

LOWSPEC

Assembly instructions

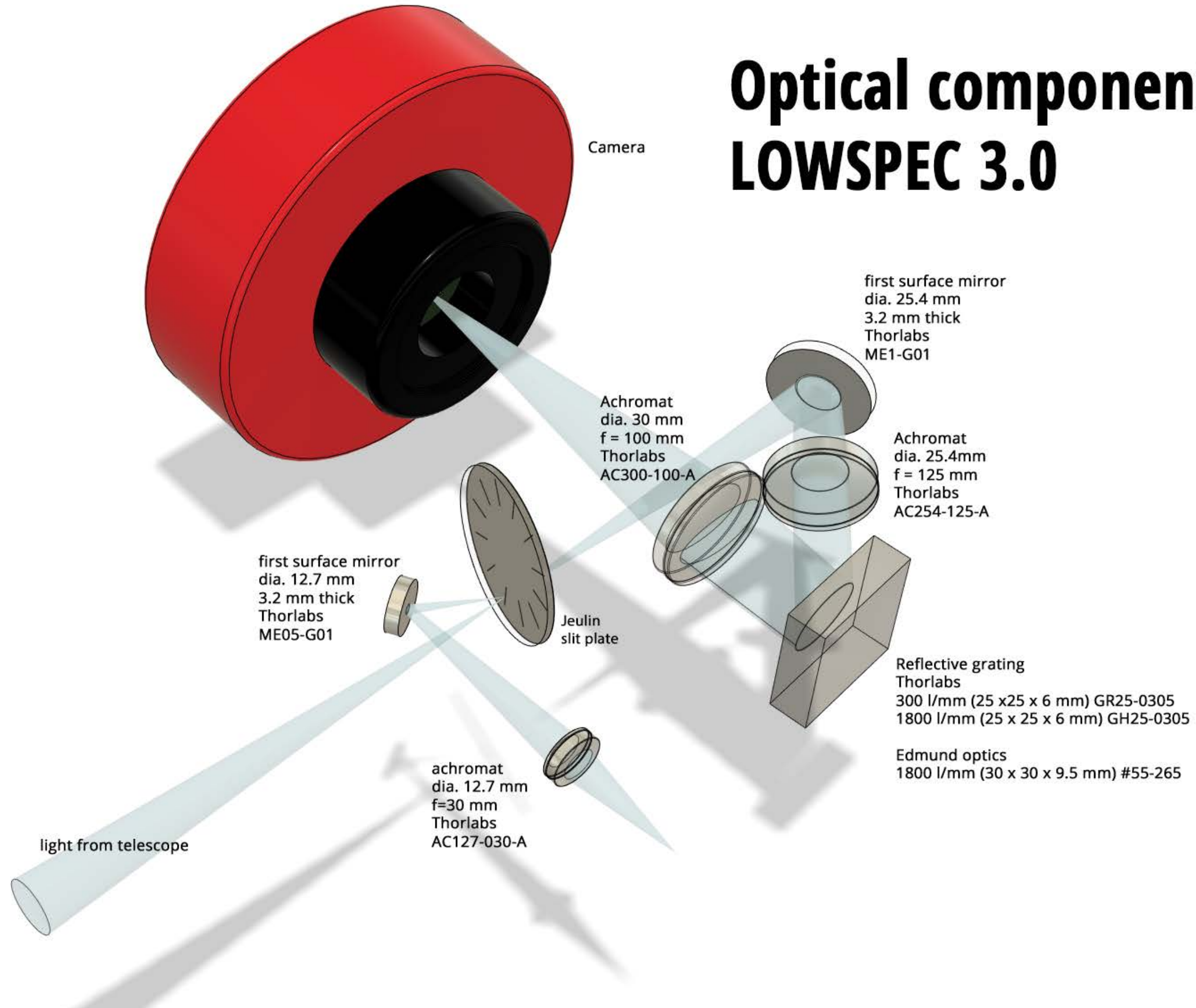


Designed by Paul Gerlach

(version 3.0 April 2020)

Optical components

LOWSPEC 3.0



Optical parts

When click on the partnumbers you will be directed to the correponding webpage.

