

## List of the parts:

### Motors:

Nema 8 (8HS13-0604S) 33mm, stepperonline, 4mm shaft, x1 unit	(16.00)
Nema 11 (11HS12-0674S) 31mm, stepperonline, 5mm shaft, x2 units	(22.22)
Nema 17 (17HS19-0854S) 48mm, stepperonline, 5mm shaft, x1 unit	(9.48)
Nema 23 (23HS30-2804S1) 76mm, stepperonline, 6mm shaft, x2 units	(40.30)

### Belts:

A 6R51M087060, 87 teeth GT2 2mm, 6mm wide timing belt, sdp-si, x2 units	(10.26)
A 6R51M139060, 139 teeth GT2 2mm, 6mm wide timing belt, sdp-si, x1 units	(5.55)
A 6R53M128090, 128 teeth GT2 3mm, 9mm wide timing belt, sdp-si, x1 units	(10.06)
A 6R53M152090, 152 teeth GT2 3mm, 9mm wide timing belt, sdp-si, x1 units	(10.67)

### Pulleys:

GT2 Pulley (20 Tooth), GT2 2mm, 20 teeth, 5mm bore, e3d-online, x3 units	(13.41)
A 6A53M020DF0906, GT2 3mm, 20 teeth, 6mm bore, sdp-si, x2 units	(16.12)

### Bearings:

Ball Bearing, 21x15x4mm, hobbyking, x3 units	(7.21)
Ball Bearing, 16x8x5mm, amazon, x3 units	(5.00)
Ball Bearing, 8x3x3mm, BR030803, hobbyking, x4 units	(6.64)
Q6000 ZZ, 26x10x8mm, hpceurope, x2 units	(6.62)
Q625 ZZ, 16x5x5mm, hpceurope, x4 units	(13.00)
Q6001 ZZ, 28x12x8mm, hpceurope, x2 units	(6.62)
TB51102, 28x16x28x15x9mm, hpceurope, x2 units	(5.00)

### Carbon fibre parts:

Cut from carbon fibre sheet (3mm and 4mm) (could be printed from high stiffness plastic)	
Axis3part1 (3mm thickness), famoushobby, x2 units	(23.04)
Axis2part1 (4mm thickness), famoushobby, x2 units	(33.24)
Axis1part2 (4mm thickness), famoushobby, x2 units	(53.52)

### Screws and nuts:

M2x8mm + M2 nut, x1 set	
M2x6mm, x4 units	
M3x25mm + M3 nut, x1 set	
M2.5x8mm + M2.5 washer, x8 sets	
M2x12mm + M2 nut, x3 sets	
M2x10mm + M2 nut, x1 set	
M3x12mm + M3 washer + M3 nut, x12 sets	
M3x30mm + M3 washer + M3 nut, x2 sets	
M3x20mm + M3 washer + M3 nut, x2 sets	
M3 washer, x10 units	
M3x25mm + M3 washer, x4 sets	
M3x20mm + M3 washer + M3 nut, x4 sets	
M3x10mm + M3 washer + M3 nut, x1 set	
M3x30mm + M3 washer + M3 nut, x4 sets	
M4x12mm + M4 washer + M4 nut, x8 sets	
M5 washer, x10 units	
M5x50mm + M5 washer + M5 nut, x8 sets	
M5x50mm + M5 washer + M5 nut, x4 sets	
M5x35mm + M5 washer + M5 nut, x4 sets	
M3x12mm + M3 washer + M3 nut, x2 sets	
M5x40mm + M5 washer + M5 nut, x1 set	
M3x16mm + M3 washer + M3 nut, x2 sets	
M5x50mm + M5 washer + M5 nut, x4 sets	
M5x10mm + M5 washer, x12 sets	
M5x20mm + M5 washer, x2 sets	
M5 threaded standoff, OD: 8mm, length: 20mm, x7 units	

**Other parts:**

Magnets 6mm diameter and 2mm height, local hardware store, x2 units  
DP2.0-6/B, dowel pin 2x6, hpceurope, x4 units

Tube: 8mm OD, 6mm ID, 70mm length, swagelok

Tube: 10mm OD, 8mm ID, 115mm length, swagelok

Tube: 12mm OD, 10mm ID, 106mm length, swagelok

Silicon insulated high quality wires

Rubber feet with the M3 screws + M3 washer + M3 nut, x4 sets

**What would you need as a tools:**

3D printer

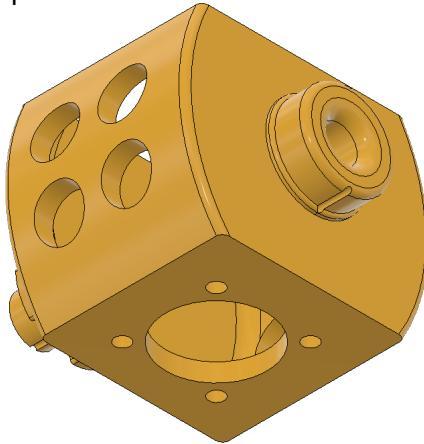
Screwdrivers

## How to assemble:

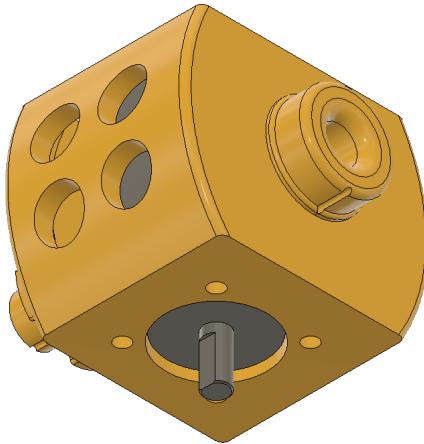
For detailed tutorial check out videos on <http://www.youtube.com/c/Skyentific> .

### Axis 6:

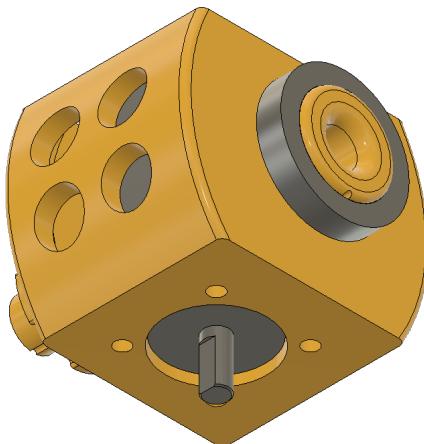
*axis6motorHolder* is 3D printed:



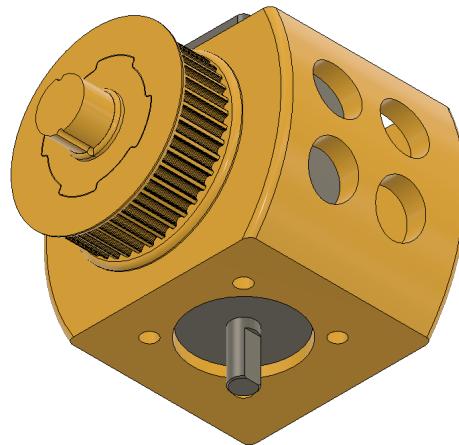
Motor for the axis 6 (Nema 8) is fixed with the four M2x6mm screws:



