

# Manual Z-precision Kit

## BallScrews

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### Evolutions

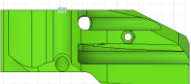
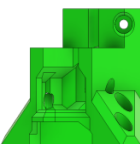
Rédacteur		Responsable X	Qualité
FBR		FBR	FBR
Indice	Date	Description de l'évolution	Auteur
0.0	07/09/2021	Création, v1.3 Beta	FBR
0.1	13/09/2021	Update v1.4 Alpha	FBR
0.2	25/09/2021	Update v1.5 Allègements	FBR
0.3	27/09/2021	Update v1.6 Fix NEMA mounting + English version	FBR
/	28/09/2021	Update v1.7 Adaptation Vcore-Pro	FBR

Etat	Beta 1.3	Alpha 1.4	V1.5	V1.6	V1.7
Statut	Fonctionnel POC	Fonctionnel, POW Artefacts légers Z	Fonctionnel Allègement matériel	Fonctionnel Réglages NEMA	En cours

Be careful, some pictures are from older revisions, but that change nothing to the process.

### BOM :



Printed parts list

 <p>Right arm</p>	X1
 <p>Left arm</p>	X1
 <p>Back arm</p>	X1
 <p>R BF_Retainer</p>	X1
 <p>L BF_Retainer</p>	X1
 <p>B BF_retainer v2.3</p>	X1
 <p>R SFU Bracket</p>	X1
 <p>L SFU Bracket</p>	X1
 <p>B SFU Bracket</p>	X1
 <p>Wing bottom</p>	X3



# Manual Z-precision Kit

## BRS-Engineering

Wing top 	X2
Wing top mirrored 	X1
Bearings covers	X2
Chain arm 1 (optionnel)	X1
Chain arm 2 (optionnel)	X1

### BOM2 :

SFU-1204 -400mm for Vcore 300 -500mm for Vcore 400 -600mm for Vcore 500	X3
SFU-1204 Nuts	X3
BK10	X3
Ball bearing 608-ZZ (included in BF10)	X3
Circlip pin 7mm (optionnel)	X3
Counternut BK10	X3
Coupler 5-8mm or Oldham coupler 5-8mm bore	X3
Round Magnet 8x3mm	X15
Steel ball 6 or 7mm <u>MAGNETIC</u>	X9
Oil port M6 OU headless screw M6x5	X3
Inserts brass m3 Ruthex	X16
Inserts brass m2 Ruthex	X4
Inserts brass m5 Ruthex	X12
screw M6 12mm	X14
screw M6 20mm	X15
screw M6 60mm	X2
Washer M5 (optionnel)	X20
Washer M6 (optionnel)	X20
screw M5 40mm	X12
screw M4 20mm	X12
screw flat head m4x20 (optionnel)	X9
screw M3 12mm	X4
screw M3 20mm	X11
screw M3 10mm	X8
screw M2 8mm	x4
hammer/T nut M5	/
hammer/T nut M6	X6

### 1-SFU retainers installation

Before assembly, check the passage of the bearings in the blocks, pre-insert them before assembly in order to make the first passage. The covers will come into abutment on the final part, to avoid having to force at the end of assembly, also check the passage of the bearing on the top of the machined screw

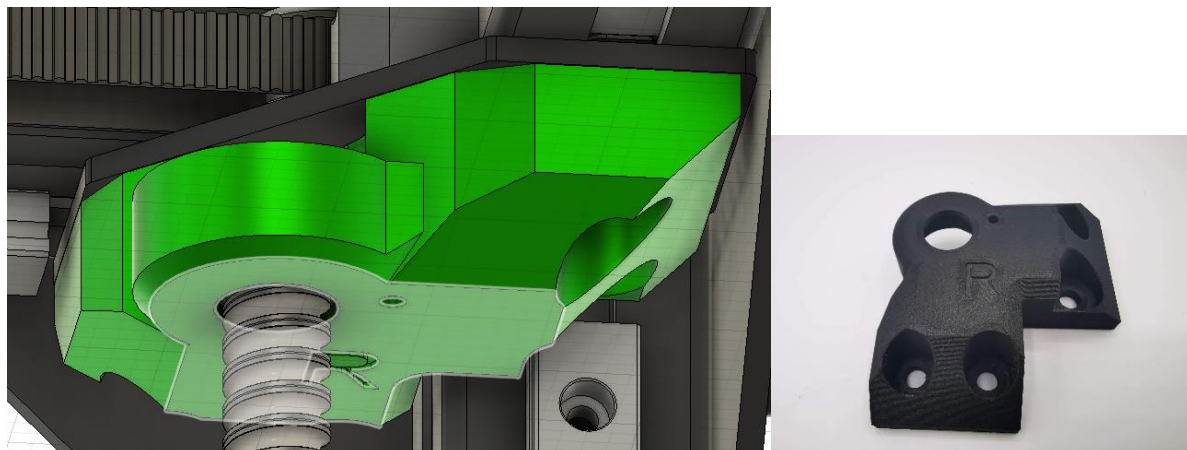


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## BRS-Engineering

A 10-12mm washer is advise on each m6 screws of the upgrade to secure pression on the printed parts

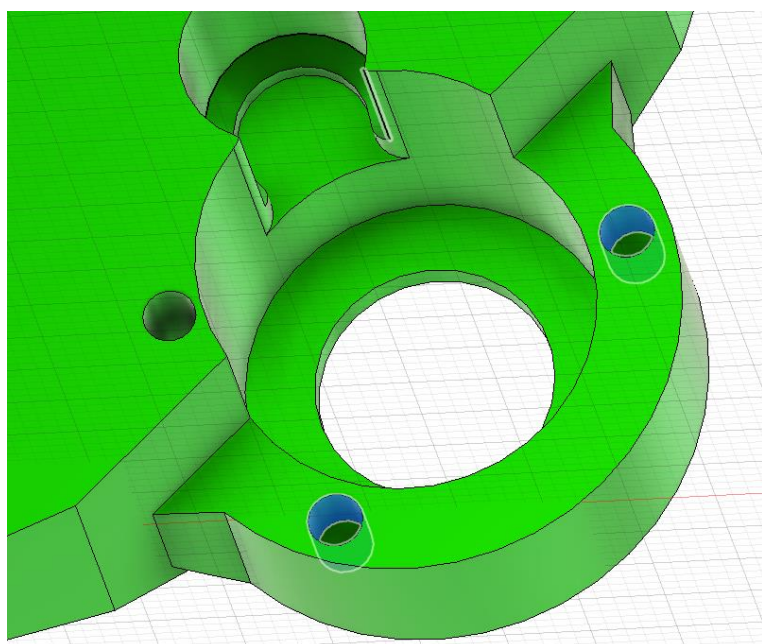
Each block is fixed under the aluminum plates of the XY idlers:



For assemblies not made, follow the RR manual and add the part to the screwing

For assemblies already made, disassembly of the XY idlers will be necessary

**!!! Do not insert the 608ZZ bearings now !!!**



Insert the 2 brass insert of 2mm

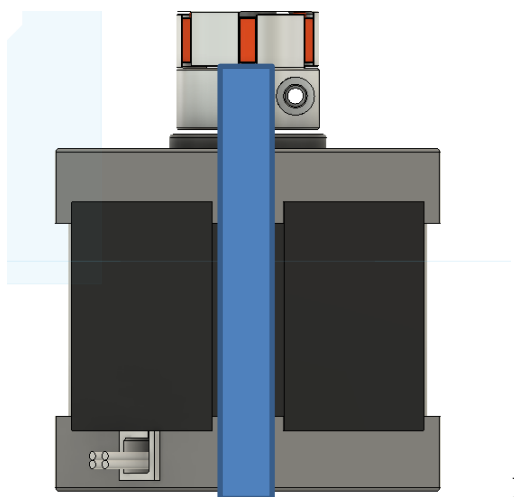
### **2-Motor Bracket R+L**

Cut the axes of the NEMA so that the 5mm coupler arrives at 0.2mm (cutter blade height) depending on your motors or size of structure, a different value may be more suitable. Fix the lower part of the coupler and insert the red spider