Optical parts from Thorlabs

Part number	Description
AC127-030-A	lens for autoguider (f=30 mm)
ME05-G01	autoguider mirror
ME1-G01	backside mirror
AC254-125-A	Collimator lens (f = 125 mm)
GR25-0305	grating 25x25 mm (300 l/mm)*
GH25-18V	grating 25x25 mm (1800 l/mm)*
AC300-100-A	camera lens (f = 100 mm)

* You can choose one of them or both. The GR25-0305 is for low resolution and large spectral range. The GH25-18V is for high resolution spectroscopy and small range. This will work for a f/10 telescope but at the cost of some efficiency. I do not advice to use a faster telescope in the high resolution configuration. The alternative from Edmund Optics below is a better choise because then all the light will fall on the grating.

Alernative Optical parts from Edmund optics

Part number	Description
#55-265	grating 30x30 mm (1800 l/mm)


Optical parts from Jeulin

Part number	Description
204012	slit disc


Optional Illumination device from Baader (Teleskop Express)

Part number	Description
BA2404305	Illumination Device for slit


Hardware list




(5x) Hexagon socket head cap screw M4 x 60mm




(1x) M4 threaded insert




(5x) M4 lock nut




(1x) M5 lock nut




(7x) M3 nut




(10x) Allen grub screw M4x10mm




(1x) Philips cylinder screw (M3x25mm)




(3x) Allen grub screw M4x6mm




(4x) M3x16mm




(3x) M3x12mm




(5x) M3x10mm




(1x) Knurled screw or cylinder screw M4x30mm




(2x) Ball pen spring




(1x) Coil spring 7.5x35.8x0.7mm




Extension spring 5.0x18.3x0.45mm




Steel ball (5mm dia.)




(1x) Ball bearing 625ZZ




(2x) 8 x 2 mm Neodymium magnets (strength N50)




