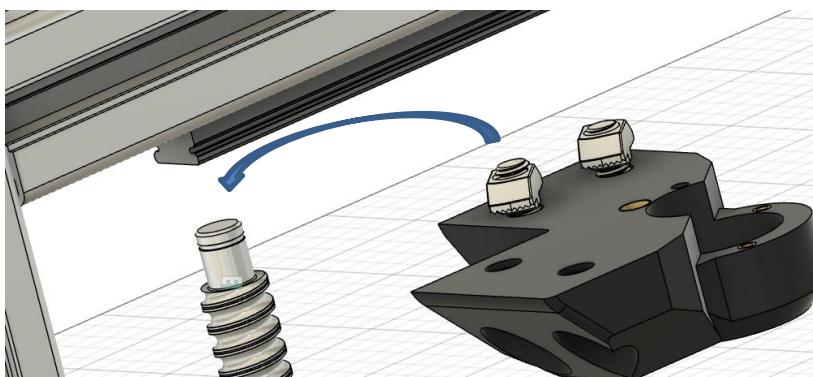
## 3/ Open Front Idlers/retainers

### A/ V1 (Work with SFU1204/1605)(Not used anymore)

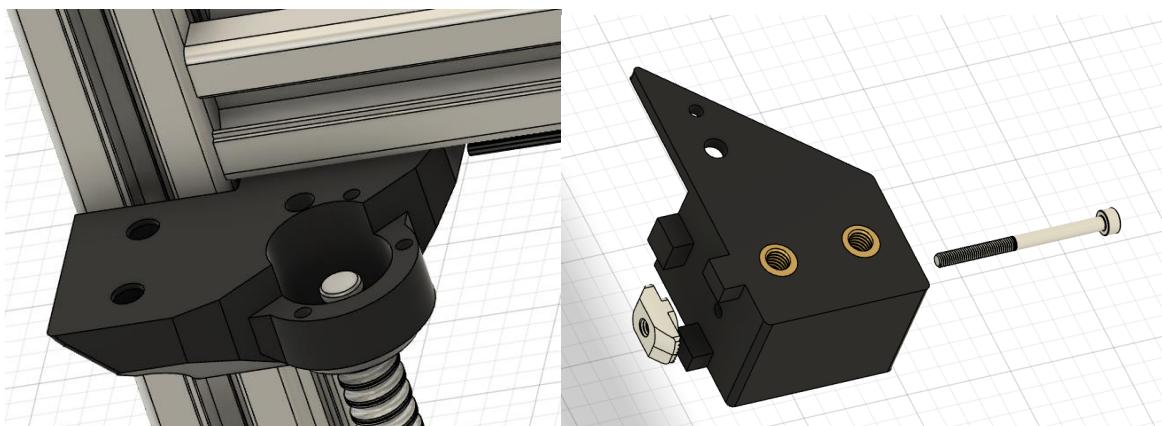
*Those modules are specific to either 1204 or 1605 but it is build on the same methods, it assembles the same way.*



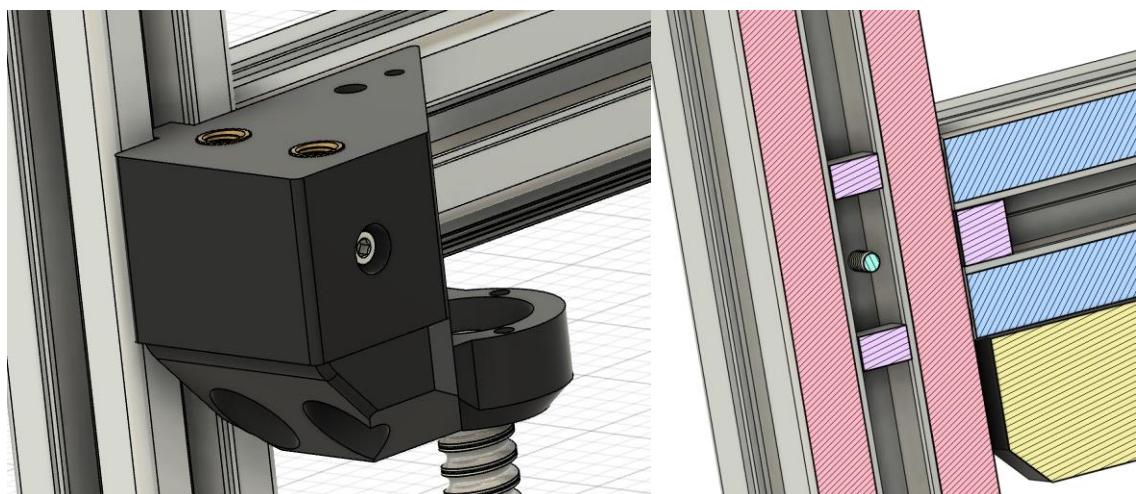
Install the M6x14 + the T-Nut



The objective will be to fix this retainer to the frame, since we have a bit of flex now, wiggle it a bit and this will take place. You can tighten the 2 M6 to secure it in place



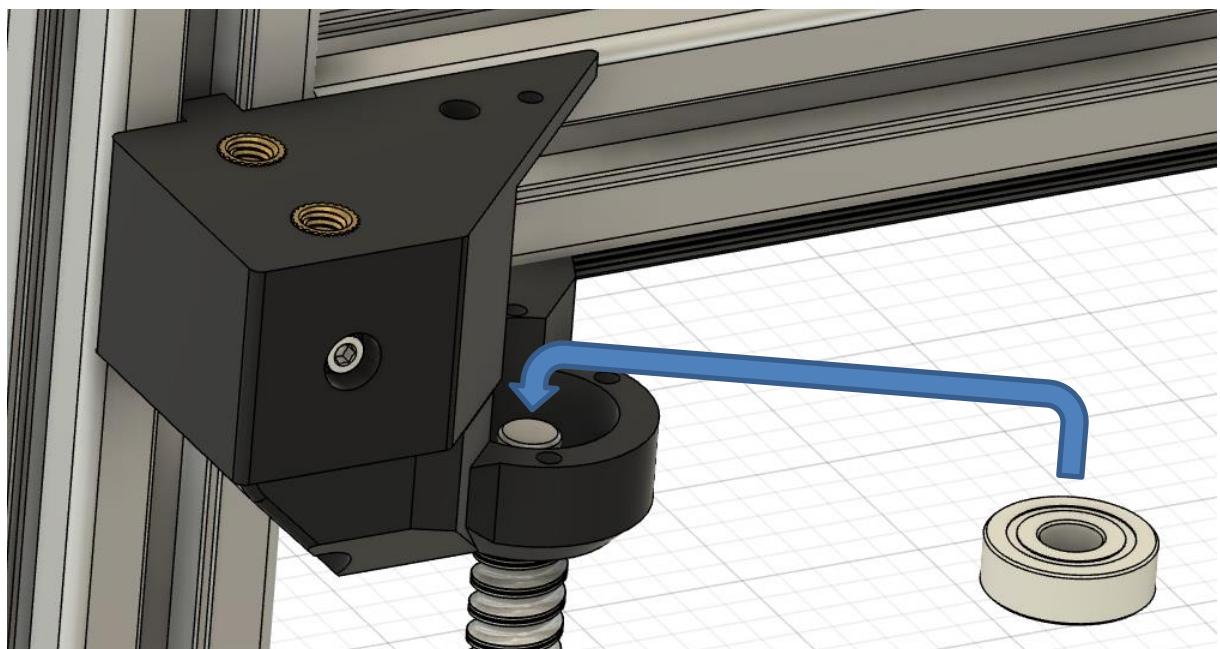
Prepare Middle front part, by placing an m3x40 with a M3 T-nut.



Slide it in the front junction

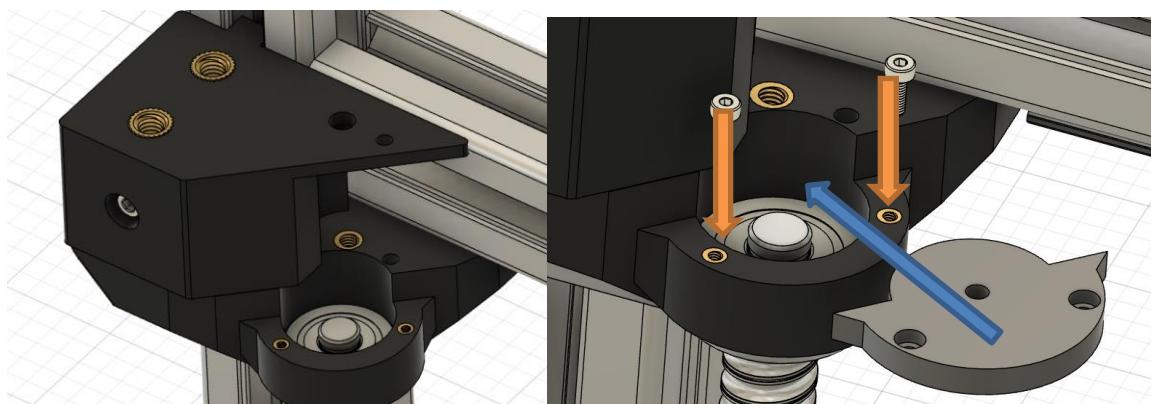
The 3 plots should auto-lock the part position, You can tighten the m3x40

And then place the 2 M6x14 **BUT don't overtighten them** since the inserts can pull over.