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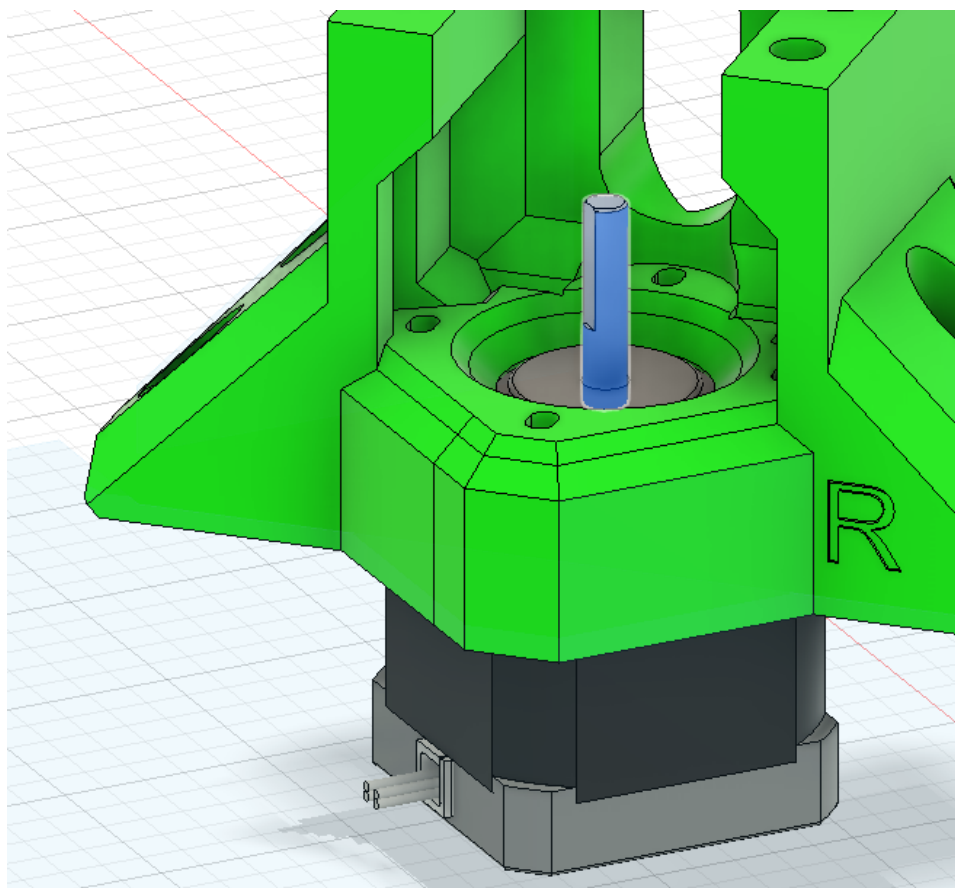
## BRS-Engineering



Detail for the cut

It is not necessary to put the original balls stops, the BK10 supports the screw and the bed.

Secure the NEMA to the block, do not over-tighten the screws so that you can manage the alignment later. However, the motor should not have too much play.

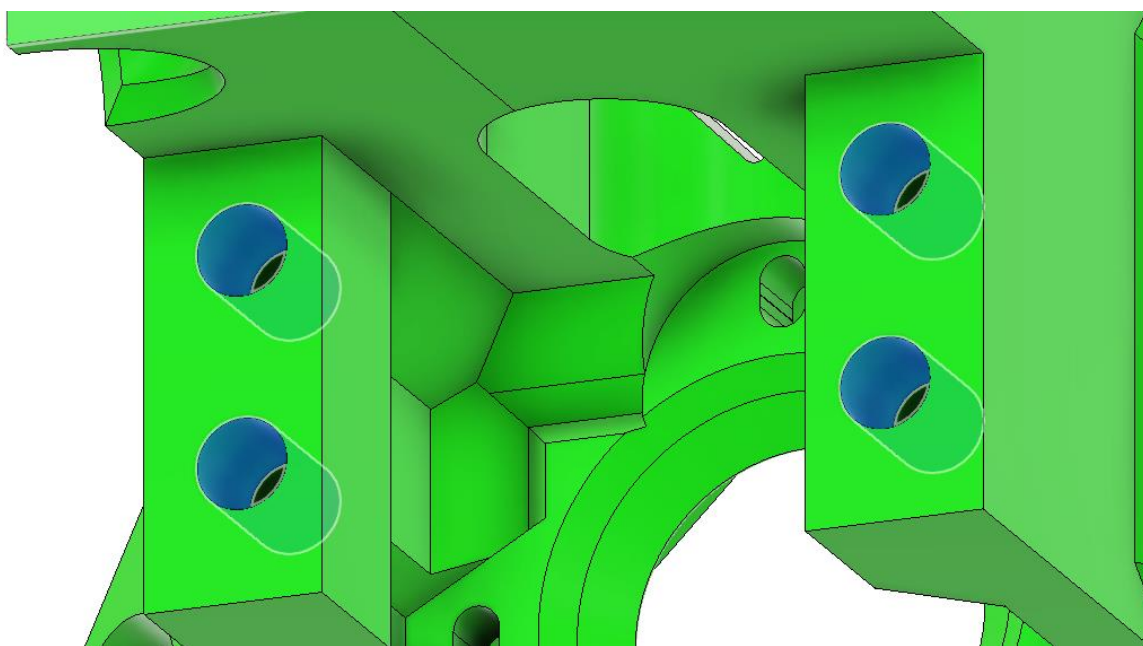


Hot insert the M5 brass inserts, **THIS STEP REQUIRES GREAT PRECISION** in the 4 upper holes, they must be flush or even slightly below. Deburr the excess if necessary with a cutter blade.



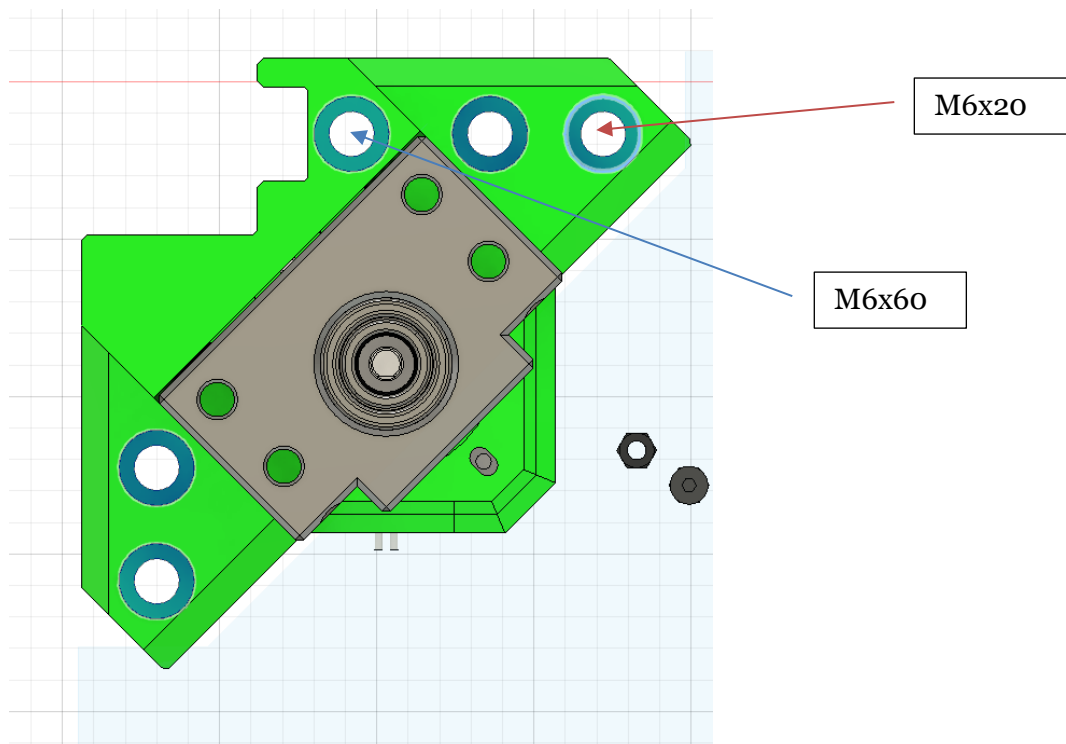
# Manual Z-precision Kit

## BRS-Engineering



Insert 4 M5 40mm screws, take the thread without tightening.