(1x) M5 knurled nut




(1x) M5 metal washer




(1x) Micrometer travel 1-13 mm build-in diameter 9.5mm




(1x) M5 x 25mm round coupling nut



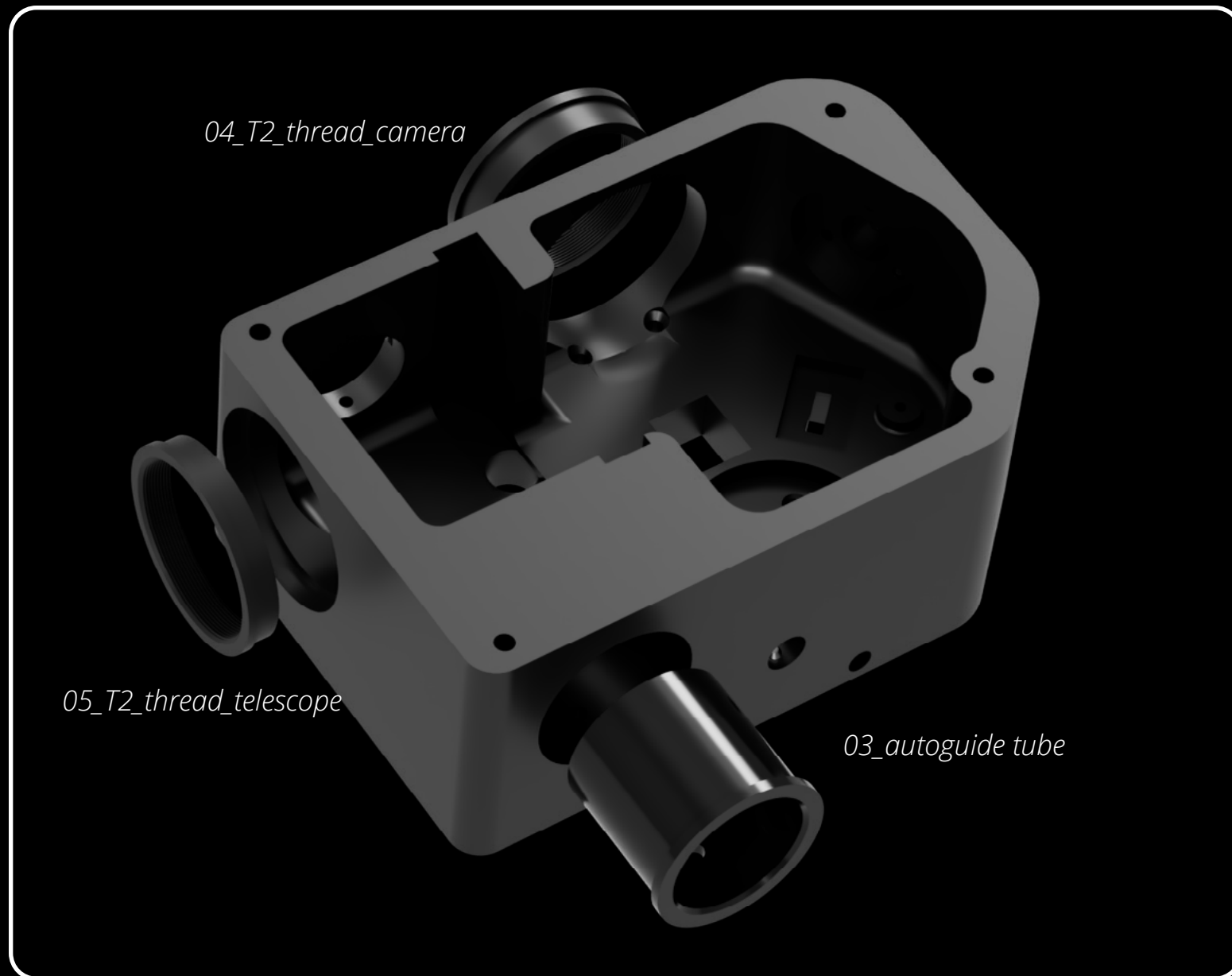
(2x) Aluminum pipe (6mm dia. 55mm length)