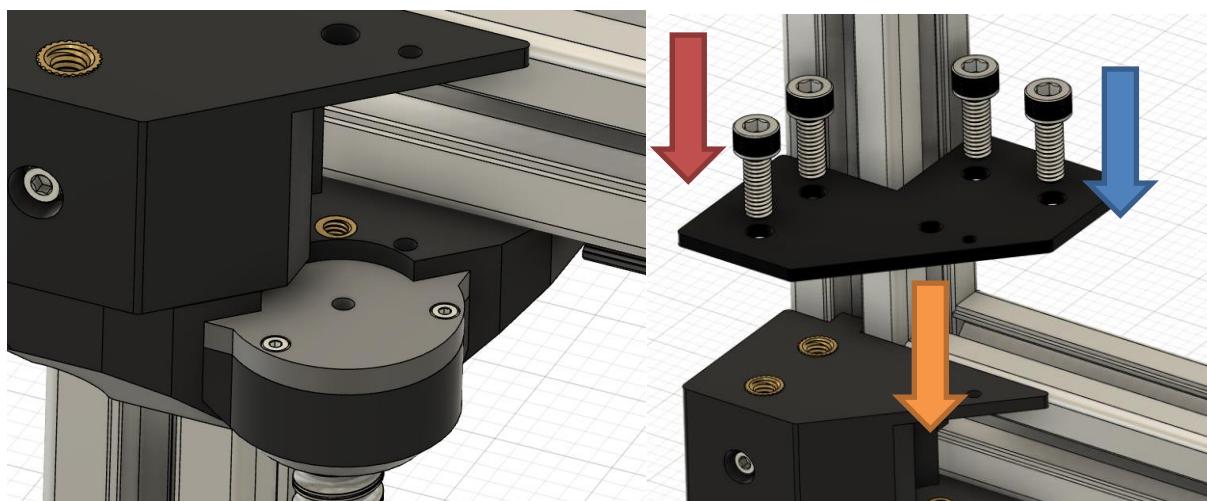
You can place the 608zz bearing in the SFU spindle to the flange of the part.

## Manual Z-Upgrade 2.0 + Oldham V2.3

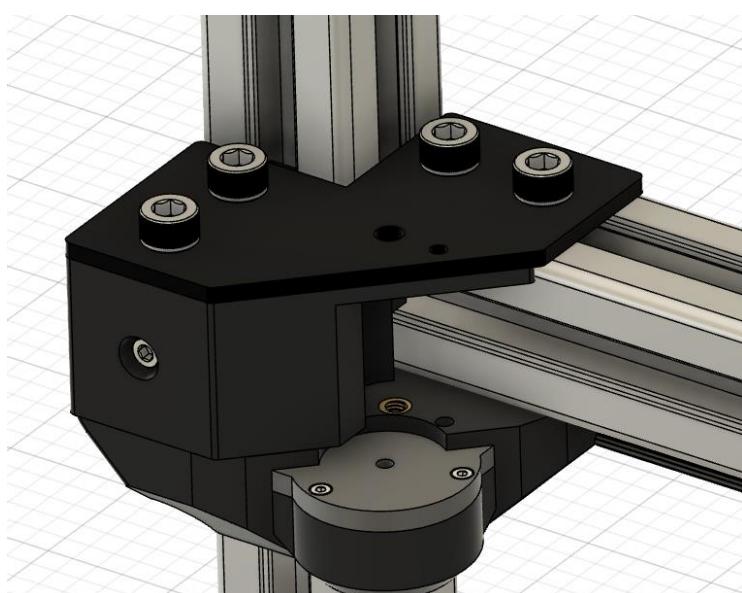


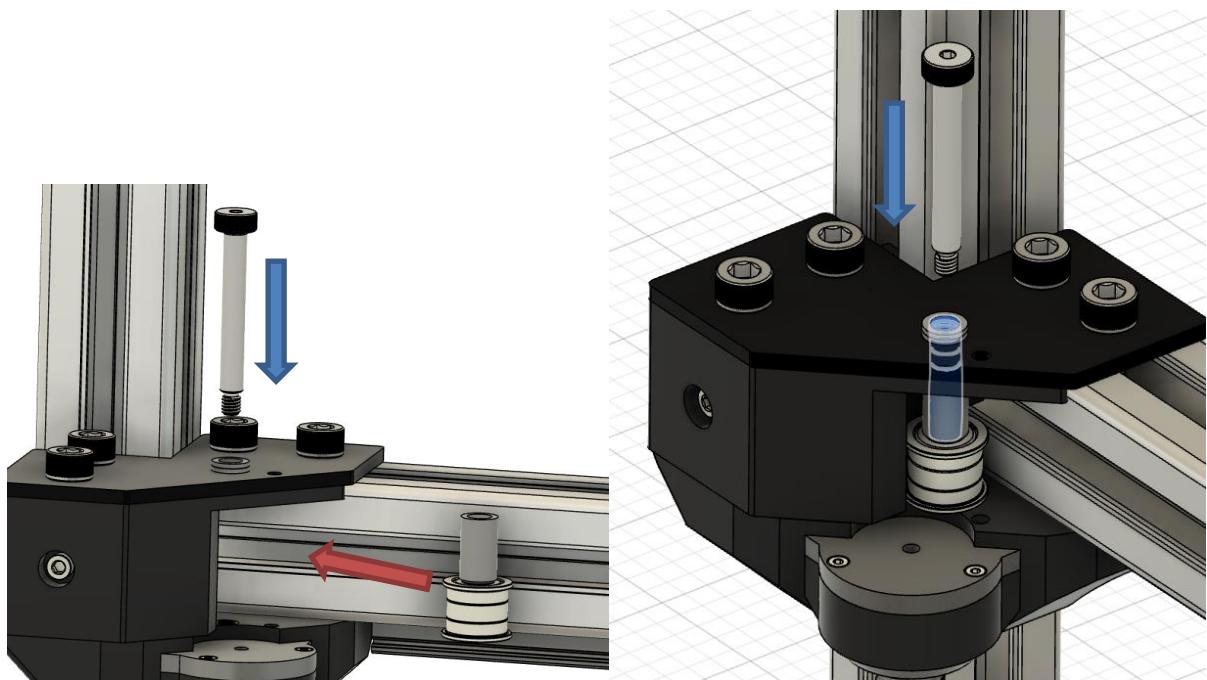
\*

Place the protection top, then Secure it with the 2 M2x8

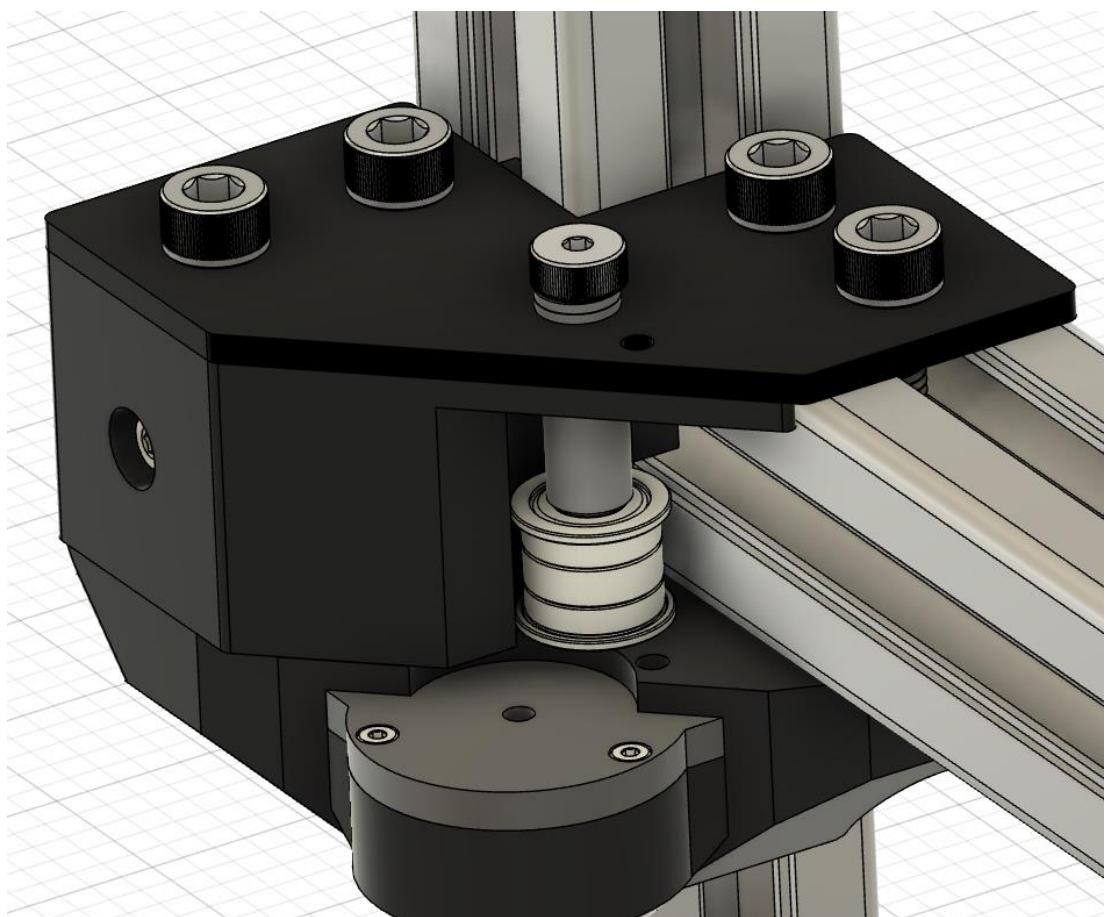


Place 2x M6x14 with 2x Tnus, Position the plate on the top assembly, secure everything on the front side with 2x M6x14





Prepare the idler stack (1mm shim-F695-695-F695-14mm Spacer)(Same logic than the RR 3.1 manual), **then slide it** inside the assembly, it will be very tight that is normal, then **secure It** with a 35mm D5M4 shoulder-bolt. Use shims to level the Shoulderbolt on the top plate