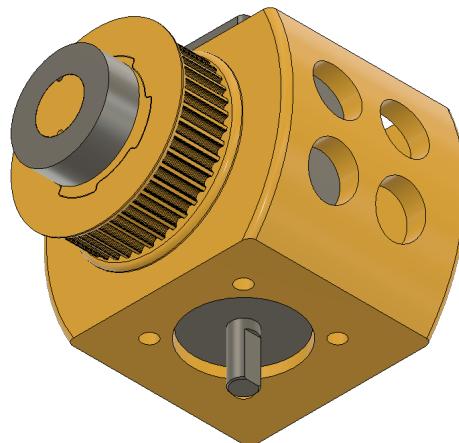
Ball bearing (21x15x4mm) is installed on one side:



On other side the 3D printed *Pulley42* is installed (may be glued):



Ball bearing (16x8x5mm) is installed on the same side:



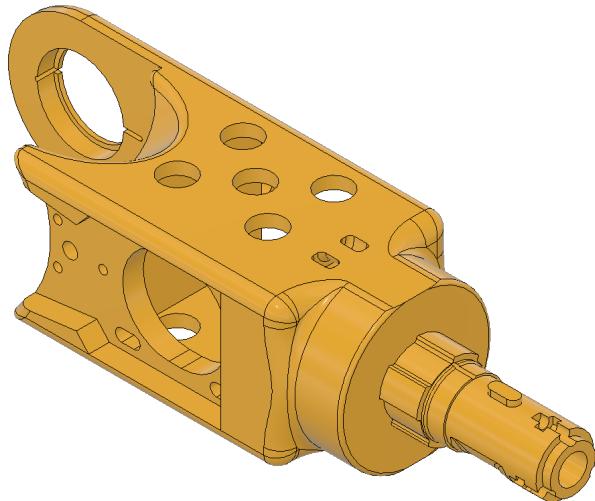
The 3D printed part (*Axis6*) is installed on the shaft of the motor, the part is fixed with M2x8mm screw and M2 nut:



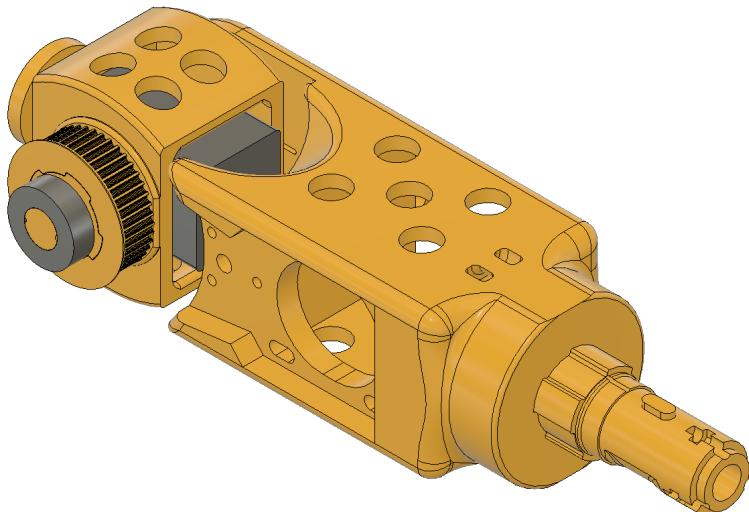
Two small magnets could be glued in the two holes of the *Axis6*.

**Axis 5:**

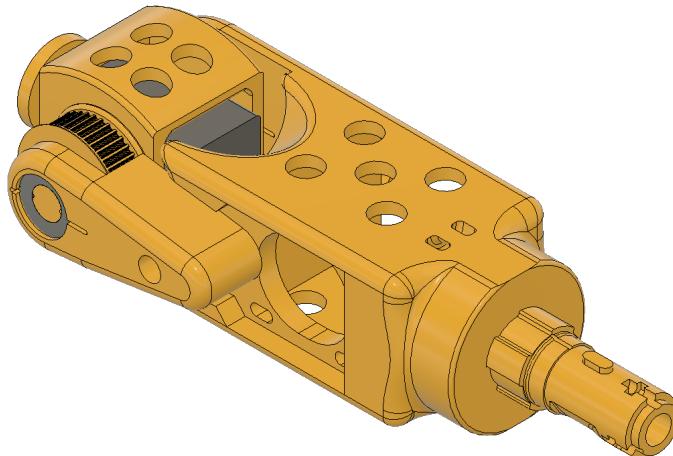
Axis5 is 3D printed:



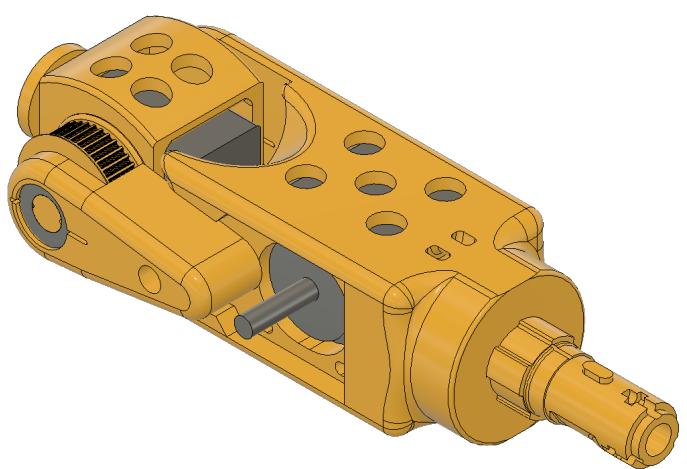
The Axis 6 assembly is installed on the Axis5 part:



Axis5Bracket is fixed with three dowel pins and M3x25mm screw and M3 nut:

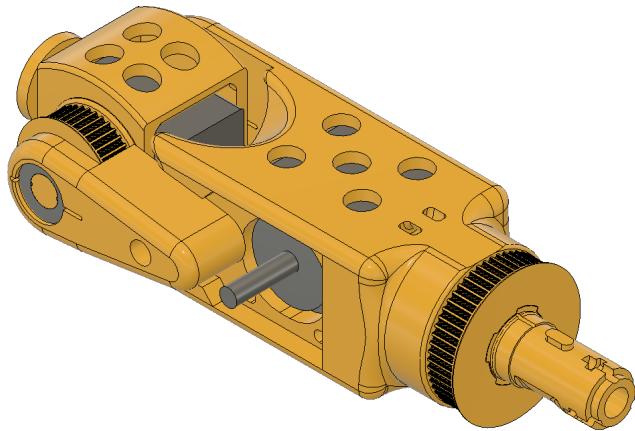


Nema 11 motor with the GT2 20 teeth pulley and the GT2 87 teeth belt is fixed with four M2.5x8mm screws and M2.5 washers:

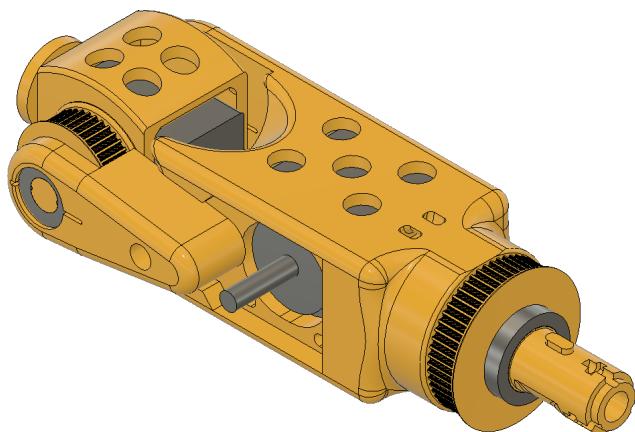


**Axis 4:**

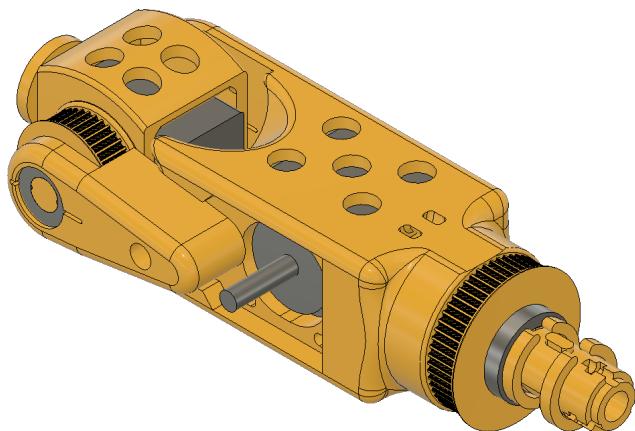
Pulley56 is installed (may be glued):



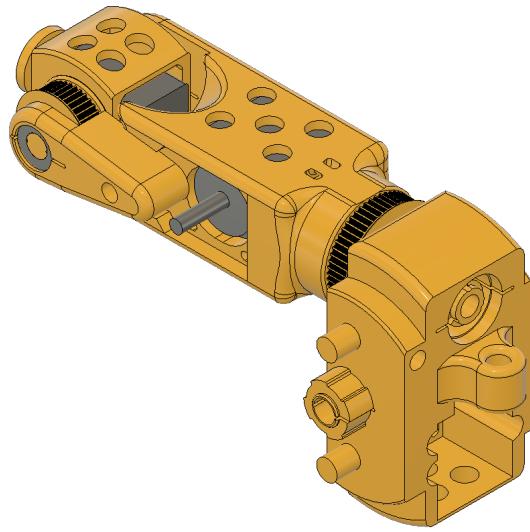
Ball bearing (21x15x4mm) is installed:



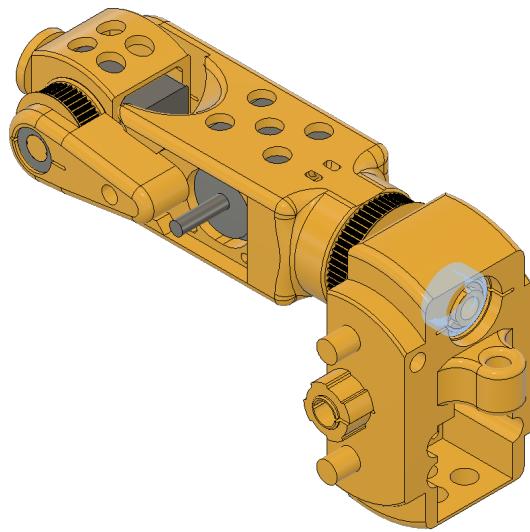
*Axis4limit* is installed after the bearing:



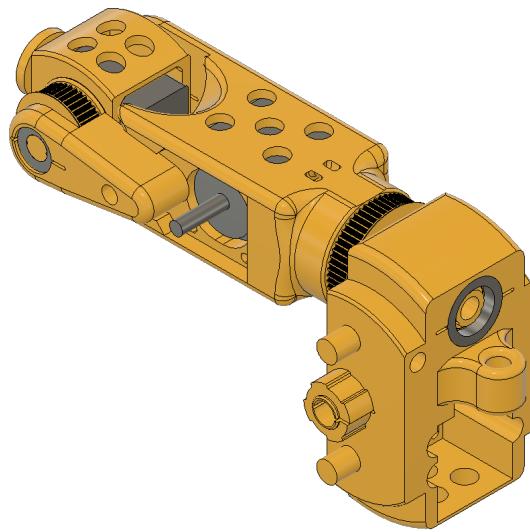
Axis4 is installed:



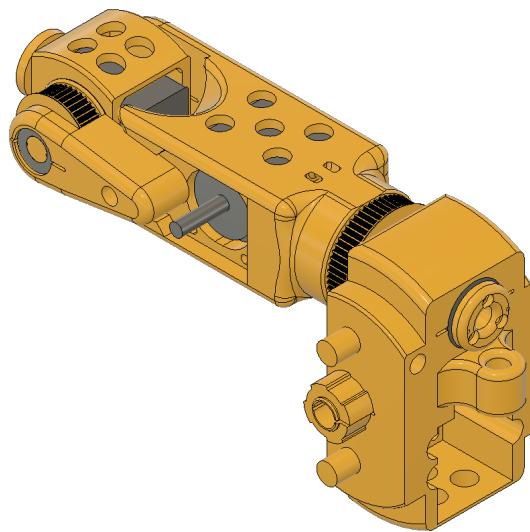
*Axis5screwHolder* is installed with three M2 nuts:



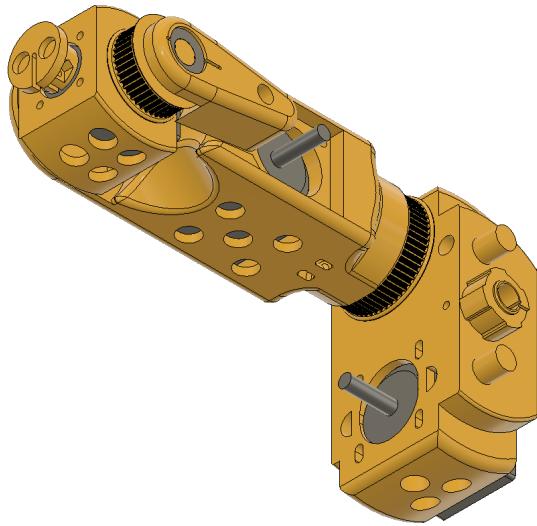
Ball bearing (21x15x4mm) is installed:



*Axis5plug* is fixed with three M2x12mm screws:

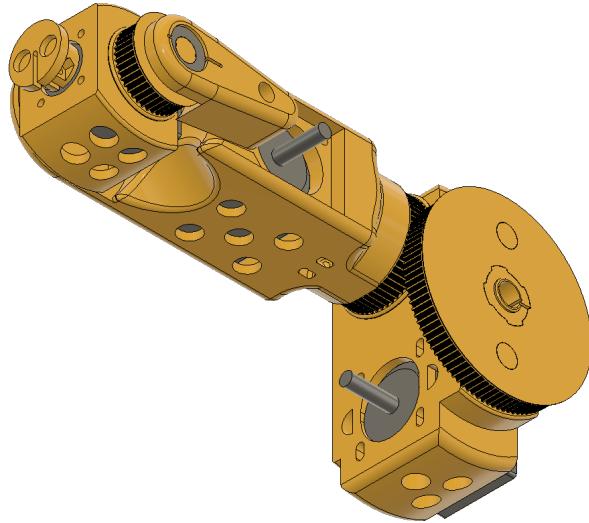


The Nema 11 motor with the GT2 20 teeth pulley and the GT2 87 teeth belt is fixed with four M2.5x8mm screws and M2.5 washers:



**Axis 3:**

Pulley100 is installed (may be glued):

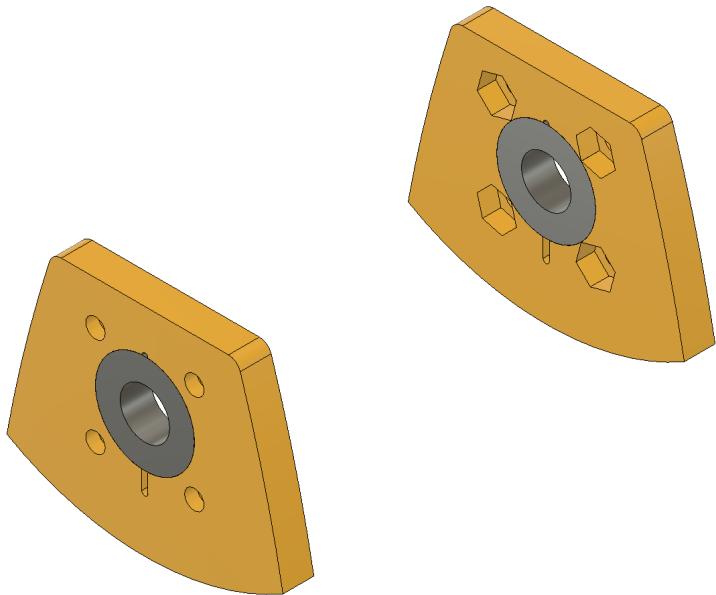


The tube with OD of 8mm should be installed and fixed with the screw (M2x10mm and M2 nut). See the video on <http://www.youtube.com/c/Skyentific>.

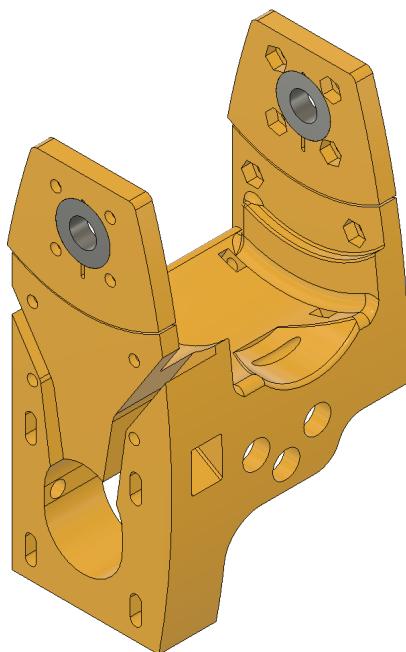
Two ball bearings (16x8x5mm) are installed on each side of the axis (axis itself is not shown):



Two 3D printed *Axis3bearingHolder* with eight M3 nuts installed on the both bearings:

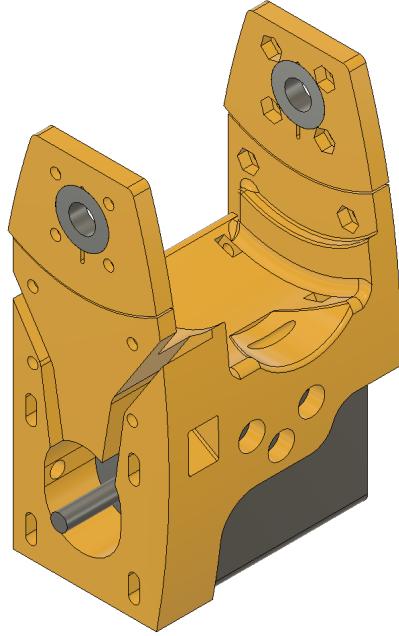


3D printed *Axis3part2* with eight M3 nuts installed is used:

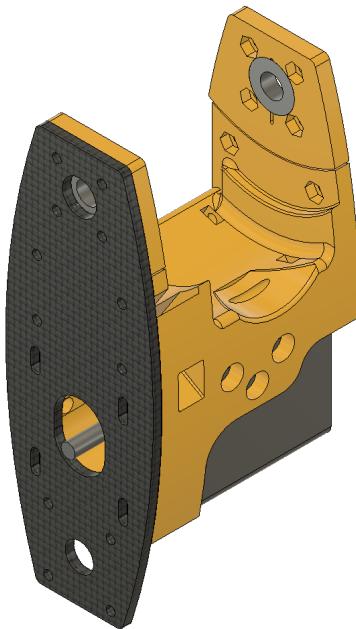


Four ball bearings (8x3x3mm) with M3 washers is installed to guide the belt.  
See the video on <http://www.youtube.com/c/Skyentific> .

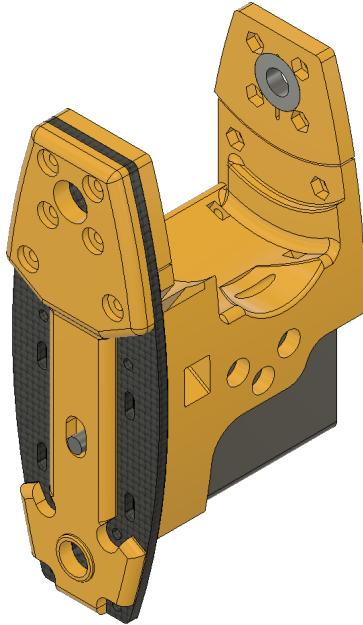
The Nema 17 motor with the GT2 20 teeth pulley and the GT2 139 teeth belt is installed:



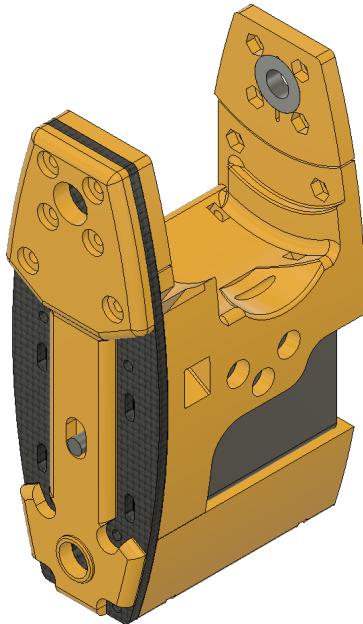
Axis3part1 is cut from carbon fibre, but if this is not possible it could be printed from high stiffness plastic. Axis3part1 is installed and fixed with two M3x30mm screws and M3 washers, and also fixed with four M3x25mm screws and M3 washers:



Axis3cover1 is fixed with six M3x12mm screws and M3 washers:



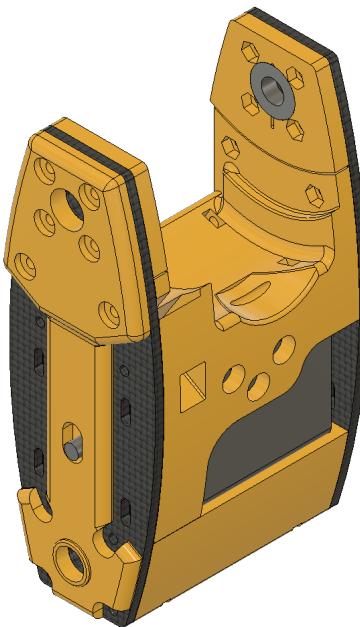
Axis3part3 with installed eight M3 nuts is fixed with four M3x20mm screws and M3 nuts:



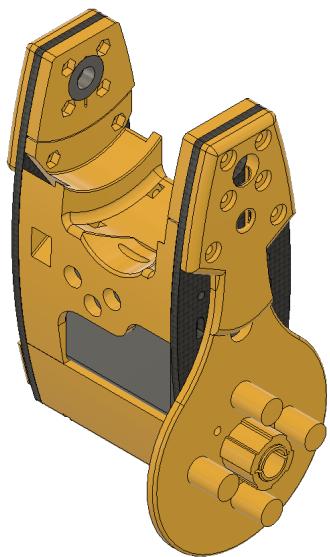
The tube with OD of 10mm should be installed and fixed with the screw (M3x10mm + M3 washer + M3 nut).

See the video on <http://www.youtube.com/c/Skyentific> .

The second Axis3part1 is installed and fixed with two M3x20mm screw and M3 washers:

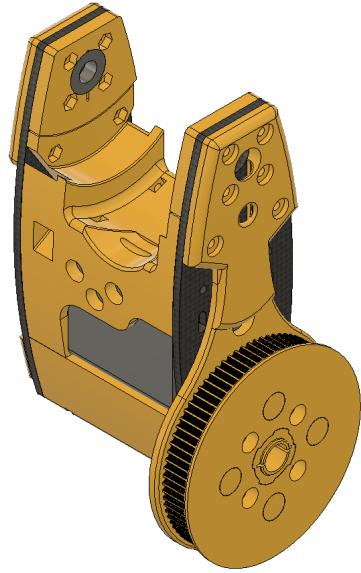


*Axis3cover2* is installed and fixed with six M3x12mm:

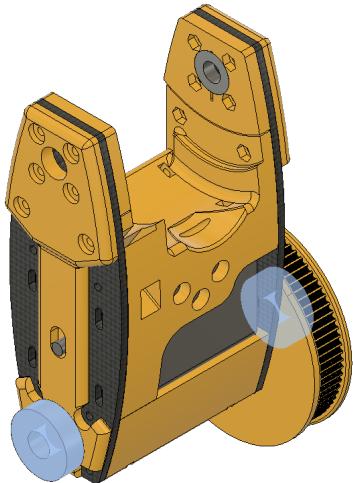


**Axis 2:**

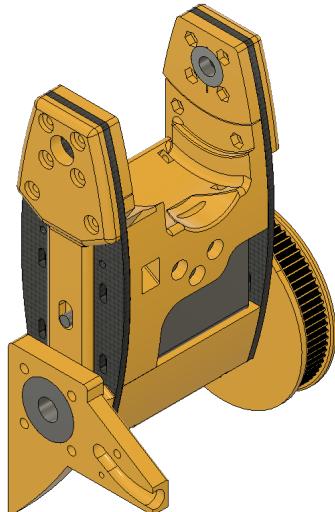
*Axis2Pulley* is installed (may be glued) and fixed with the four M3x30mm screws and M3 washers:



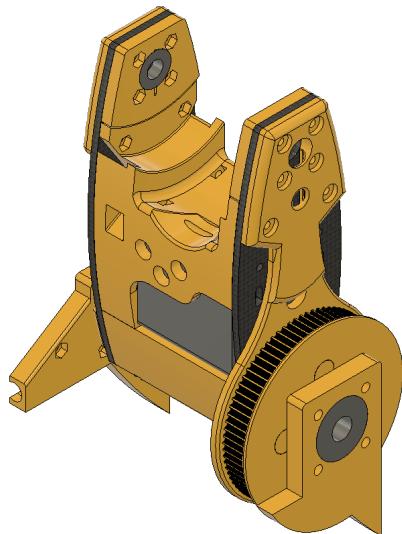
Two ball bearings (26x10x8mm) are installed on each side of the tube (the tube is not shown):



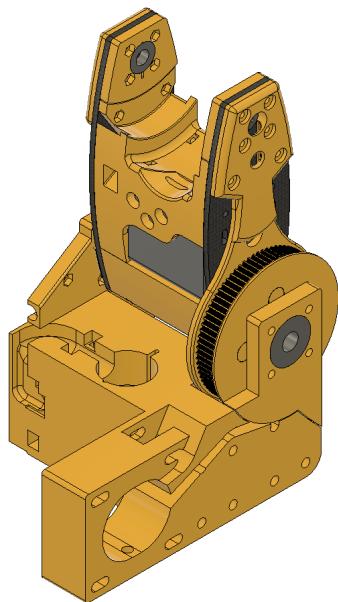
*Axis2bearingHolder* with installed four M4 nuts is fixed on one of the bearing:



*Axis2bearingHolder* (1) with installed four M4 nuts is fixed on another bearing:

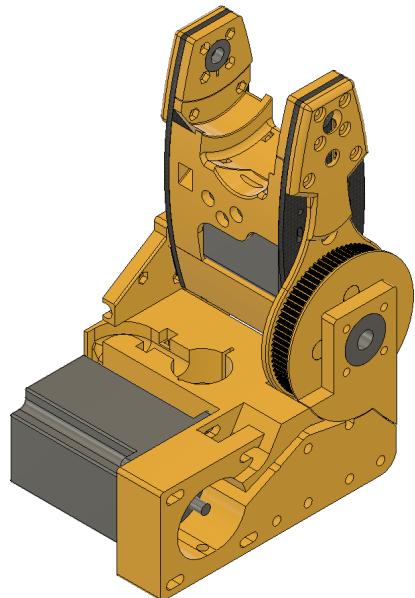


*Axis2part2* is installed:

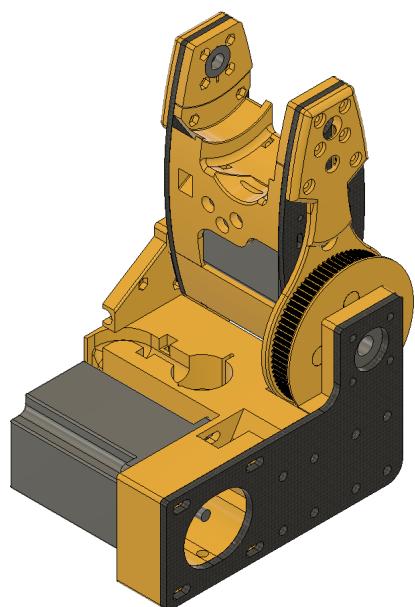


Four ball bearings (16x5x5mm) with M5 washers is installed to guide the belt.  
See the video on <http://www.youtube.com/c/Skyentific> .