(1x) M5 x 80mm cylinder screw



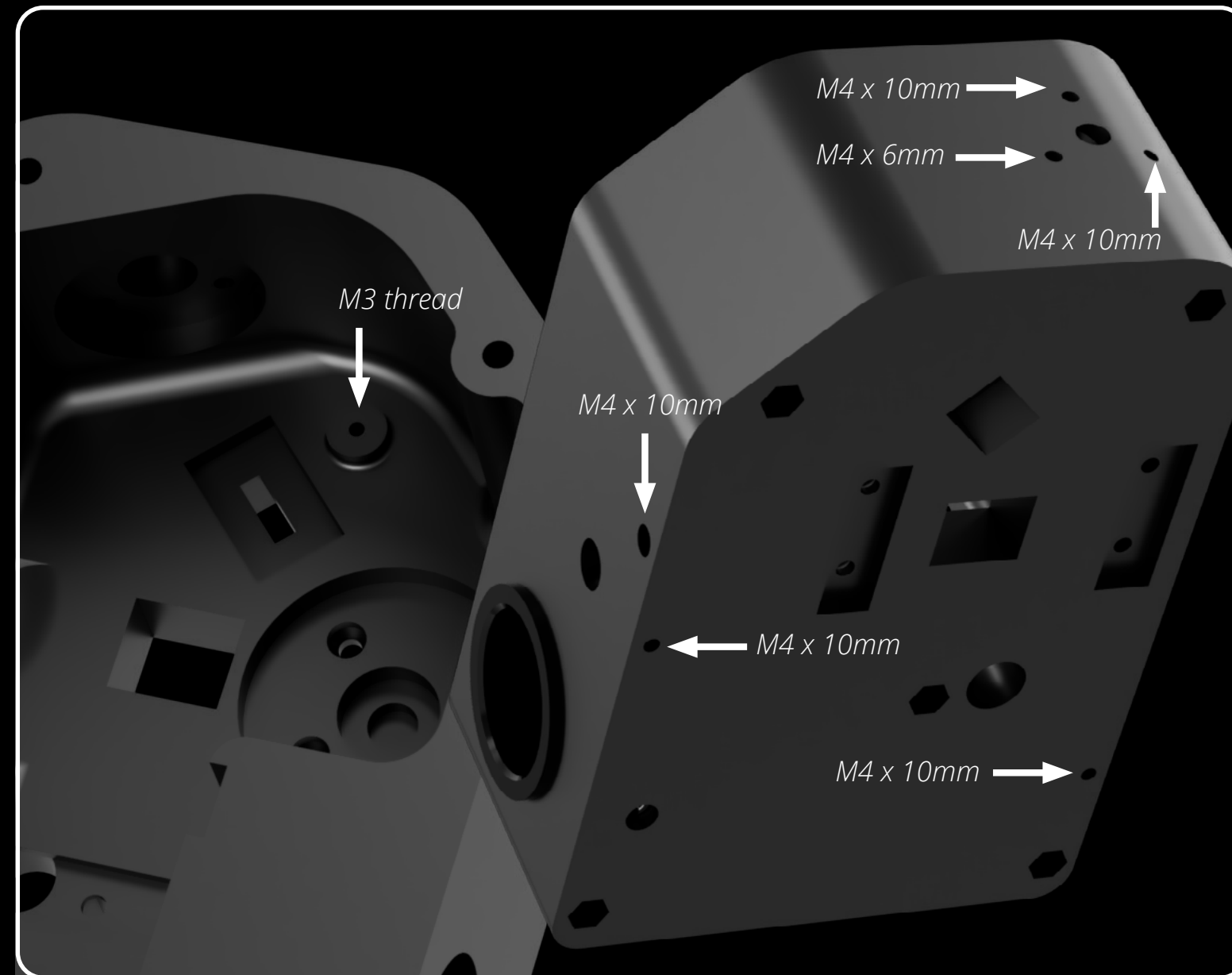
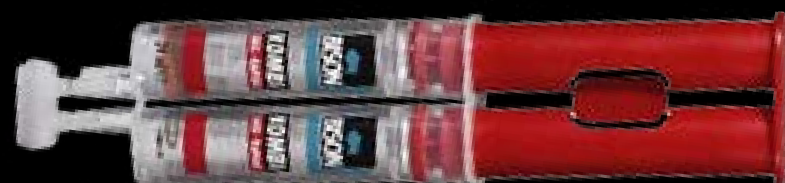
M6 x 6mm Allen grub screw



1

Apply some clear two component epoxy glue on the contact surface. Make sure to spread the glue evenly across the surface and that it's not too thick. Make sure that the two threaded parts fit without being deformed. Otherwise sand the inner part of the main body until it fits. Also make sure that the small hole in the side of the auto guide tube lines up with the hole in the main body.

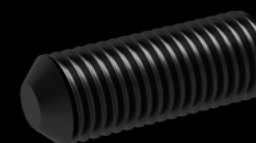
Let it cure for 15-30 minutes before going to step 2.