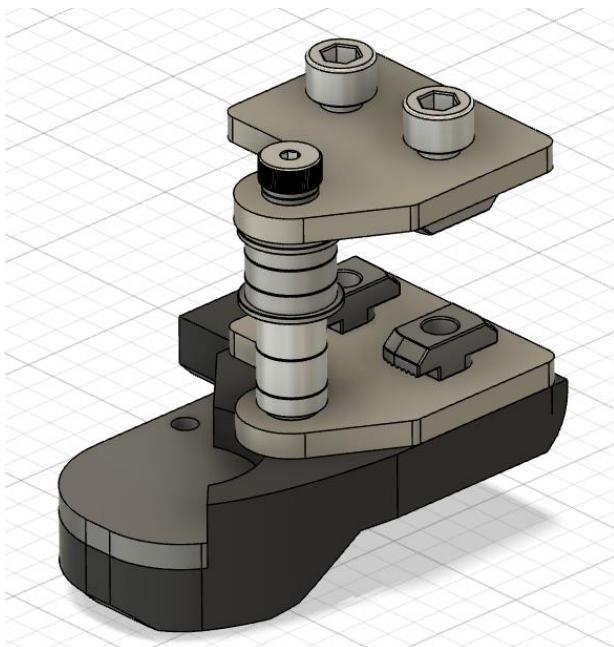


**B/ Open Front Idlers/retainers V2 (Work with SFU1204/1605)**

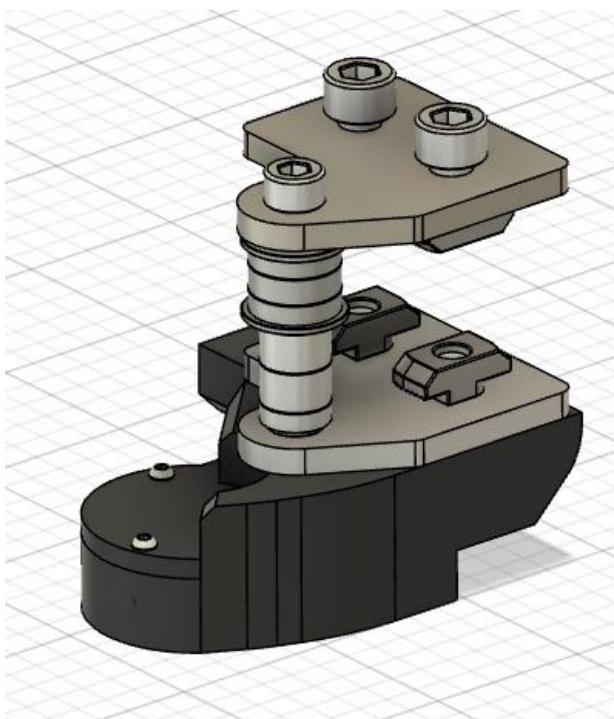
**If you have the 2.0 enclosure idlers plates, you can use this method:**

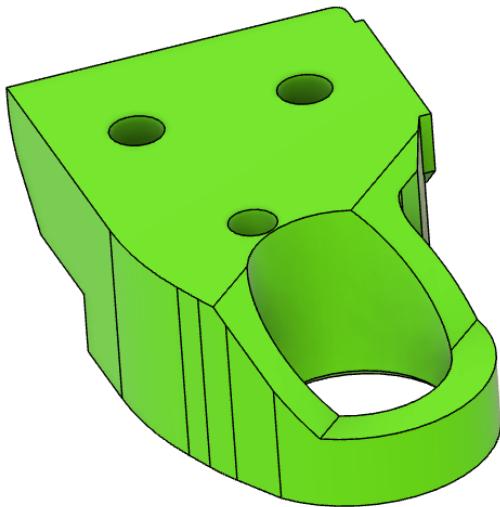
***You can use the other option to adapt directly on the 3.1 new front idlers plates:***

The ZU 2.0 1605 version



The ZU 2.0 1204 version



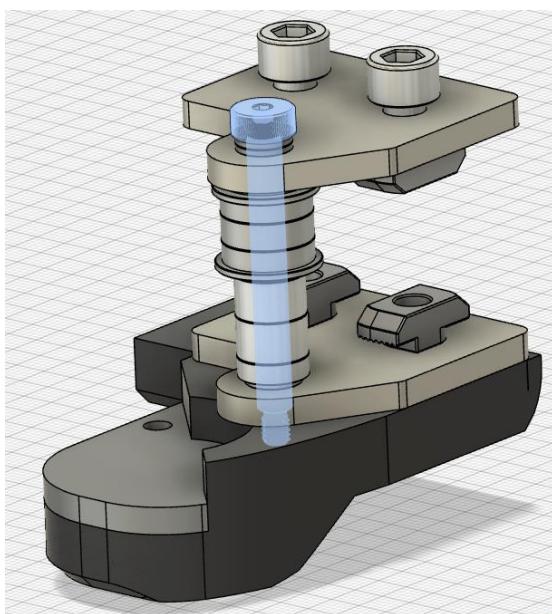


The ZU 2.8 DE (ACTUAL VERSION [May 2024])

You need to substitute the “Y bumper” with this part to keep the Actual Idle Assembly

***For ZU2.0: I strongly advise to swap the M5 to a D5m4 35mm shoulder bolt***

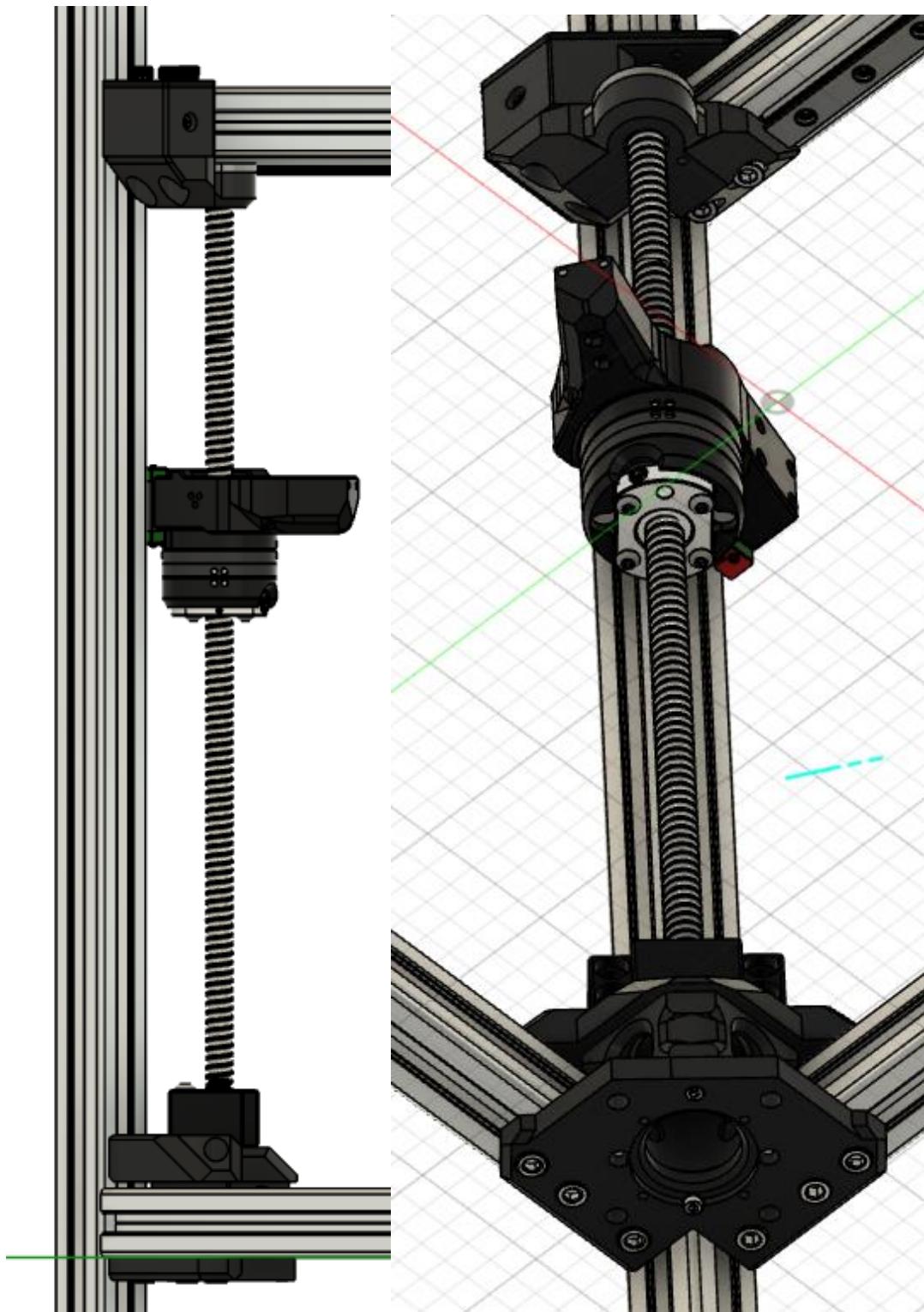
***For ZU2.8 DE: The D5m4 35mm shoulder bolt and the M4 insert are provided in the kit***