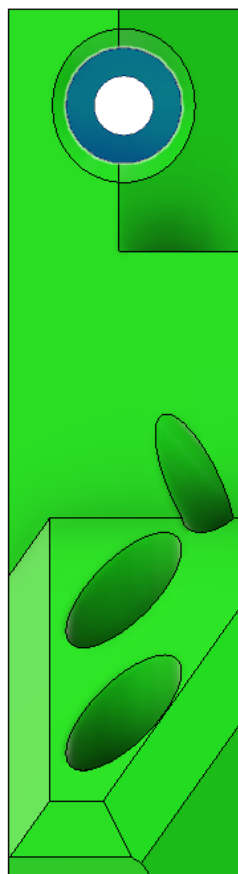
Place the block on the corner of the machine and insert 4 M6 15 / 20mm screws and one M6 60mm, leave loosened





# Manual Z-precision Kit

## BRS-Engineering



The vertical mounting hole, use to secure and align the SFU at the end, made for a m6x20

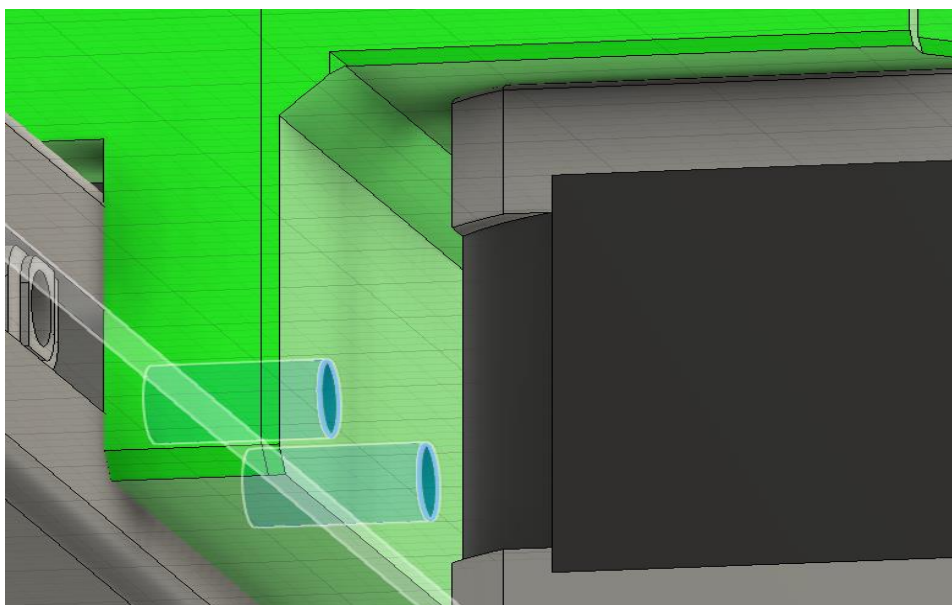
### **3-Rear Bracket**

Mount the NEMA in the same way as the front blocks. Hot insert the 4 M5 brass inserts Once assembled, attach 2 M6 12mm screws with two hammer nuts on the bottom holes and tighten while maintaining good alignment

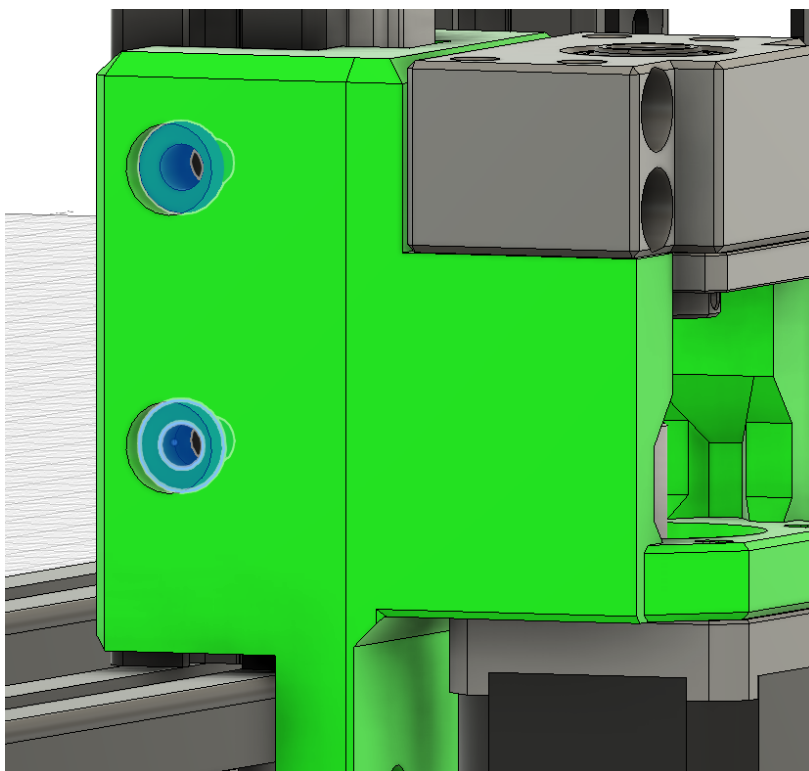


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## BRS-Engineering



Insert at an angle and position the other inserts by hand, the operation is not easy but doable!  
The use of self-locking T-nuts can simplify the task.



Do not over-tighten

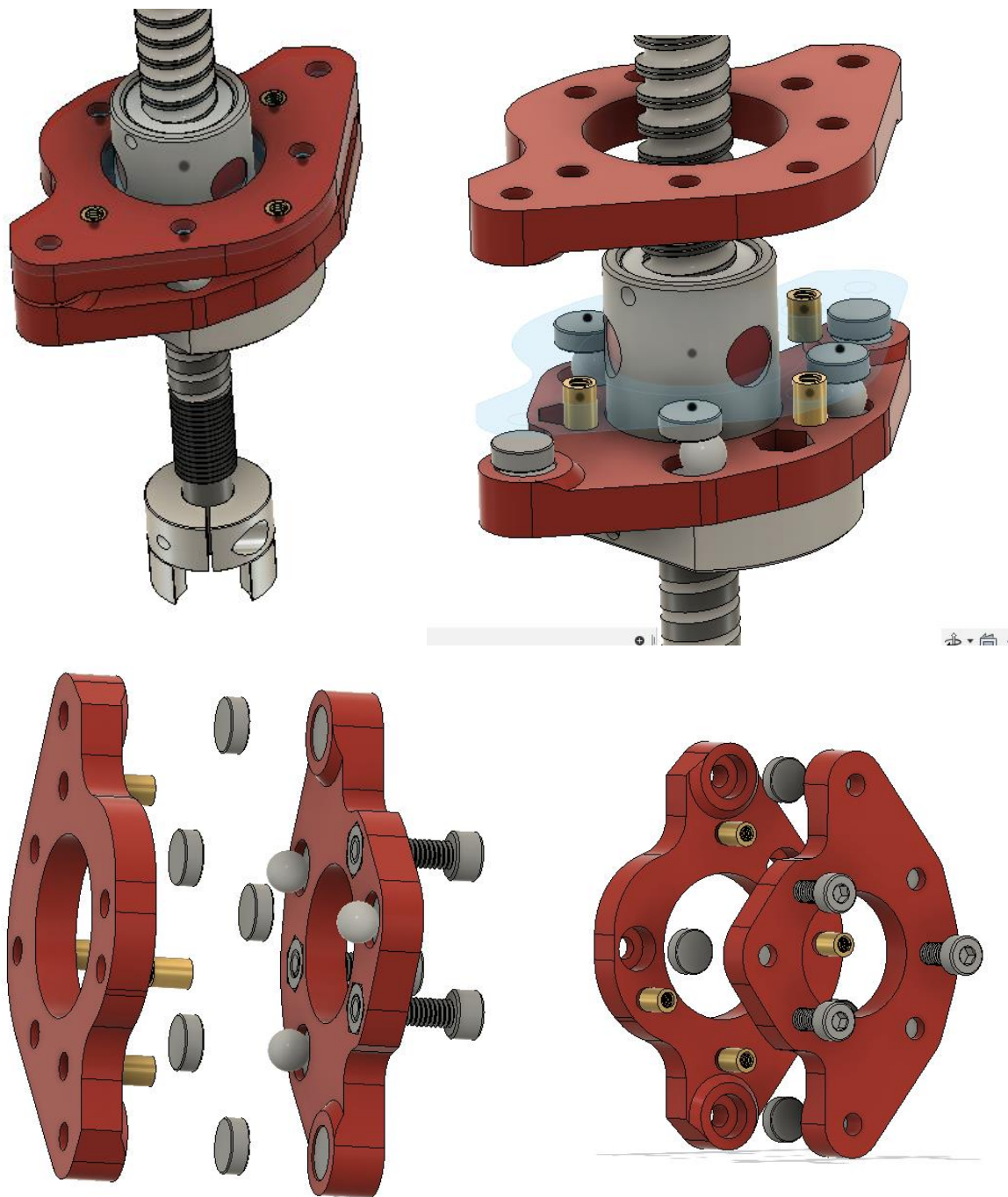




# Manual Z-precision Kit

## BRS-Engineering

### 4-SDU, anti-wobble wings :



Wing assembly details above: Two are the same, one is the mirror of the other two, The screws holding the ball screw nut are 3x M4x20, the reciprocal nuts are M4.