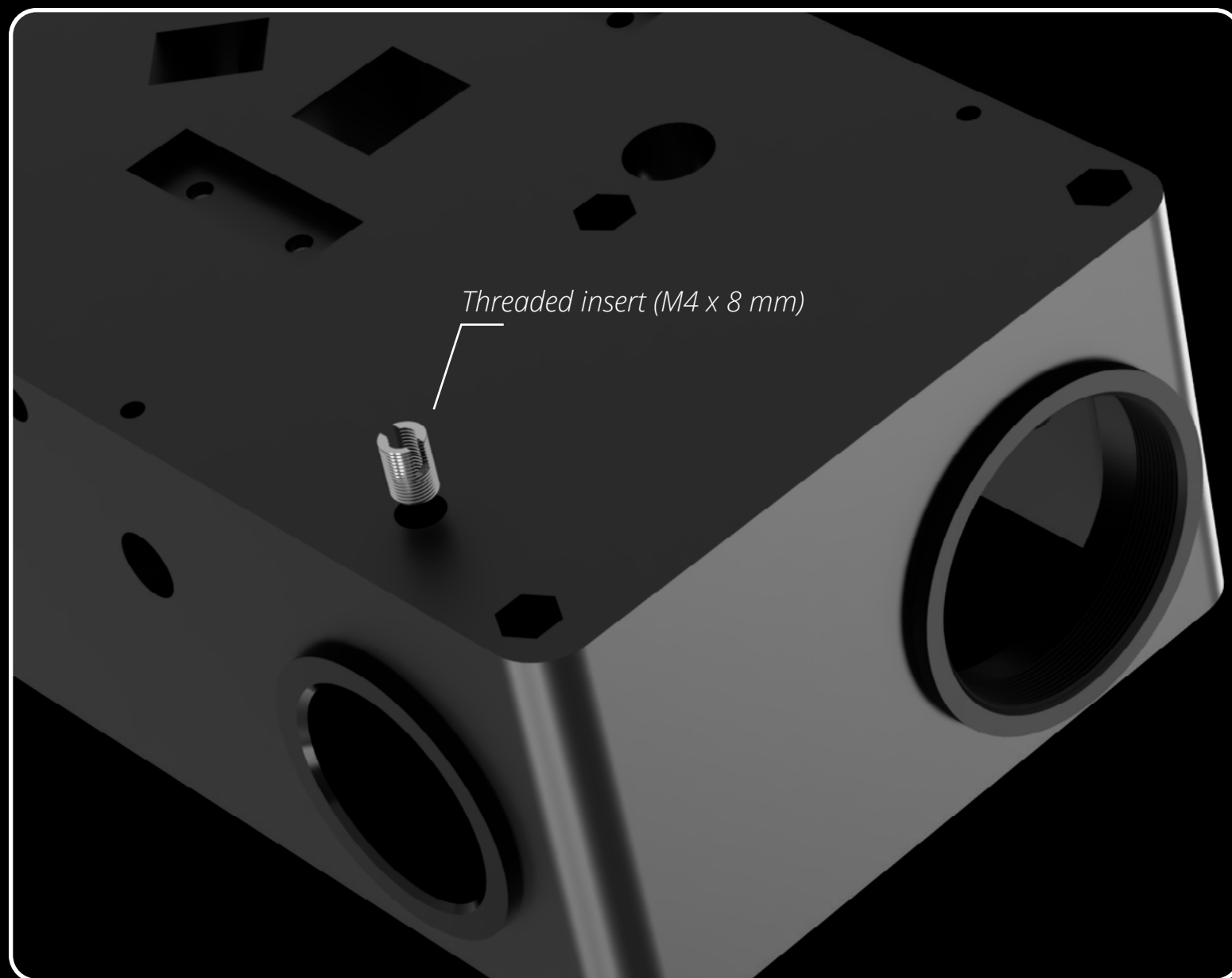


2

Use a M3 threading tool to thread the indicated location in the picture above. Use a M4 threading tool to thread the locations on the outside of the main body indicated by the white arrows.

Next screw Allen Grub Screws (M4) into these threaded holes. The sizes are indicated in the illustration. Make sure to use ones with a flat surface.