**If you are using the BRS-AWD Drives mod, it comes with a specific Ballscrew retainer!**

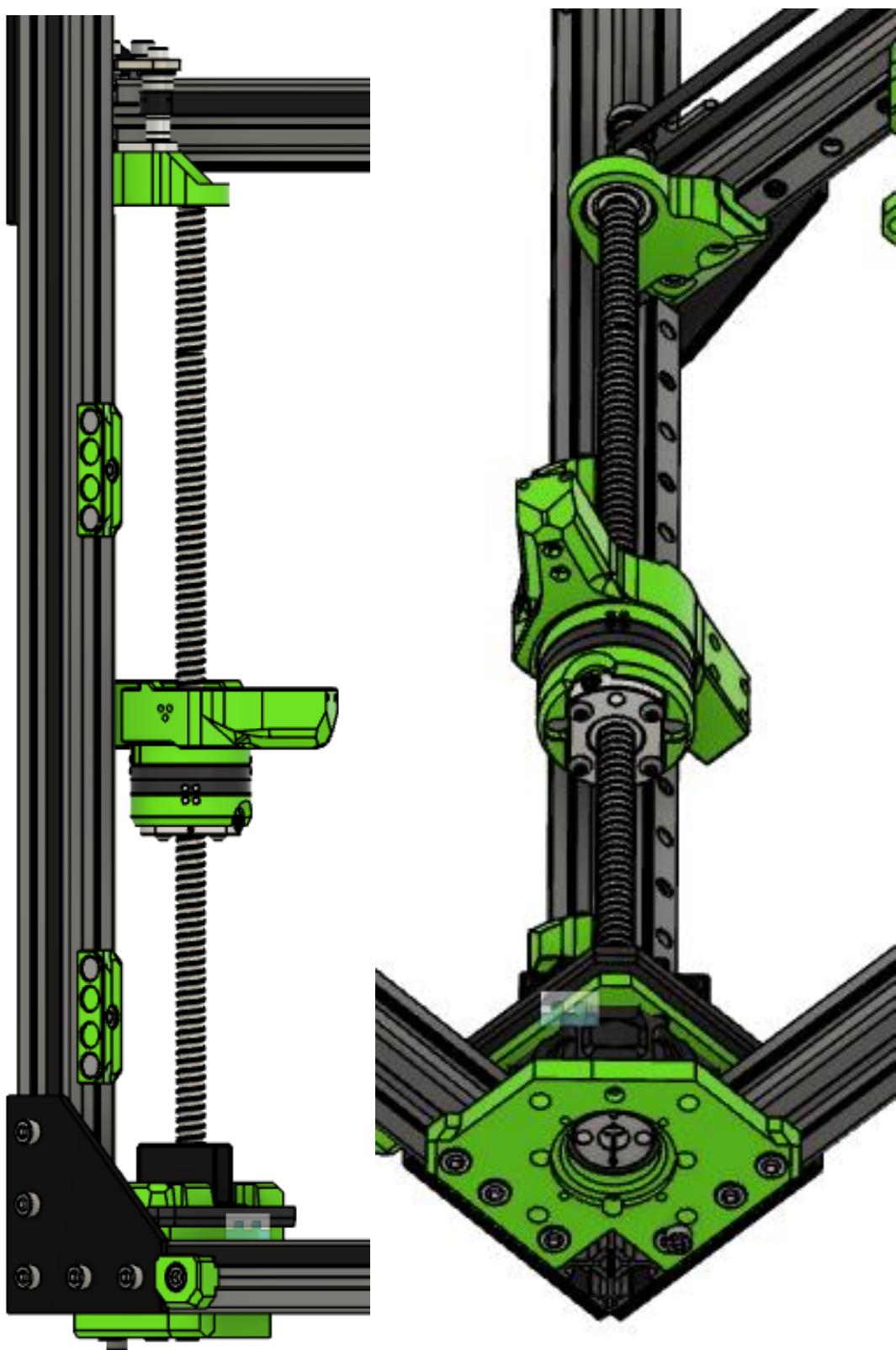
## 4/ Results

**ZU 2.0:**



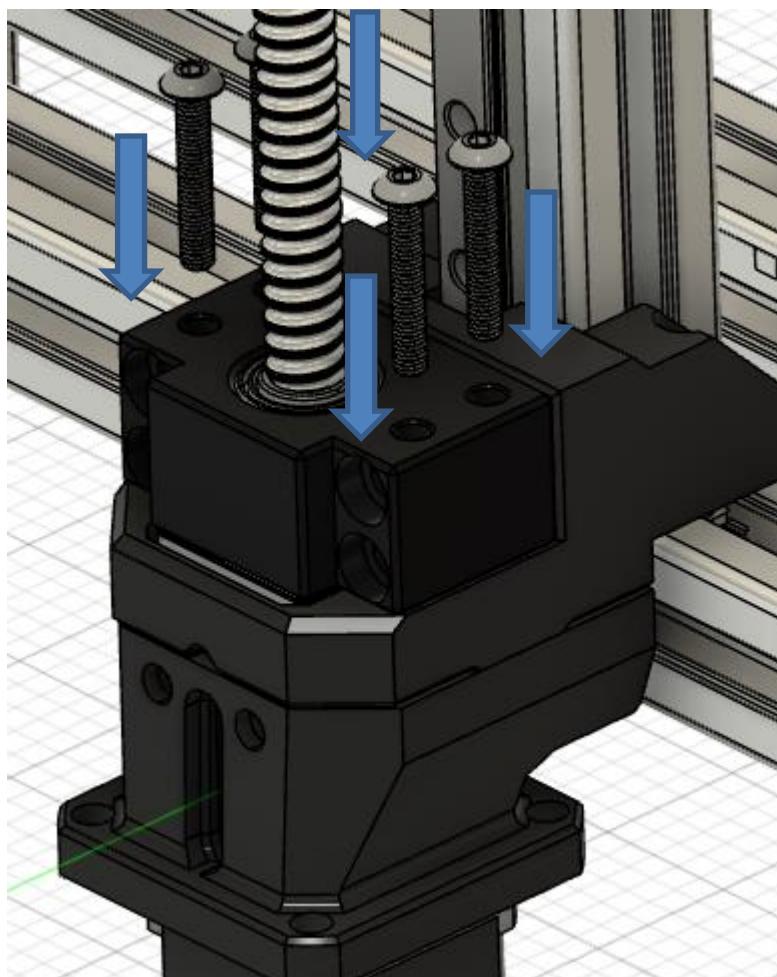
This process is the same across both front Z axis, only the idlers swapped place in the order of it.

**ZU 2.8 DE:**



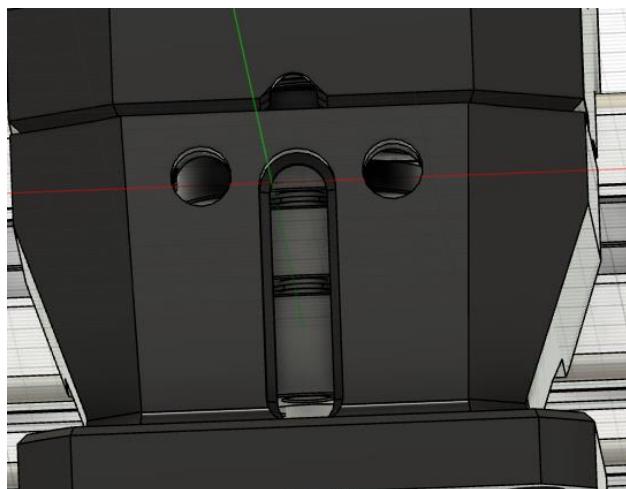
## **5/ REAR AXIS + ARM**

### **Rear Axis:**



Insert the x4 M5x50 to secure the whole block

-For the NEMA17 installation, install the coupler on the nema17 shaft before assembling the BK10/Spindle



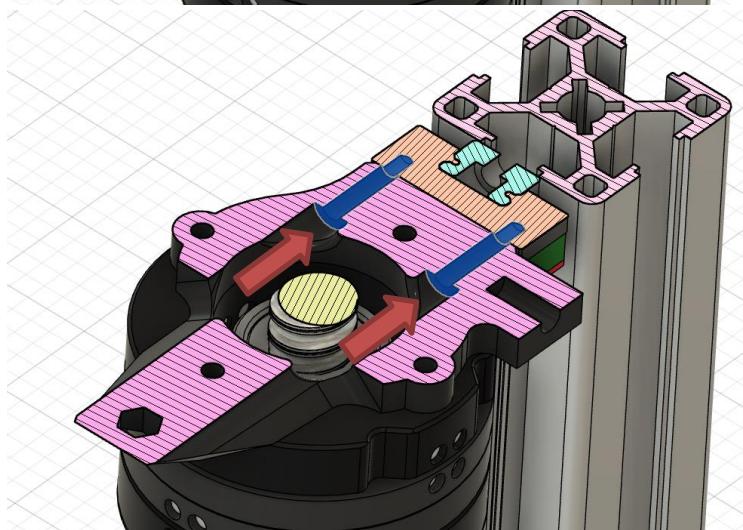
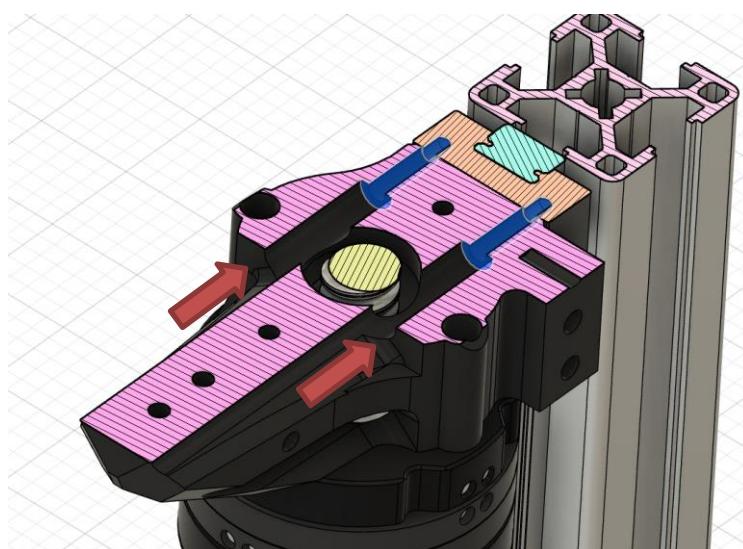
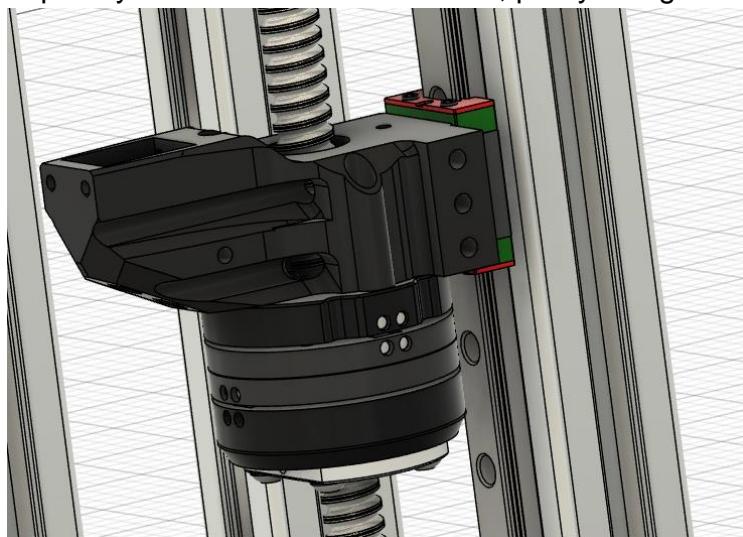
This section will be slightly change for the BEACON/GOLIATH mod

## Manual Z-Upgrade 2.0 + Oldham V2.3

You can now tighten the coupler via the holes here, it can be a bit hard to access but it works fine at the end 😊

For NEMA23 the installation will be at the end!