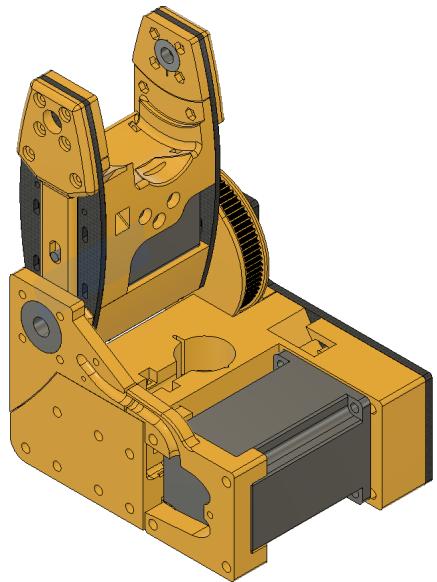
The Nema 23 motor with the GT2 3mm 20 teeth pulley and the GT2 3mm 128 teeth belt is installed:



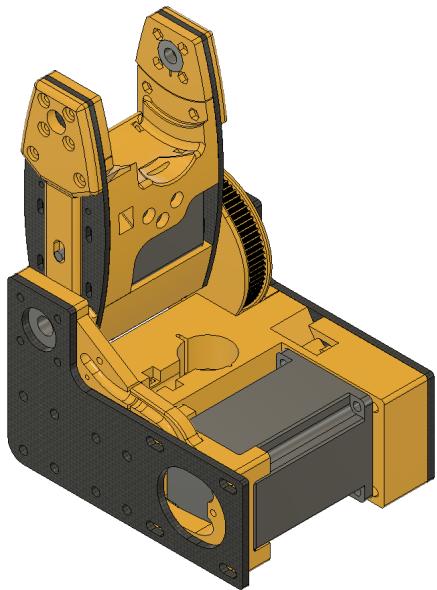
Axis2part1 is cut from carbon fibre, but if this is not possible it could be printed from high stiffness plastic. Axis2part1 is installed and fixed with four M4x12mm screws and M4 washers, and also fixed with eight M5x50mm screws, M5 washers and M5 nuts:



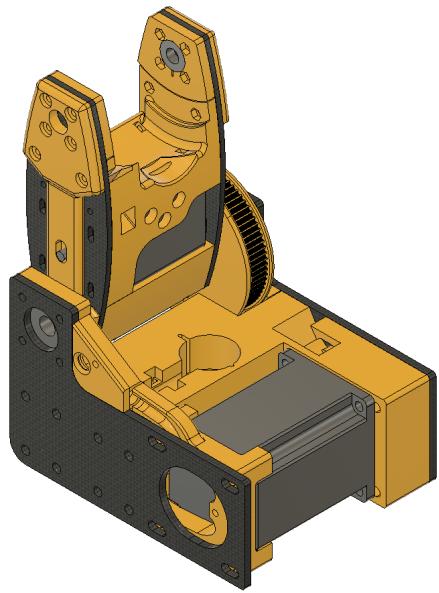
Axis2MotorOp is installed:



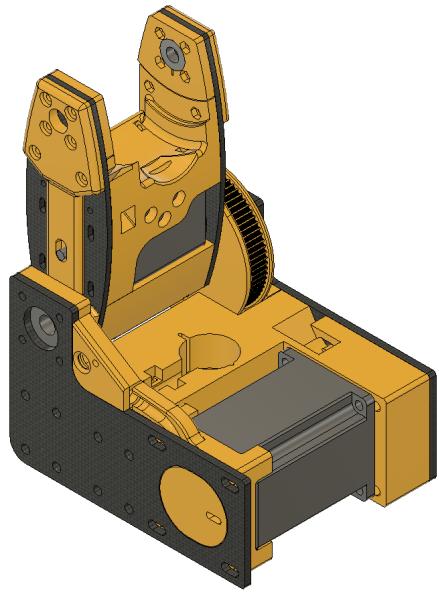
Axis2part1 is installed and fixed with four M4x12mm screws, M5 washers and M5 nuts, and with four M5x50mm screws, M5 washers and M5 nuts, and with four M5x35mm screws, M5 washers and M5 nuts:



Axis2bearingHC is fixed with a dowel pin and a M3x12mm screw, M3 washer and M3 nut:

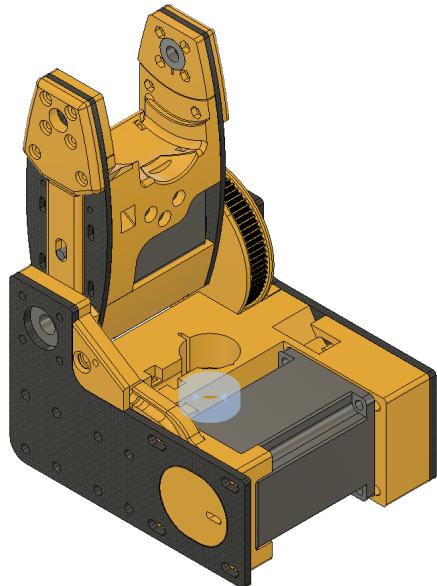


Axis2MotorOpC is fixed with a M3x12mm screw, M3 washer and M3 nut:

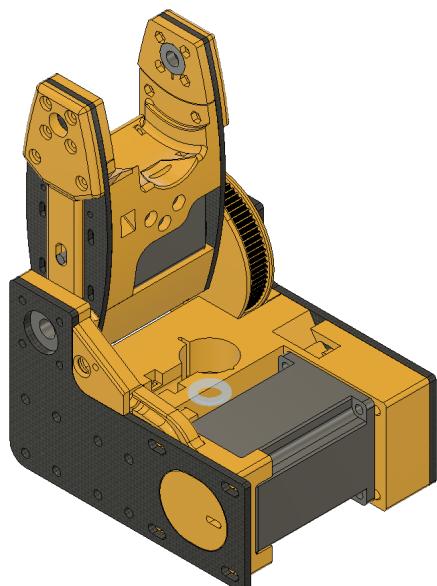


**Axis 1:**

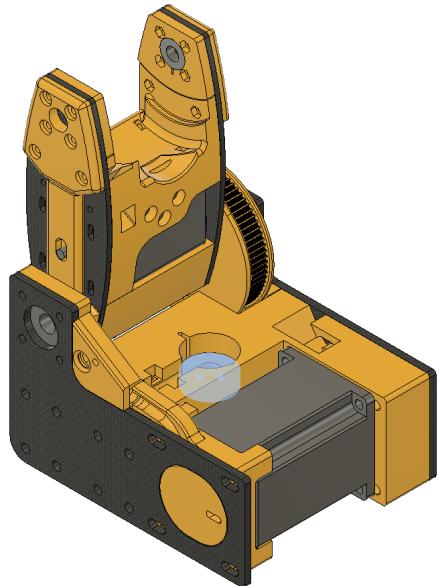
The trust bearing (28x16x28x15x9mm) is installed:



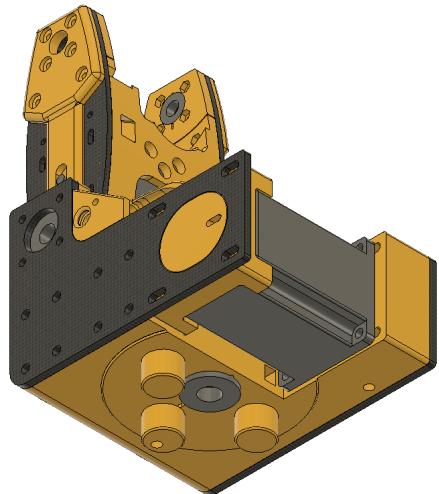
3D printed *Axis2washer* is installed on top of this bearing:



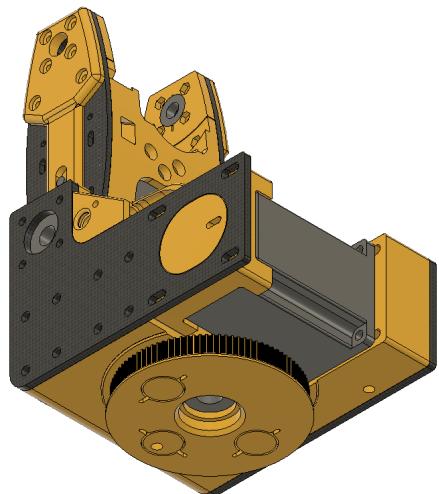
The ball bearing (28x12x8mm) is installed on top of the washer with the tube (OD 12mm):



Another ball bearing (28x12x8mm) is installed from the bottom:

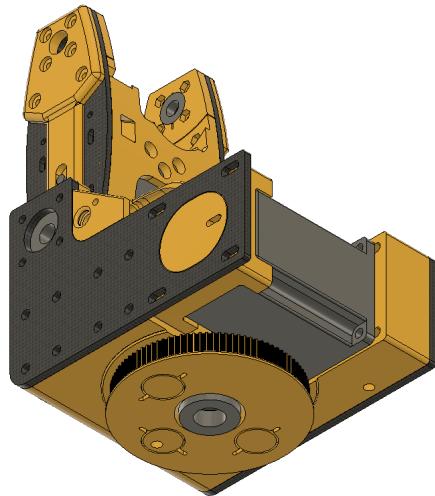


Axis1Pulley is installed (may be glued):

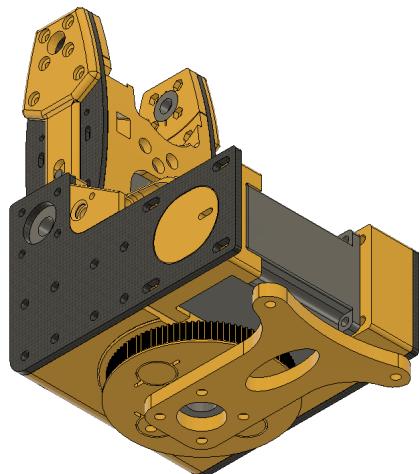


A limiting M5x40mm screw with M5 washer and M5 nut should be installed.

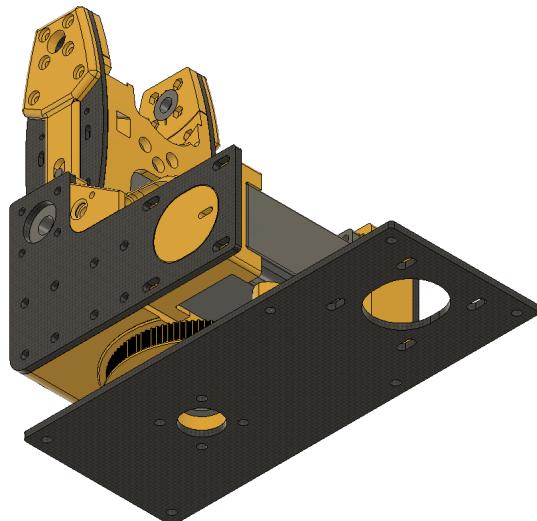
Another thrust bearing (28x16x28x15x9mm) is installed on the pulley:



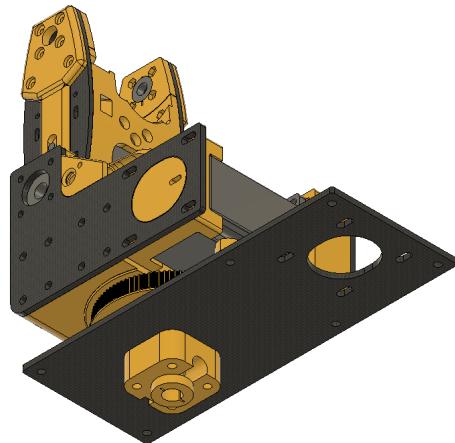
*Axis1washer* with installed four M5 nut goes under the pulley:



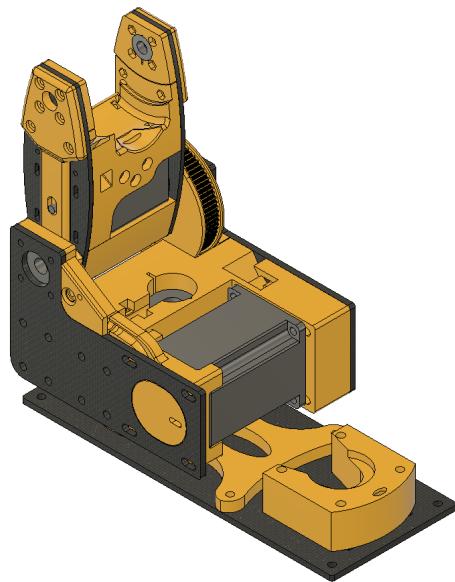
*Axis1part2* is cut from carbon fibre, but if this is not possible it could be printed from high stiffness plastic. *Axis1part2* goes under the *Axis1washer*.