There are 4 m3 brass inserts to be inserted per wing.



## Manual Z-precision Kit

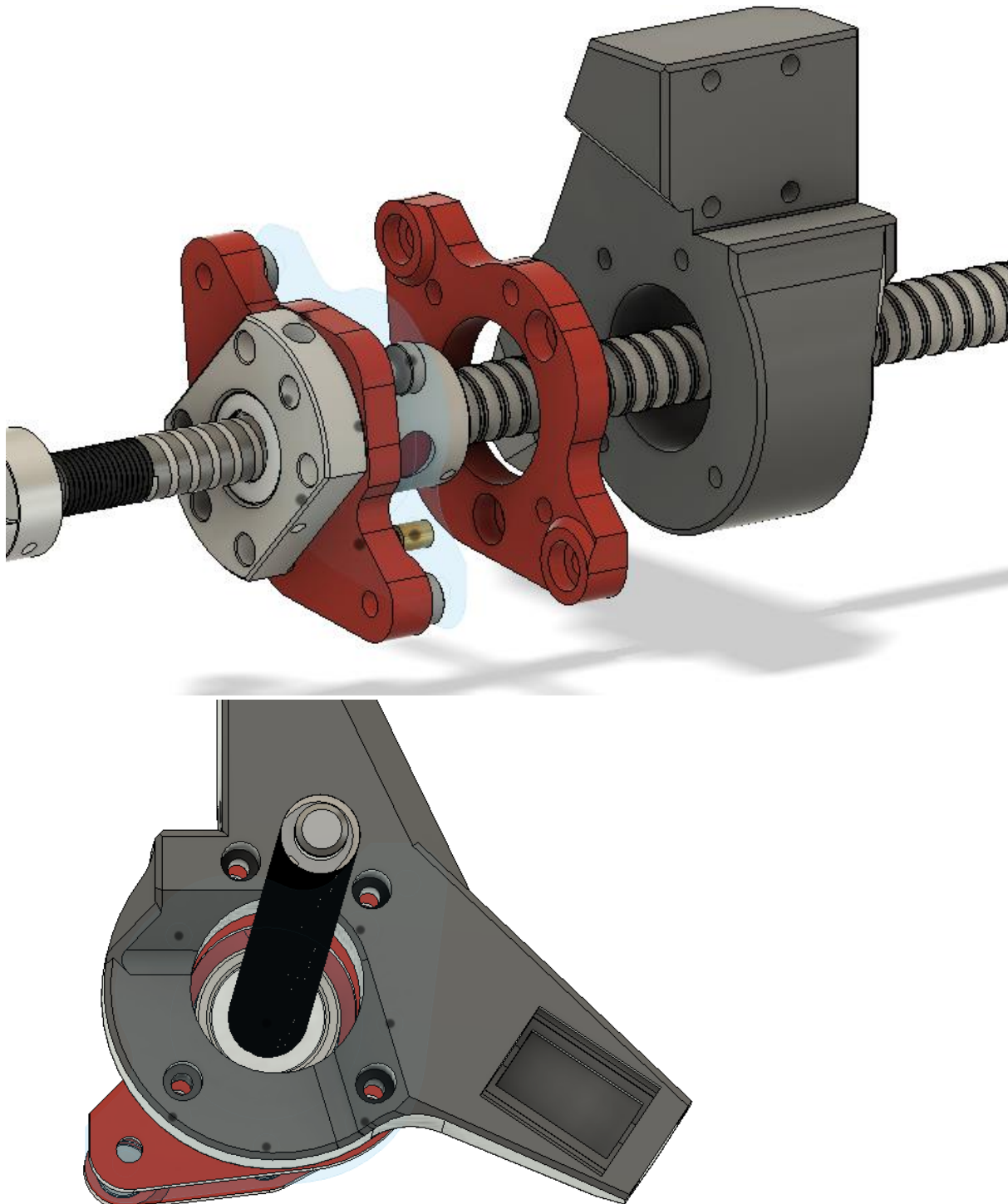
### BRS-Engineering

Magnets should attract each other, pay attention to their polarities. Hold them in place with a cyanoacrylate glue type (Loctite Superglue-3 Power Easy which does not leave a white marks by exemple). The magnets must come to a stop and their surface, parallel to the part; an absence of parallelism can generate artefacts on the future prints

The magnets must be clean, free of glue, a drop of precision oil is possible.

Insert a steel ball on the 3 central magnets

Ensure that the locking mecanism is working, polarity respected.

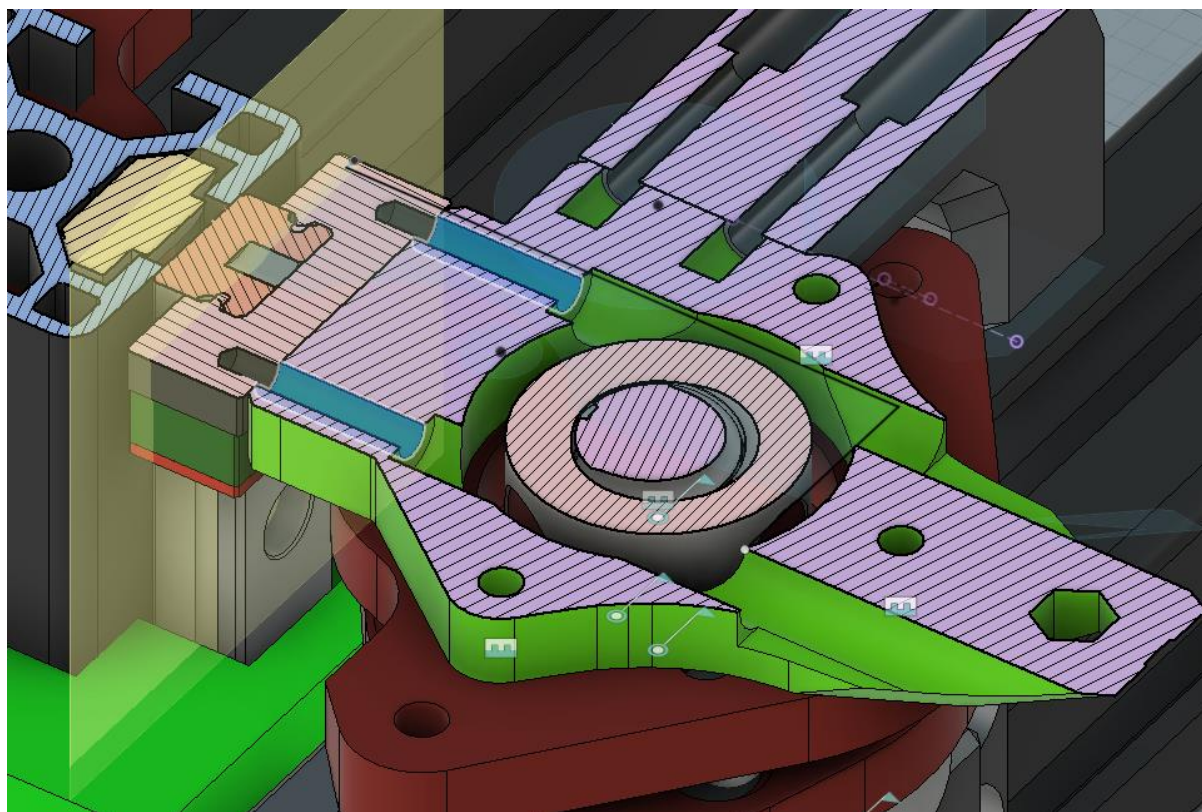




The arm is screwed with 4 m3 20mm screws, from above. It will be necessary to apply the mounting of the magnet and the bed ball retaining pins

Repeat the operation for the left arm, and the principle is the same for the back arm

The left arm is to attach to the mirrored wing, holes self align themselves anyway, mistake is easy to avoid.