At this point you can install the Back arm, pretty straight forward



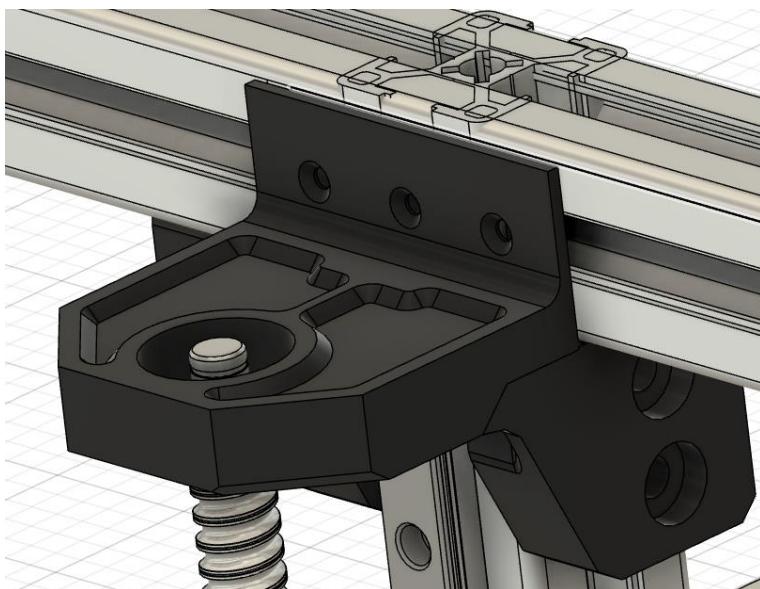
**Rear Arm:**

There is some variation of the rear arm, it has been corrected to fit all the needs

**The original one (VC3.0/ early VC3.1):**

4x M3x15 via the 4 specific holes.

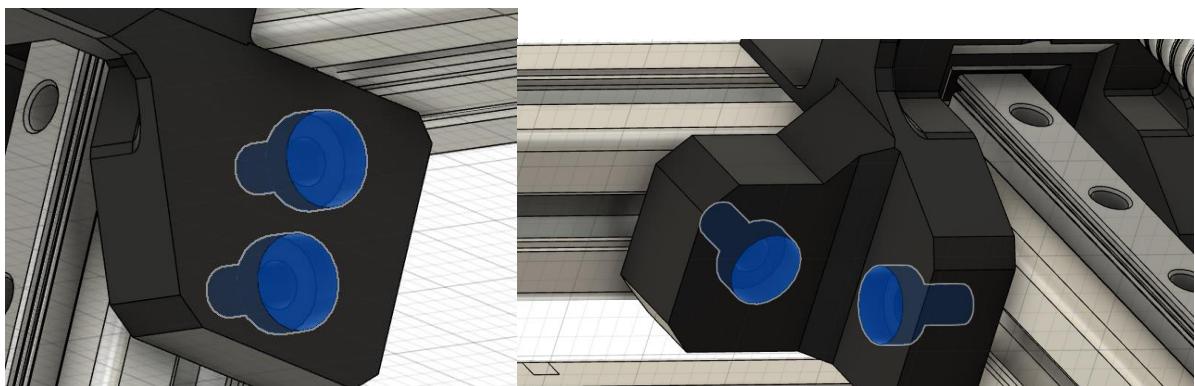
The last part is a bit of a pain, but with the help a a magnet it is completely possible



3 countersunk m3x8 with 3 M3 T-nut

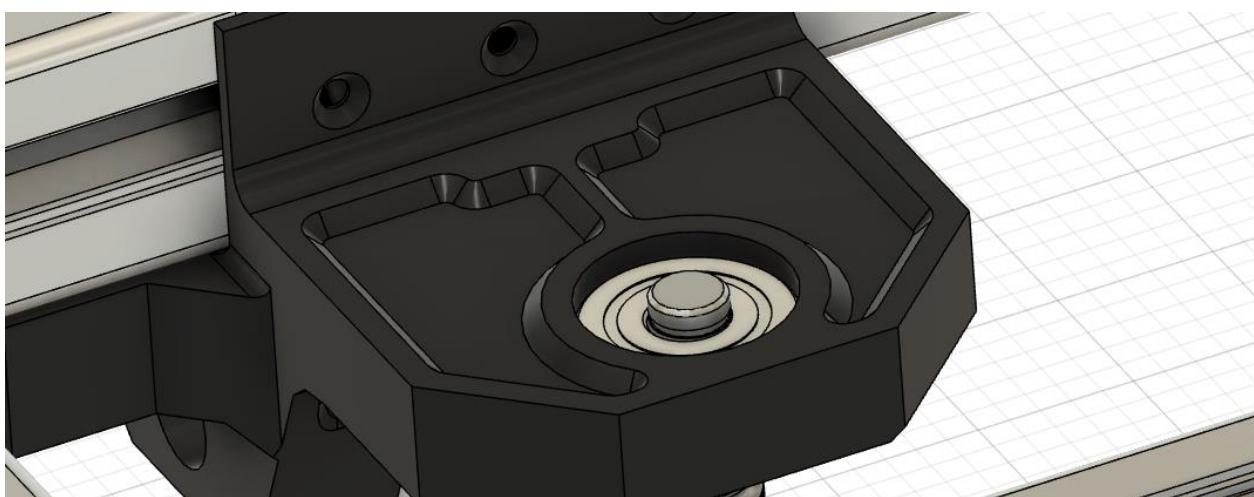
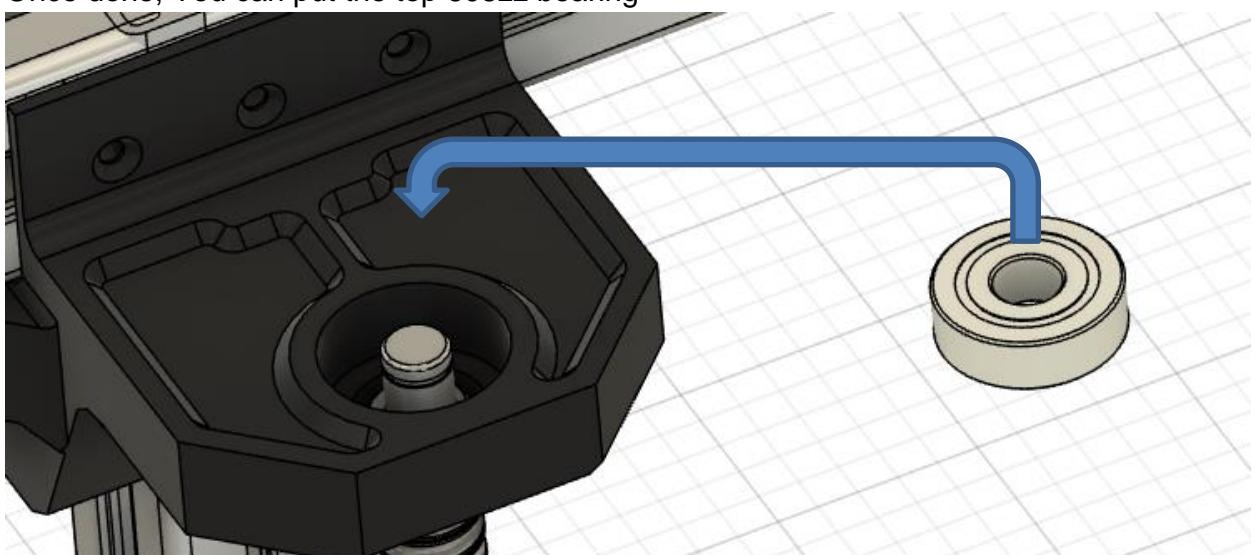