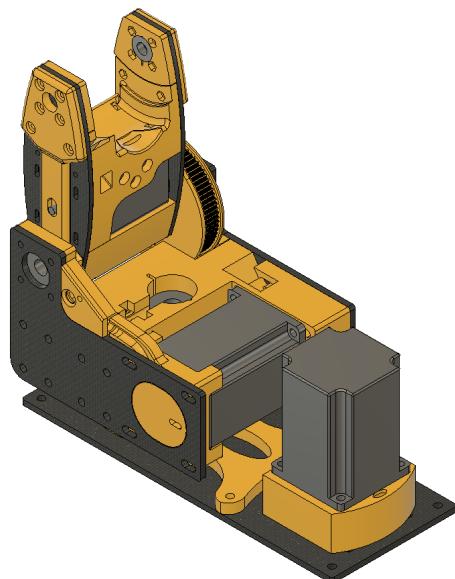
*Axis1Holder* is installed on the tube and fixed with two M3x16mm screw, M3 washer and M3 nut:



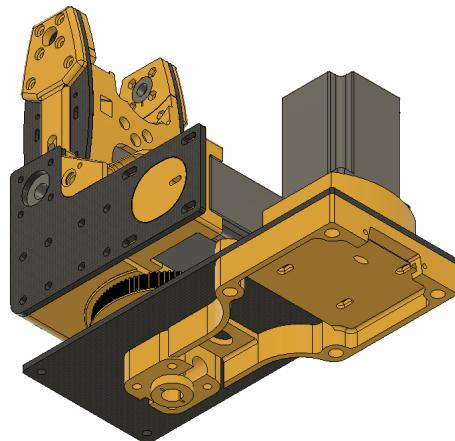
*Axis1MotorHolder* goes on top of the *Axis1part2*:



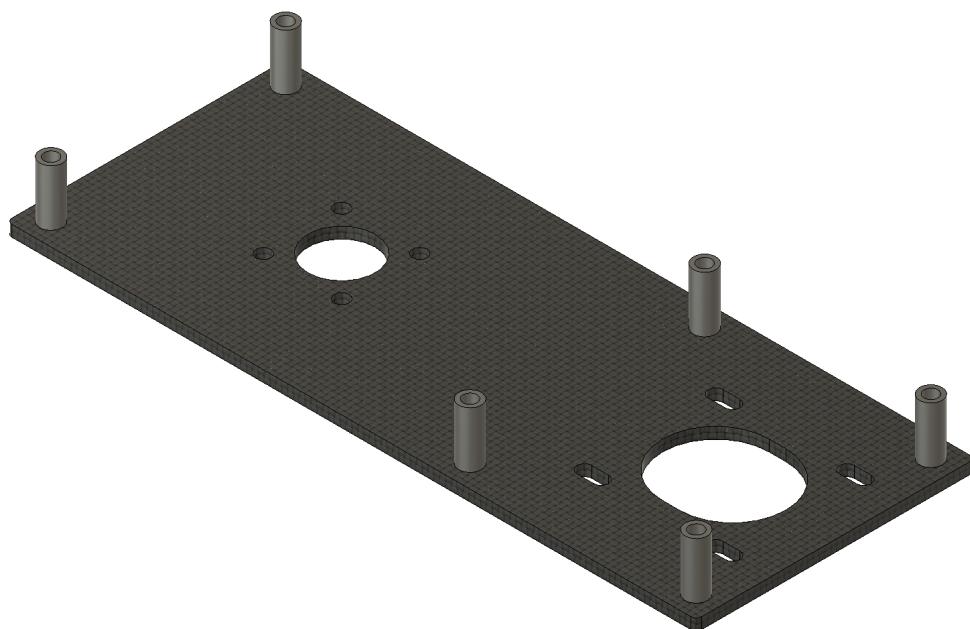
The Nema 23 motor with the GT2 3mm 20 teeth pulley and the GT2 3mm 152 teeth belt goes on top of the *Axis1MotorHolder* (fixed with M5x50mm + M5 washer + M5 nut):



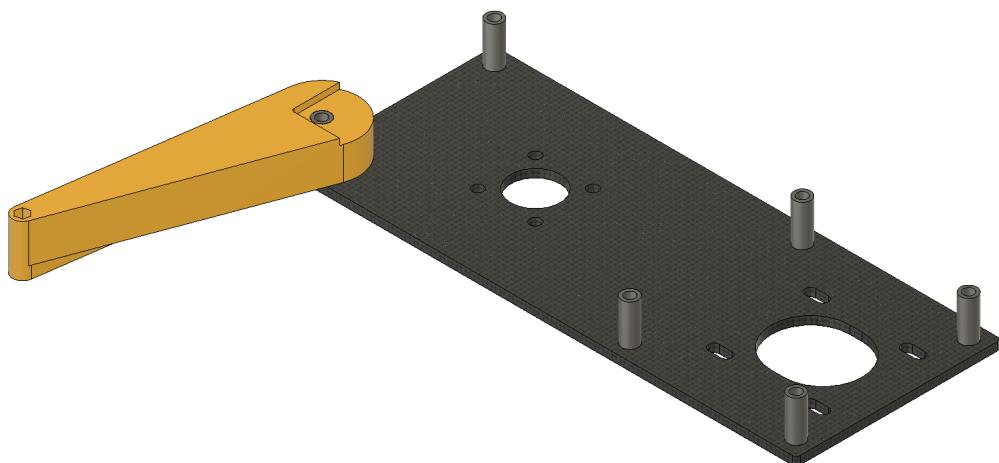
*Axis1MotorHolderOp* goes on the other side of the *Axis1part2*:



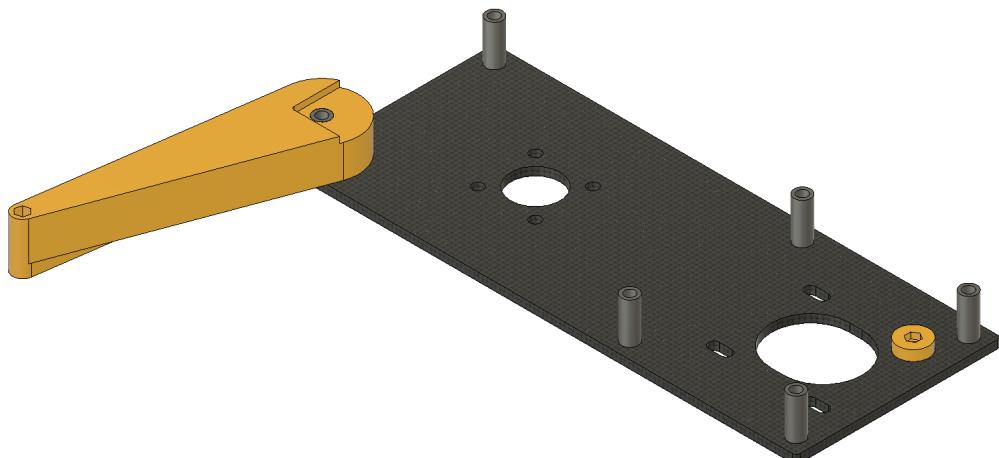
Seven M5 standoffs are fixed to the second *Axis1part2* with seven M5x10mm screws and M5 washers:



The *LegLeft* is installed with the mirrored one:



Two *FootHolder* are installed:



With the five M5x10mm screws and M5 washers, and with two M5x20mm screws and M5 washers this part is fixed to previous Axis1part2.

**What to improve:**

1. ???
2. ???