For the same logical rear arm, the 4 M3 screws are screwed through the holes in the next step.

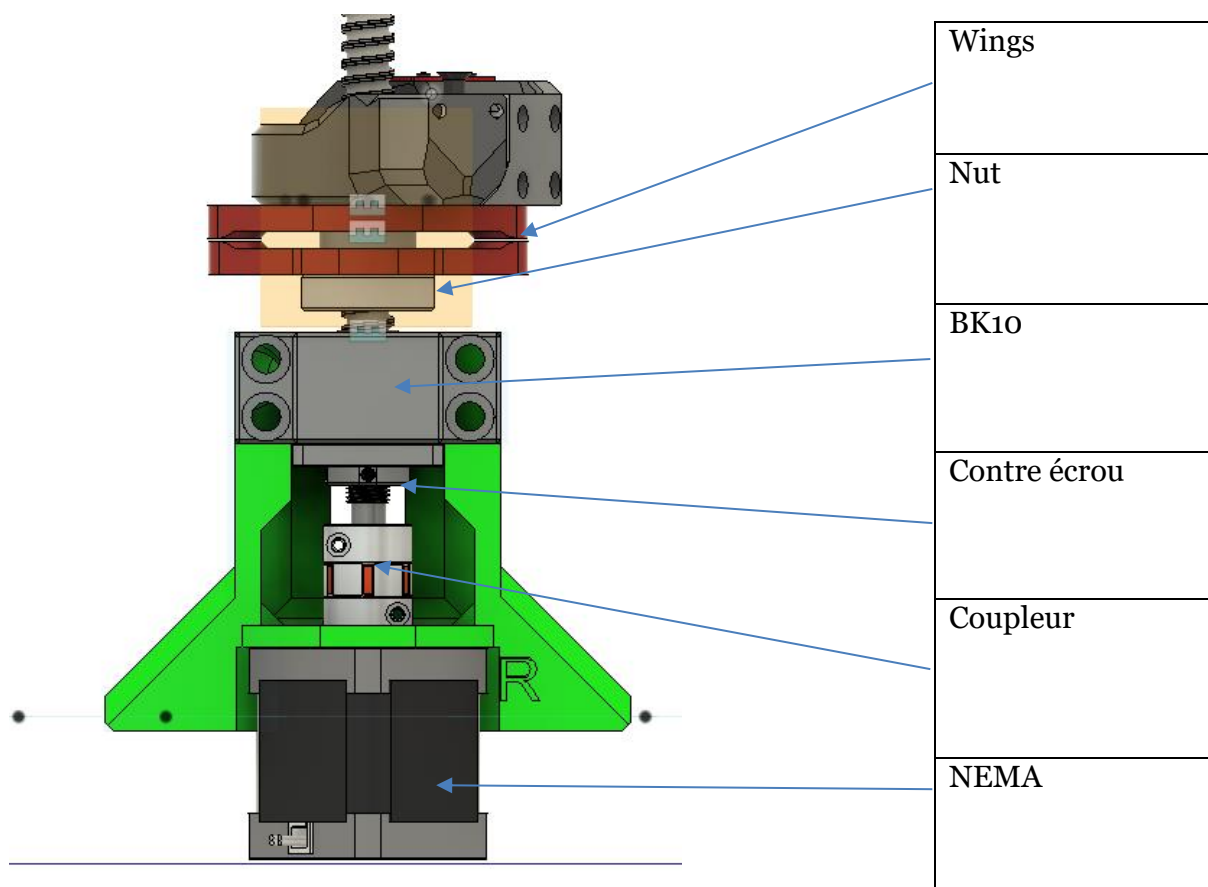
## 5-Installation des Axes Z

Remove the screws from the BK10s and insert BK10s on the lower machined section of the ball screw, slide the retaining nut, screw it but partially (leave 5-10mm). Pre-position loosened, the second part of the coupler by raising it as far as possible against the tightening lock nut. Insert the top of the screw into the ring of the top retainer (without bearing). Tilt the axle to place the BK10 on the insert platform of the lower support, by changing the angle everything should fit in without problems. Secure the BK10 with the m5 nuts without tightening them

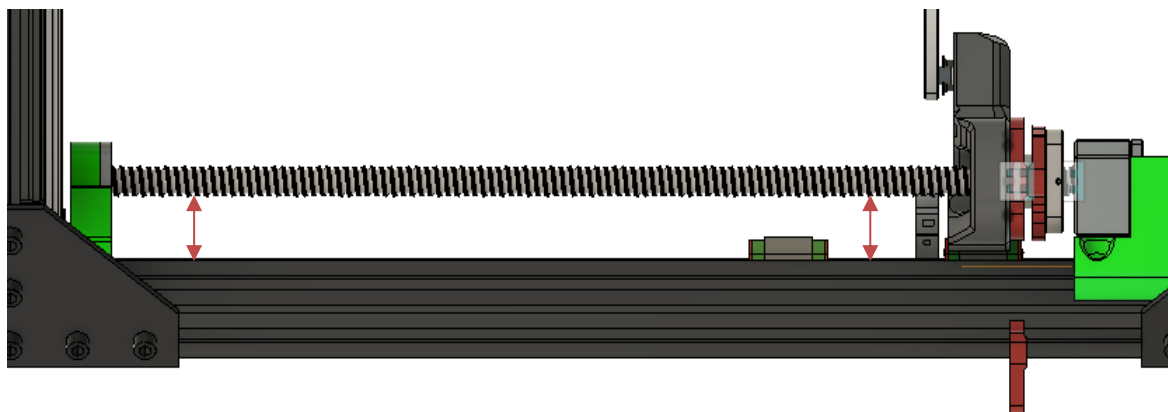


# Manual Z-precision Kit

## BRS-Engineering



Repeat on each axis



**IMPORTANT Control the alignment of NEMA/BK10/SFU/retainer.**

If no mounting errors were made on the structure of the Vcore, or on the printing of the parts, or on the insertion of the m5 inserts, the alignment should be correct. Partially insert the 608zz bearings to finish the check. You can play the bearing to make it happen. Once it matches, remove the 3 sets and tighten the NEMA retainer. It may take time and a lot of rework. **TAKE THE TIME ON THIS STEP**