## Manual Z-Upgrade 2.0 + Oldham V2.3

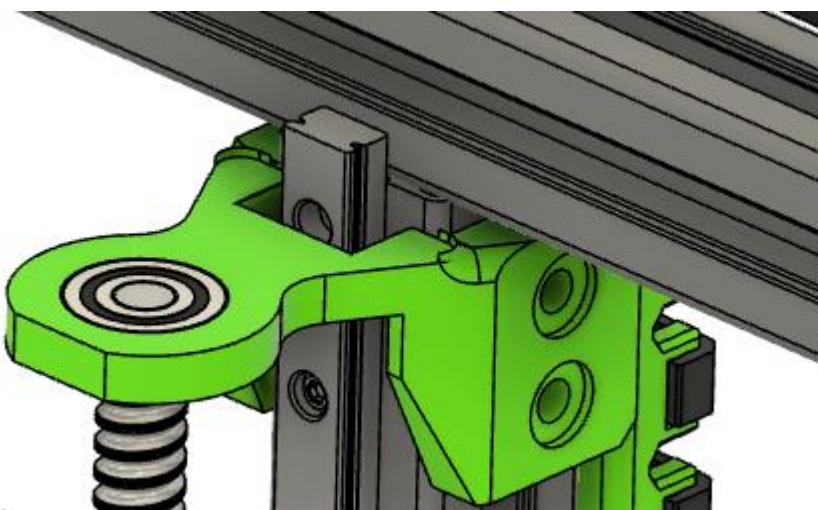


And 4 M6 with the according nut

Once done, You can put the top 608zz bearing

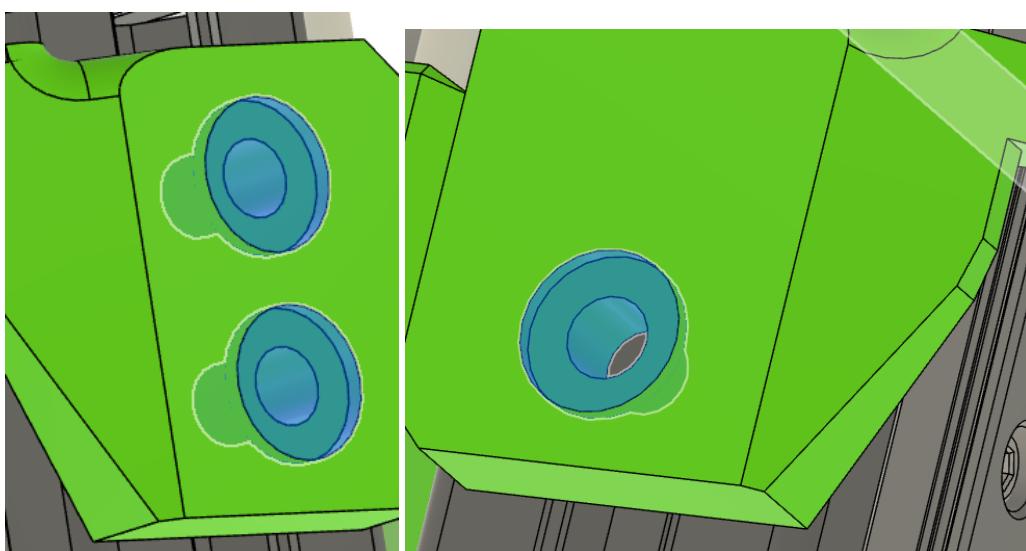


**The Actual one (All Vcore 3.0/3.1):**



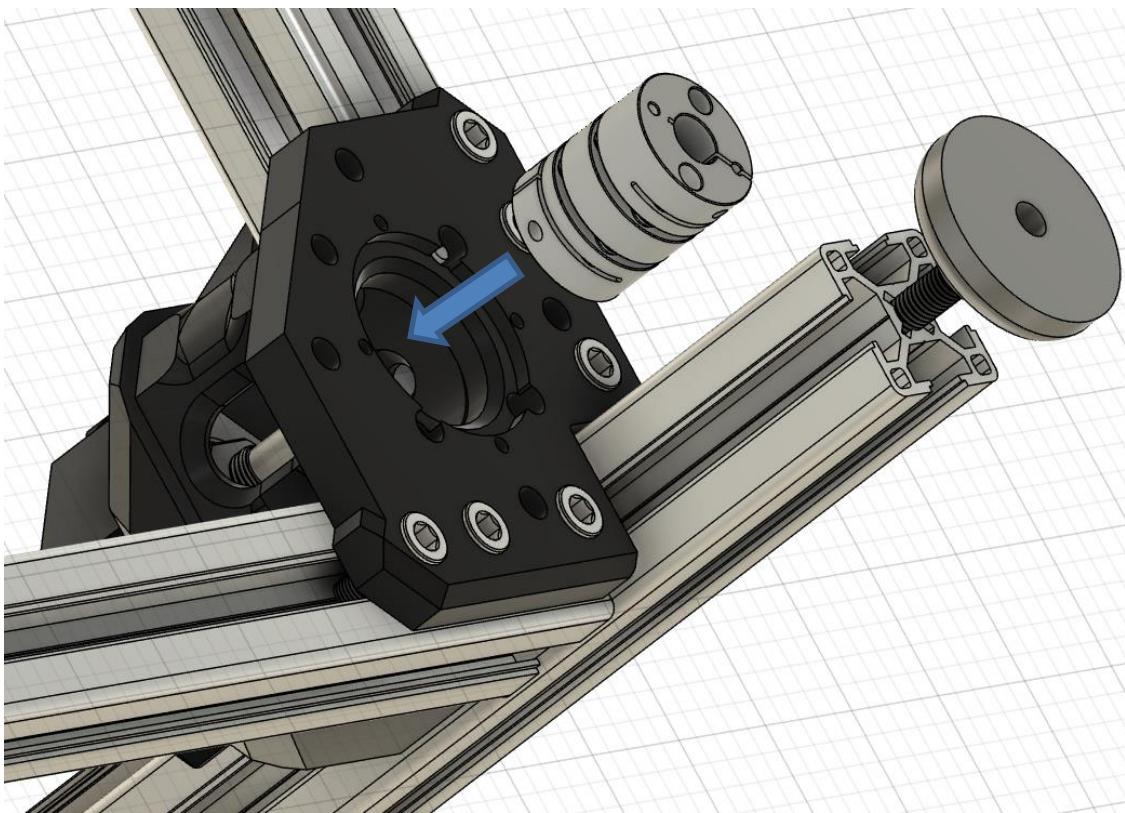
Basically the same mount system, without the 90° mount point

Will allow to tune the height for the upcoming BEACON/GOLIATH rear adaptation

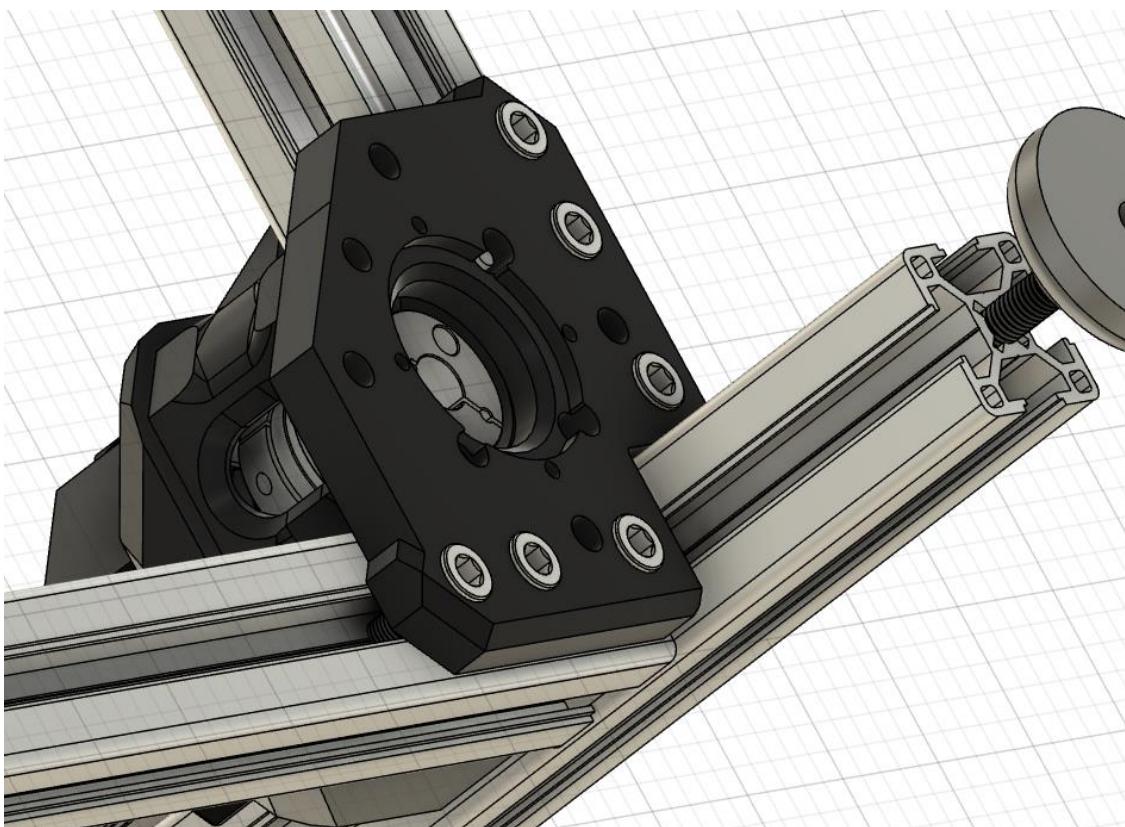


3x m6x12mm are needed with Tnuts

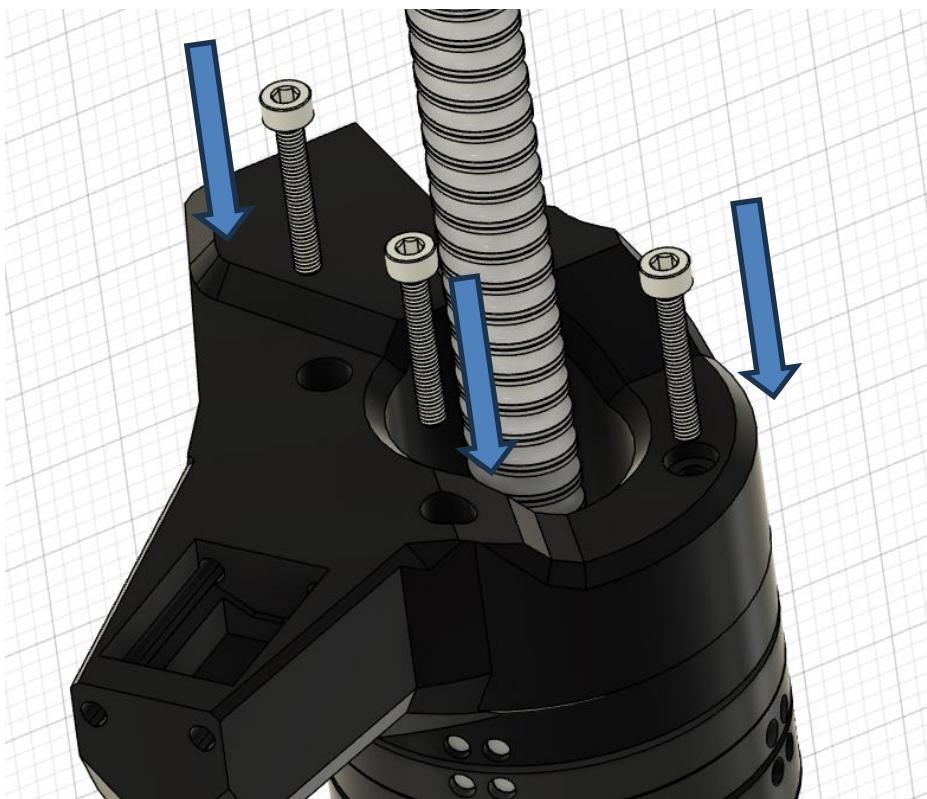
## **6/ NEMA23 Installation**



Install the coupler from bellow



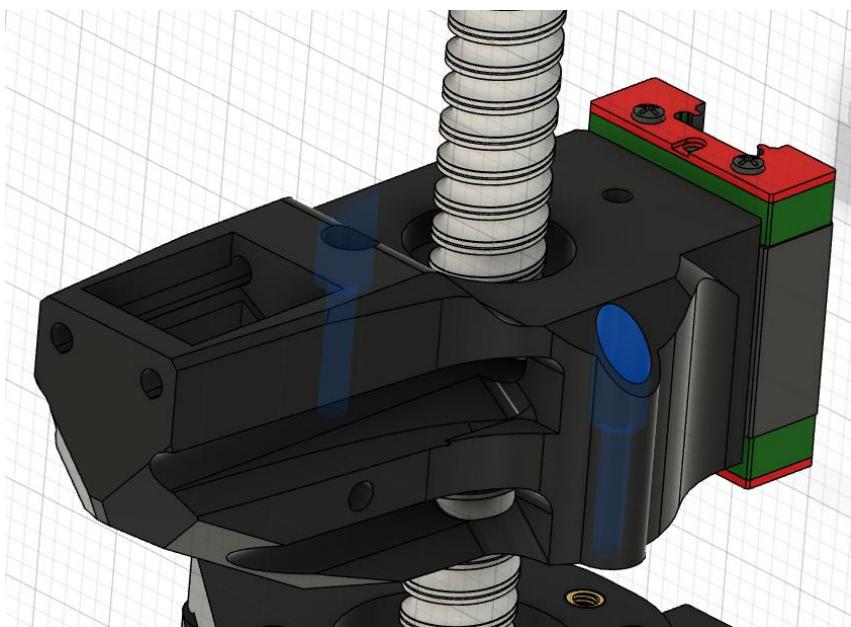
Now you can secure the 1204 Arms to the Upper ring; 3x M3x20mm for each front arm and only the 2 lateral for the rear.