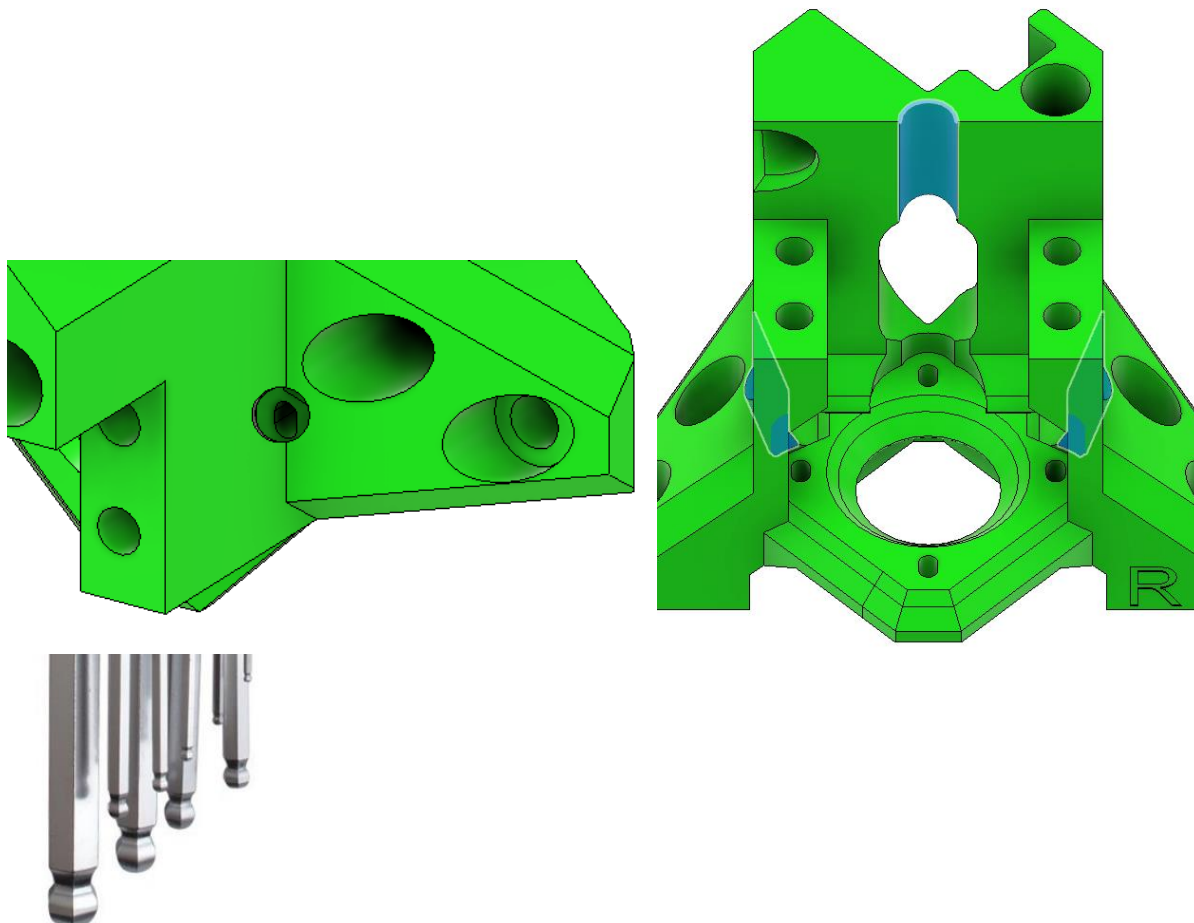




## Manual Z-precision Kit

### BRS-Engineering

\* Since the last revision 1.6, support pieces (slight differences) of the lateral oblique openings help the tightening of the Nemas; use a round end allen wrench removing the 3 set in no longer needed.



Reinsert the 3 sets (before 1.6).

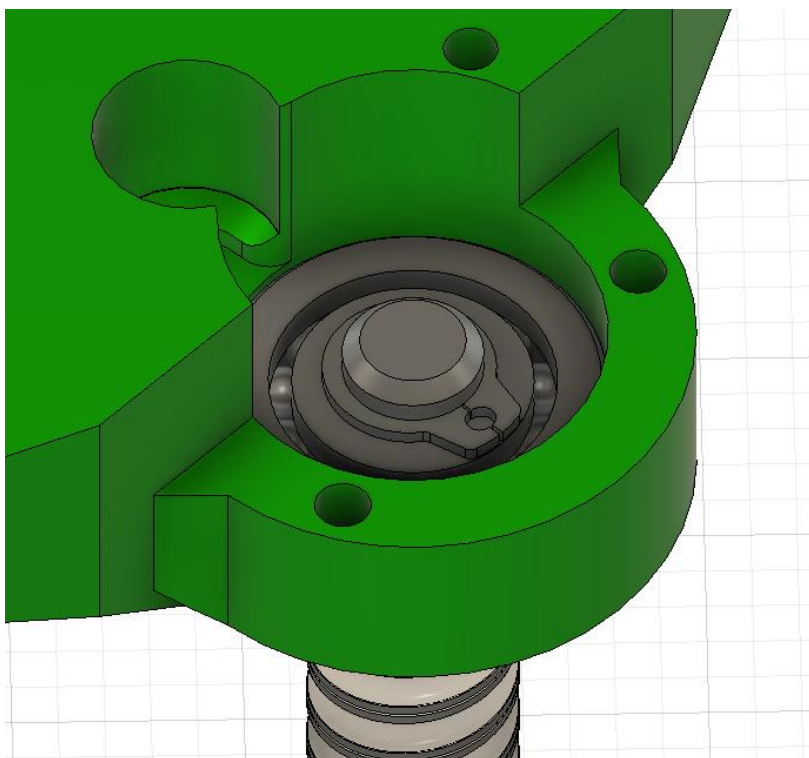
Insert the 3 608ZZ bearings, use a sleeve to force the retraction into the printed part. The fit is very tight, you will have to force its insertion, this is normal, be careful not to damage the shielding of the bearing. Apply the circlip using specific pliers. If it does not fit, the assembly is prone to be faulty, the circlip is not mandatory but is recommended

A gap is possible between the BK10 and the motor mount, a margin is made for adjustment, so this is normal



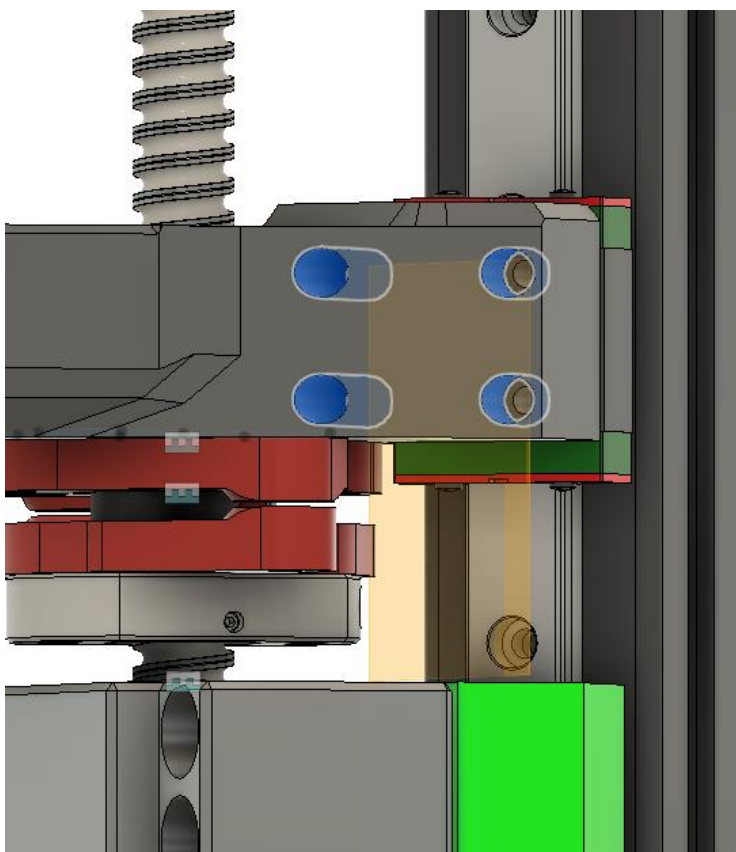
# Manual Z-precision Kit

## BRS-Engineering



Tighten the 4 screws of each BK10, the couplers, the supports.

Screw the arms to the carriages of the 3 linear rails.





## Manual Z-precision Kit

### BRS-Engineering

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).

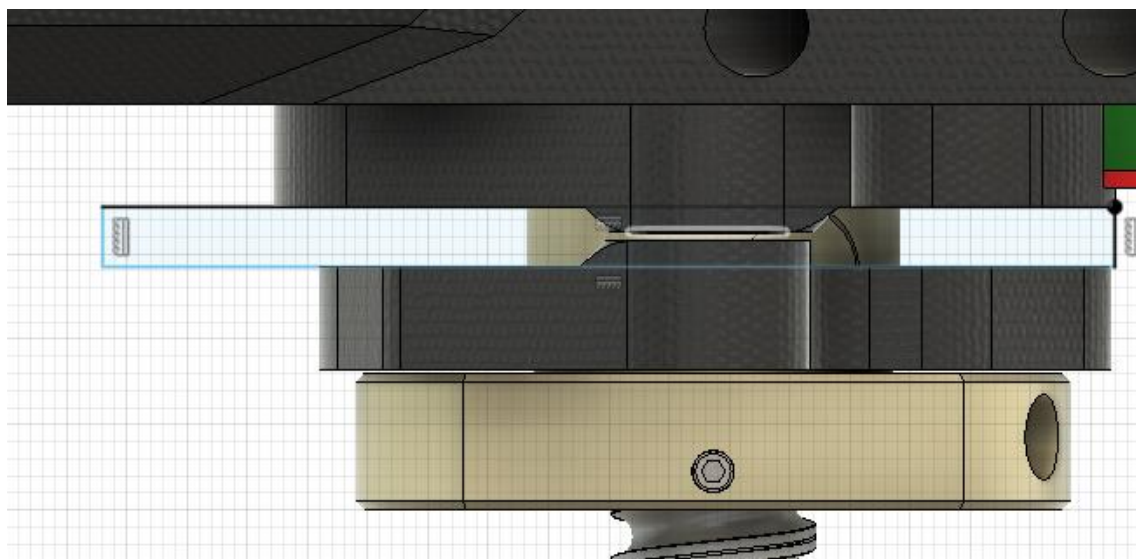
*-Clean the ball screws with a clean cloth and lubricate them with a HIWIN GSO4 type grease or any other lithium based grease compatible with bearings*

**CAUTION, grease loaded with particles such as Graphite, ..., are to be avoided, do not use WD40 (except cleaning), dry PTFE lubricants are also to be avoided**

*-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.

Check the parallelism of the decoupling wings, the 3 balls must be at the interface of the 6 magnets. A lack of parallelism will over time deform the parts by stress and compromise the functions.



The decoupling wings are capable of handling up to 2.4mm circular deflection. This is more than enough for C7 grades. If the ball screw or its nut touches the wing, then either the Grade is not C7 or the screw is defective or incorrectly fitted

Double check the screws tightness.

For the rear screw, fix the rear retainer, it will be necessary to remove the right angle support, the printed part will take care of the replacement. Be careful to remove this angle only with the electronic back plate already in place to block his alignment

4 M6x20 screws with m6 hammer nuts are required, 3 m3x10 countersunk screws and reciprocal m3 hammer nuts on the upper part

Slide them in using a magnetic allen key.



## Manual Z-precision Kit

### BRS-Engineering

Control and / or adjust the depth of the Y endstop so that the distance between the back of the EVA does not collide with the rear bar and the top of the binding. As is the print volume with an EVA Mono 5015 is 410x410x364

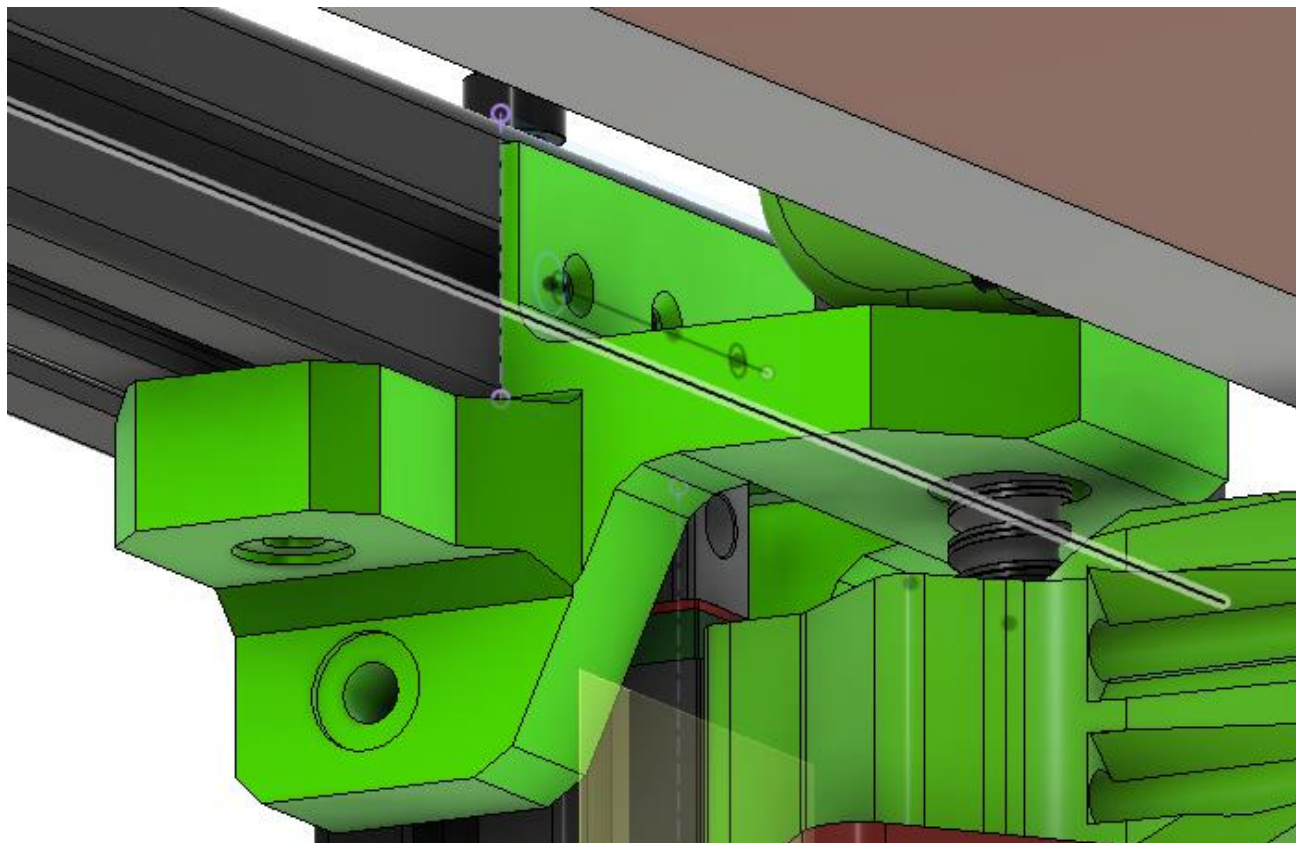
*For the dual 5015 count 410x385x364 \**

*For Mod 7530 count 410x375 \**

*\*(active)*

*ATTENTION: These figures relate to my mounting on a 400mm ^ 3*

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: 364 (+ - 5mm) (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.



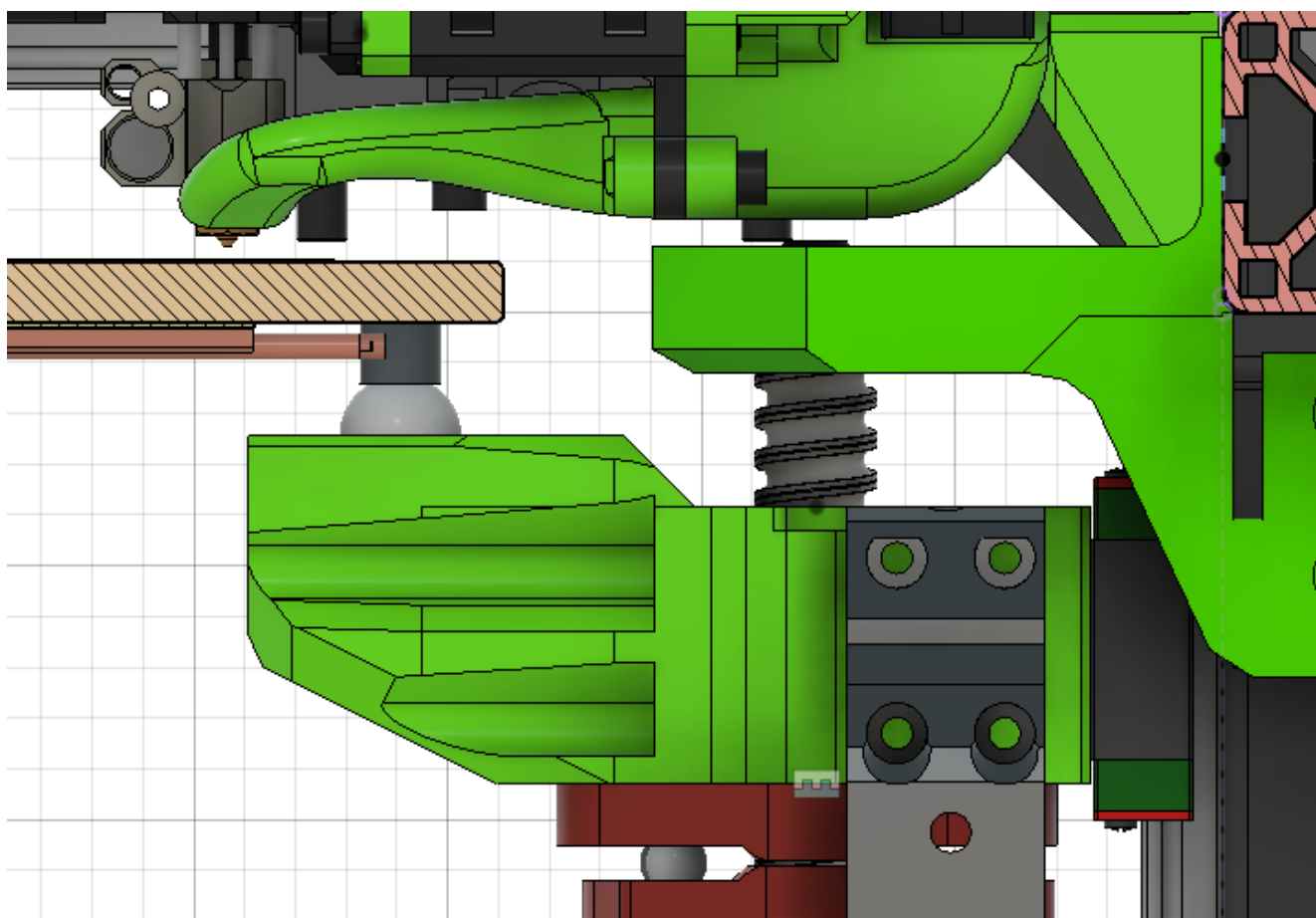
Install the 3 screws by hand to bring the bed to the level of the nozzle to check the margins. A safety distance is provided for the Tilt adjust and for a margin of error.