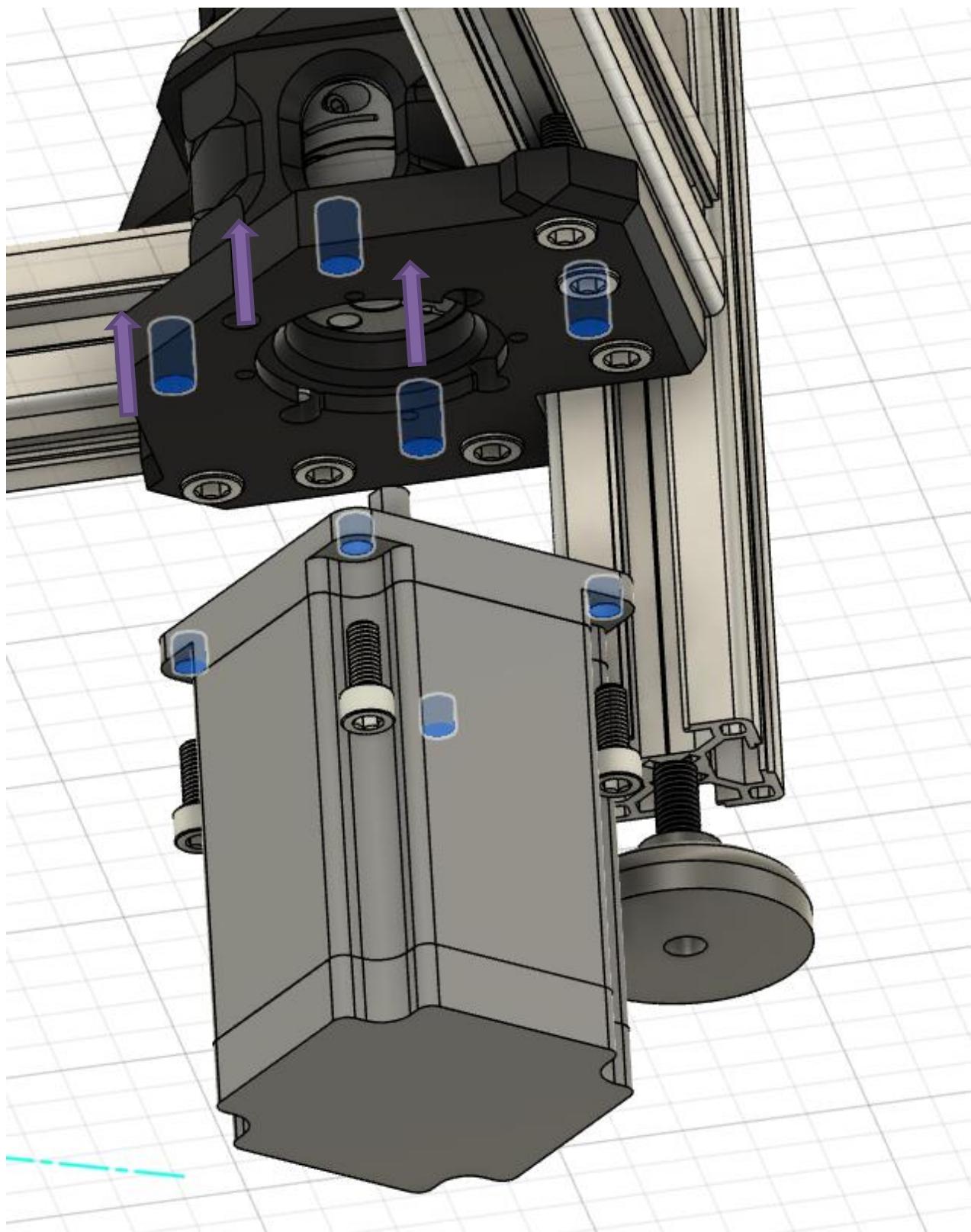


Don't forget then the upper Oldham ring have a specific layout for the front left and the front right

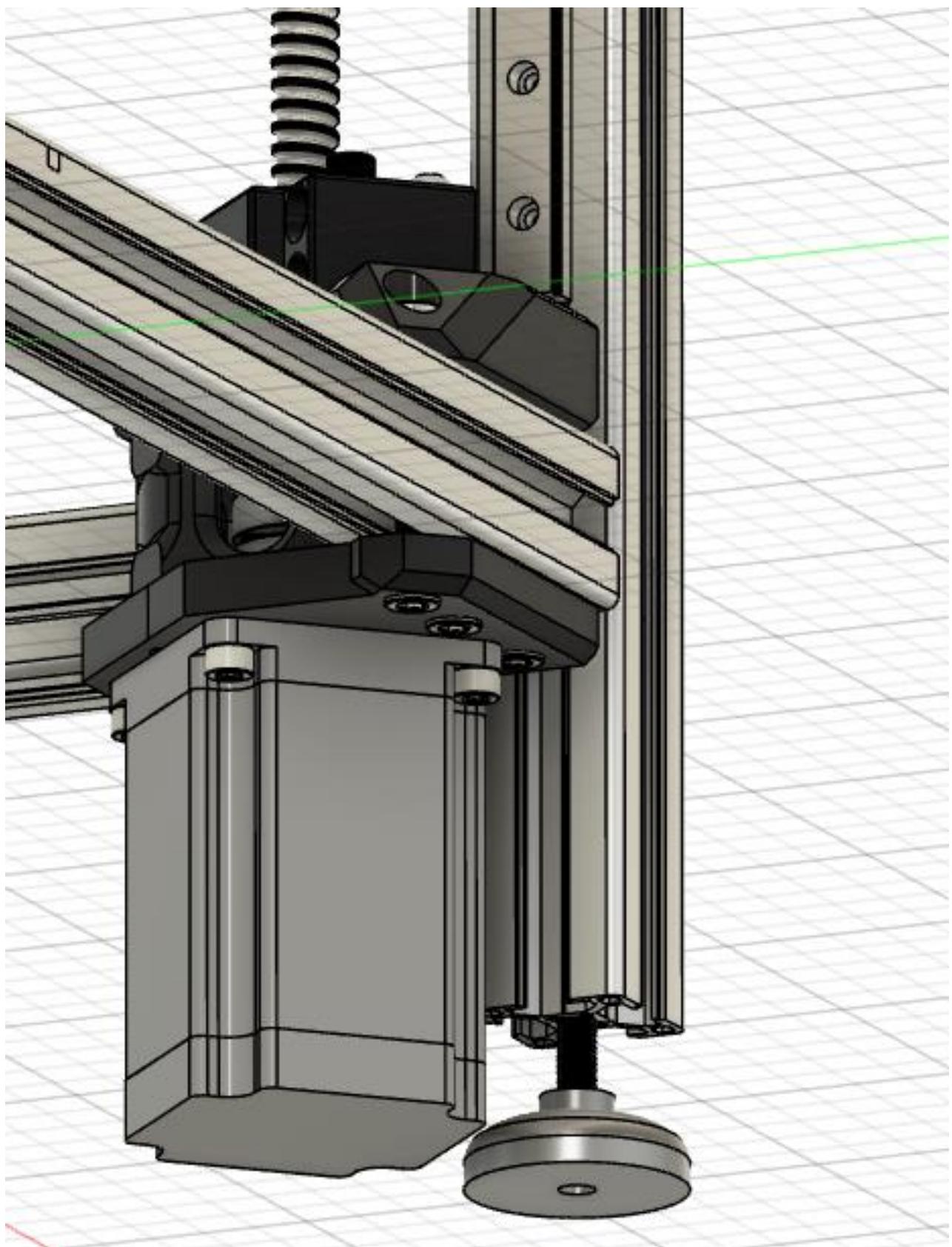
It comes with 2 upper ring, and a mirrored one.

For the 1605 you already have done it.



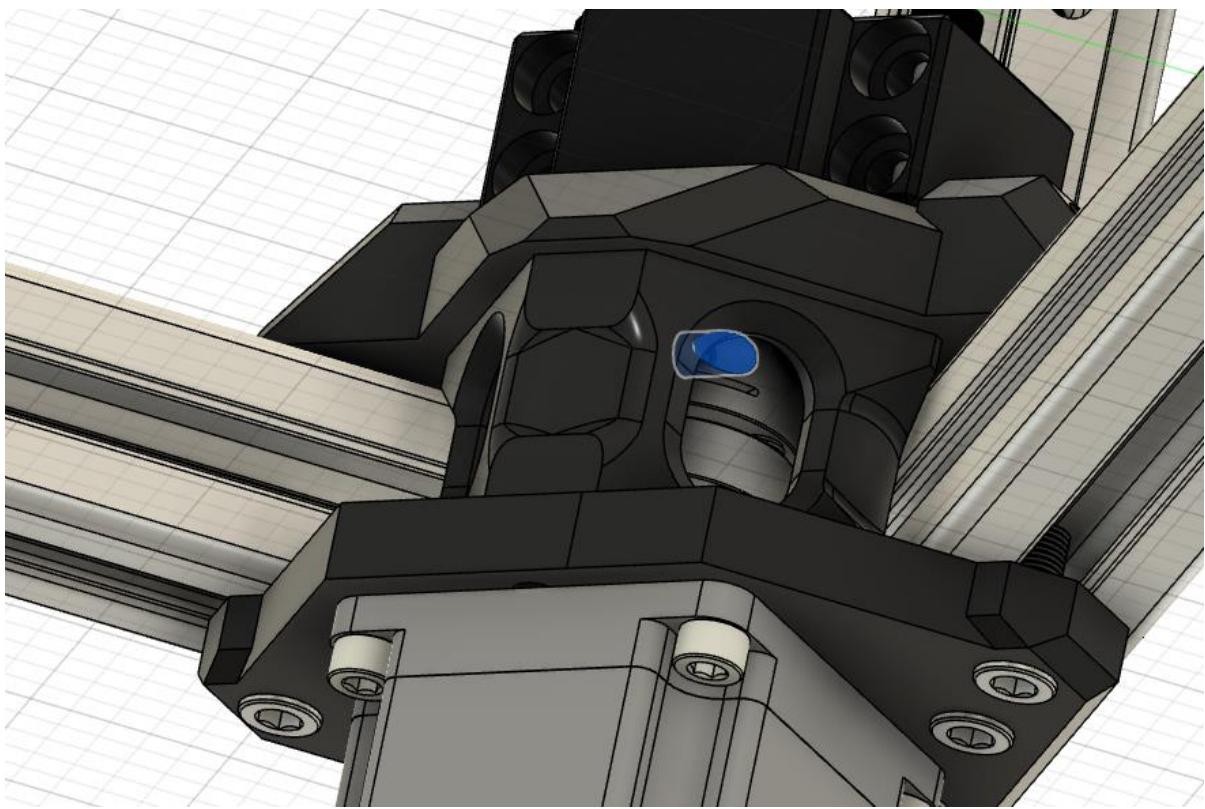


You can fix from bellow the NEMA23 (same logic for the rear pillar) with x4 M5x12 in the inserts.