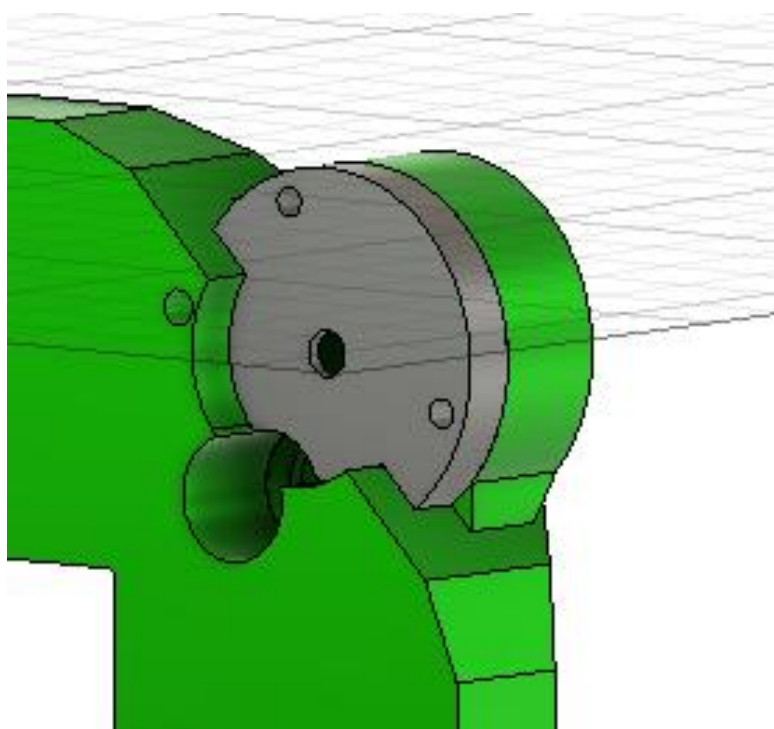


## Manual Z-precision Kit

### BRS-Engineering



You can fix the bearing protectors on top of the retainers (except rear) and screw them with 2x m2x8mm





# Manual Z-precision Kit

## BRS-Engineering

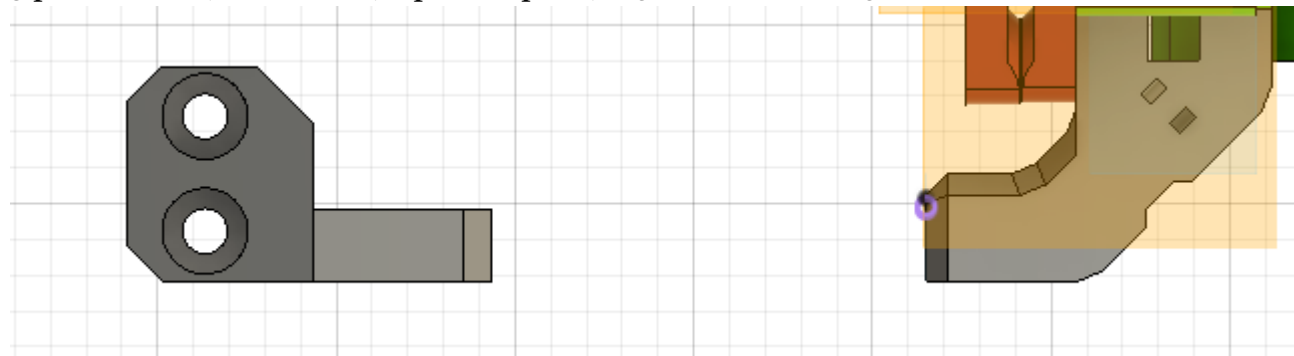
### 6-Final checks :

- 1- Check the tightening of all screws, nema etc
- 2- Check the alignments, in particular the RAIL / VIS duo
- 3- Hard point checks
- 4- Cleanliness / lubrication checks (Rails + BS): Use a Hiwin GSo4 lithium type grease or qualitative equivalent.
- 5- Check the motor wiring, order on the steppers !!!! If not done; system breakage possible
- 6- Check the motor functions in Klipper with "STEPPER\_BUZZ STEPPER = stepper\_z"
- 7- Z-probe control, Z position max control <- + 364mm !!! if not possible
- 8- Checking the Endstops (possible breakdowns), left and right motor wiring
- 9- Double check everything before switching on!

### 7-Options :

- 1- Bed drag chain :

3 parts needed, 1020 chain, 2 printed parts, M5x12 and Tnut m5



### 8-Disclaimer :

The system is designed to operate on a correctly assembled Vcore 3 (verification in progress for adaptation to Vcore Pro). Even a slight mounting error can make it impossible to upgrade.

If the parts to be printed are made by the customer, check the dimensions after the print, they need to be respected : a bad dimension will block (+ -0.25mm) the assembly.

The machine will lose between 29 and 45mm of Z travel (depending on the screws used on the BK10s, the precision of the parts and the assembly) (32mm on the prototype), the same value for the 300, 400, 500.

The kit is installed in the simplest way without destructive modifications of the machine, except axis of the NEMA to shorten the old system can be reinstalled



## Manual Z-precision Kit

### BRS-Engineering

This kit is an optional upgrade, intended for an informed public and with advanced experience, its assembly and / or its function and / or its quality of execution are the responsibility of the customer and are not guaranteed in public view. of parameters by BRS-E. BRS-Engineering accepts no responsibility in the event of bad sourcing (bad quality and / or bad dimensions sfu), bad assembly by the customer, or bad assembly of the base Vcore.

The kit has proven its POC and POW in quality controls at BRS-E as well as at a test customer, As is, the design works with expected expectations

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

### 10-License :



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**11-End**

If you are satisfied with the design and function of this upgrade, and if you are going for the dematerialized solution without going through my printing services, consider a small symbolic donation on my website to allow me to continue the R&D, which is particularly time-consuming.  
(425h for this upgrade)



*Scannez. Payez. C'est réglé.*

Thanks to you and your support

## 12-Stuff

I wish to thanks Pierre DEVOS, Friend and Admin of the unofficial Ratrig FR group, which help me to test and validate this upgrade

A special thanks to MirageC, who lead the Amazing HEVORT project system, for his amazing skills in particular to the wings system who inspire me a lot.

Thanks to my girlfriend, who supports me even with the enormous among of time dedicated to the project and the printing service 😊