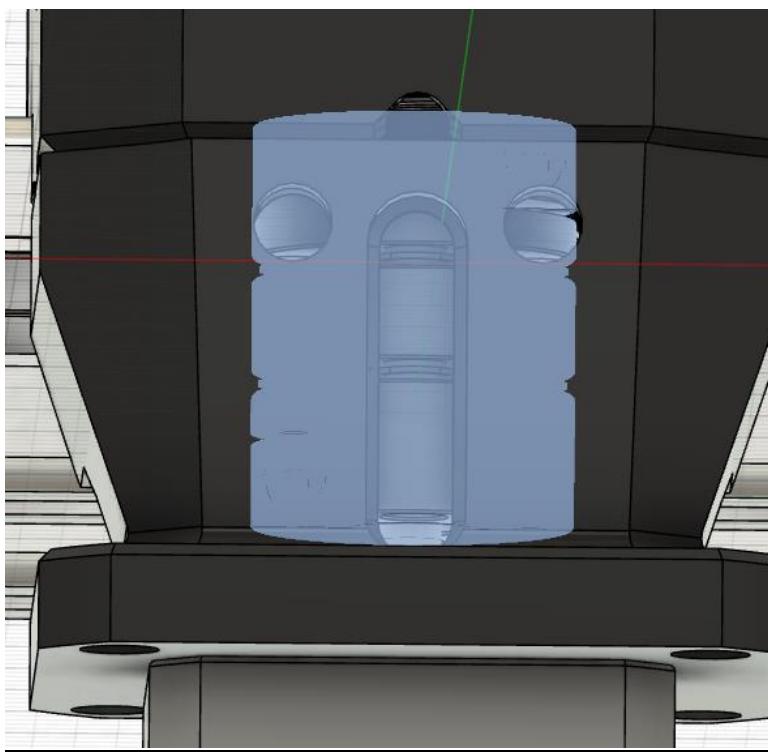


Depending the Size, an additional foot can be needed! This foot here is taped inside the 3030 M8 thread and give the opportunity to level the machine depending the flatness of your floor! It can basically same a BED MESH 😊

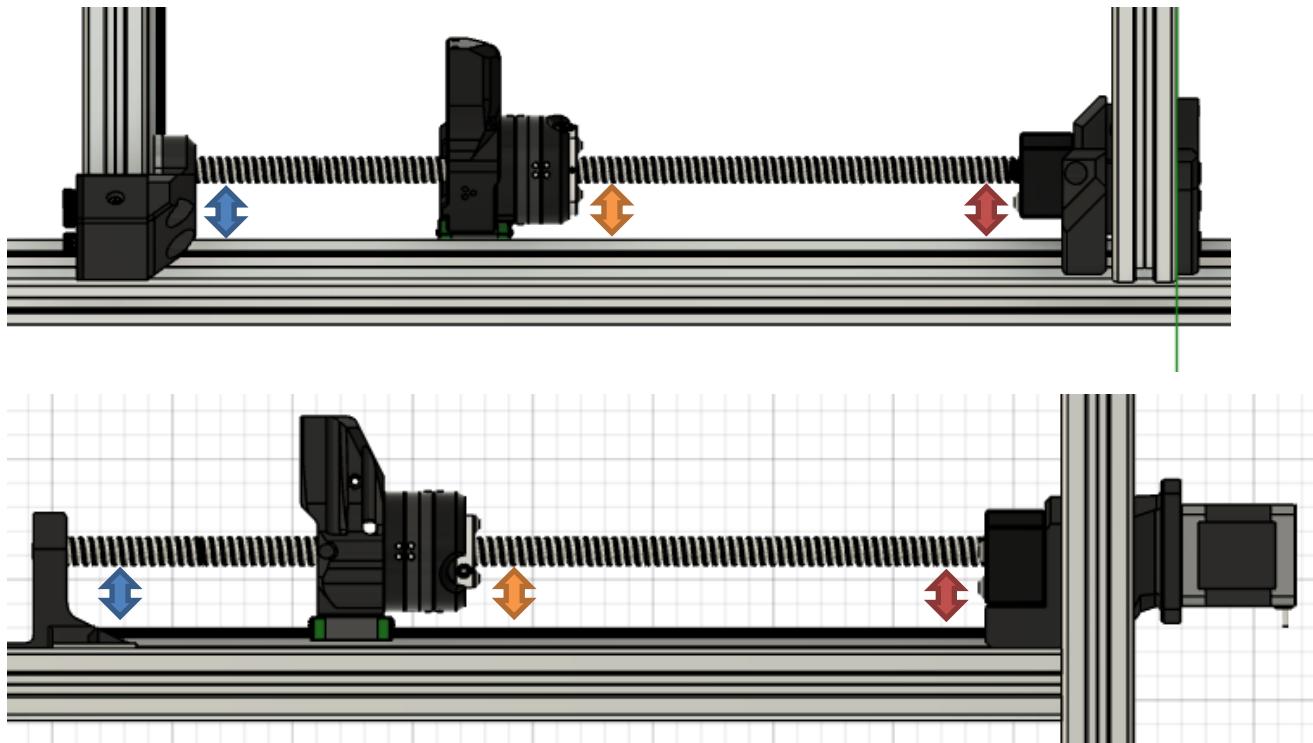
**Secure the Coupler**



Through the Middle part openings, you can access the M3 screws to secure each axis



## Alignments verifications :



Check for consistent NEMA/BK10/Ball Screw/retainer alignment.

If no mounting errors have been made on the Vcore structure, or on the printing of parts, or on the insertion of m5 inserts, the alignment should be correct.

Tighten completely the 4 screws of each BK10, couplers, brackets.

You should be able to rotate the SFU spindle to see if the rotation is smooth

Control a rotation without hard points, without deviations.

Double check the screw

Install the circlip (optional)

Strictly recheck the alignment of the screw in relation to the upright of the printer, finish tightening the low supports as soon as the dimensions are satisfied

Check the rotation without hard points, without excessive deviations (there will be some).

-Clean the ball screws with a clean cloth and lubricate them with a HIWIN GS04 type grease or any other lithium based grease compatible with bearings

**CAUTION, grease loaded with particles such as Graphite, Molybdenum or charged type, are to be avoided, do not use WD40 (except cleaning), dry PTFE lubricants are also to be avoided! I personally use Lithium based grease**

## **Manual Z-Upgrade 2.0 + Oldham V2.3**

-Close the m6 openings of the ballnuts with grub screws or M6 grease nipples

Position the nuts of the screws at the bottom, control the rise of the arms by releasing the coupling from the magnetic decoupler, control a fluid and linear movement, without hard points and without the arm rubbing the SFU1204. Repeat the alignment if this not the case.

The decoupling wings or Oldham are capable of handling up to 2.5mm circular deflection. This is more than enough for C7 grades.

Control and / or adjust the depth of the Y endstop so that the distance between the back of the toolhead does not collide with the rear bar and the top of the binding.

It is mandatory to make your own limits and measurements to integrate them into Klipper's printer.cfg. The breakage of the machine or the ball screws is a risk if this step is not carried out rigorously.

For the Z axis, it is MANDATORY to modify the line [Stepper\_Z] position\_max: (your value). A ball screw can literally twist the frame or crush parts due to its high torque, **THE MISTAKE WOULD BE FATAL** for the machine or your fingers.

## **Final checks :**

- 1- Check screw tightness.
- 2- Check Alignments
- 3- Hard Spot Checks
- 4- Lubrication, Checks (Rails + Ballscrews)
- 5- Check motor wiring, order on stepper!!!! If not done; possible system break
- 6- Check engine functions in Klipper with "[STEPPER\\_BUZZ STEPPER=stepper\\_z](#)"
- 7- Z-probe check!!!
- 8- Z Min/Max position to be calibrated, All hotends or probes setups can influence very different Z max and Z total travel from the nozzle to the ballscrew base block

## **Disclaimer :**

The system is designed to operate on a properly assembled Vcore 3.0/3.1. Even a slight mounting error can make it impossible to upgrade. That said the quality of the design or the prints are strictly related to the assembly made by yourself.

If the parts to be printed are made by the customer, check the dimensions at the printer output:

The kit is installed in the simplest way without destructive modifications of the machine, the old stock system can be reinstalled

This kit is an optional upgrade, its assembly and/or its function and/or its quality of execution are the responsibility of the customer. BRS-Engineering relieves itself of all responsibility in case of poor sourcing (poor quality and/or bad dimensions), bad customer assembly, or bad assembly of the basic Vcore.

The Z-Upgrade 1.0/2.0 are not compatible with BEACON/GOLIATH natively, some corrections need to be done to the rear spindle height due to the Very lower nozzle position induce by the Goliath and can interfere with the rear top ballscrew retainer

A modification will be released to make the spindle lower for this specific usage on the 2.8 DE version

Some version compatible have been individually made and can not perfectly reflect the manual here, without compromising it either! If you have a question, don't hesitate to contact BRS-ENGINEERING ([contact@brs-engineering.com](mailto:contact@brs-engineering.com)) or Florent Broise on Discord, Meta messenger, or on the BRS Store website <https://store.brs-engineering.com/>

By purchasing the kit, or having it done by BRS-Engineering you accept the GTC as well as the previous disclaimer

BRS-ENGINEERING is proud of designing, developing, manufacturing, and testing VCORE Mods products

### **Lifetime Warranty:**

I want all of my customers to print happy, therefore: All mods carry a lifetime warranty against manufacturing defects. The Z-Upgrade warranty covers defects in materials or workmanship by manufacturers.

**Thanks to you and your support**

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