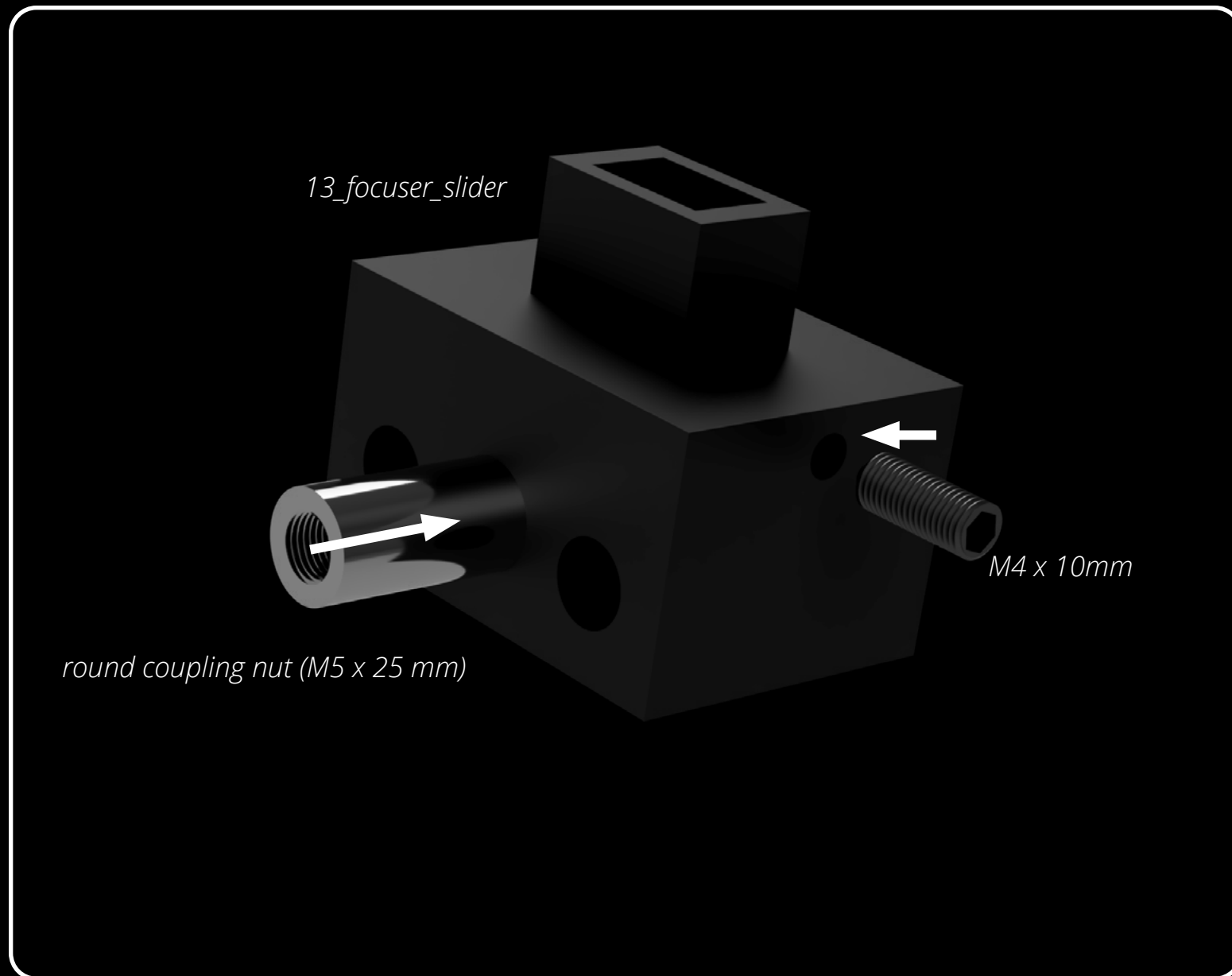
3

Place the threaded insert (M4 x 8 mm).
Use some two component epoxy glue



4

Glue the 22_Backlight-adaptring in place.
After letting the glue dry screw in the 23_Backlight_plug_M8x0.75. This
will ensure that no light can enter the spectroscope in case you don't
make use of the Baader illumination device to illuminate the slit.

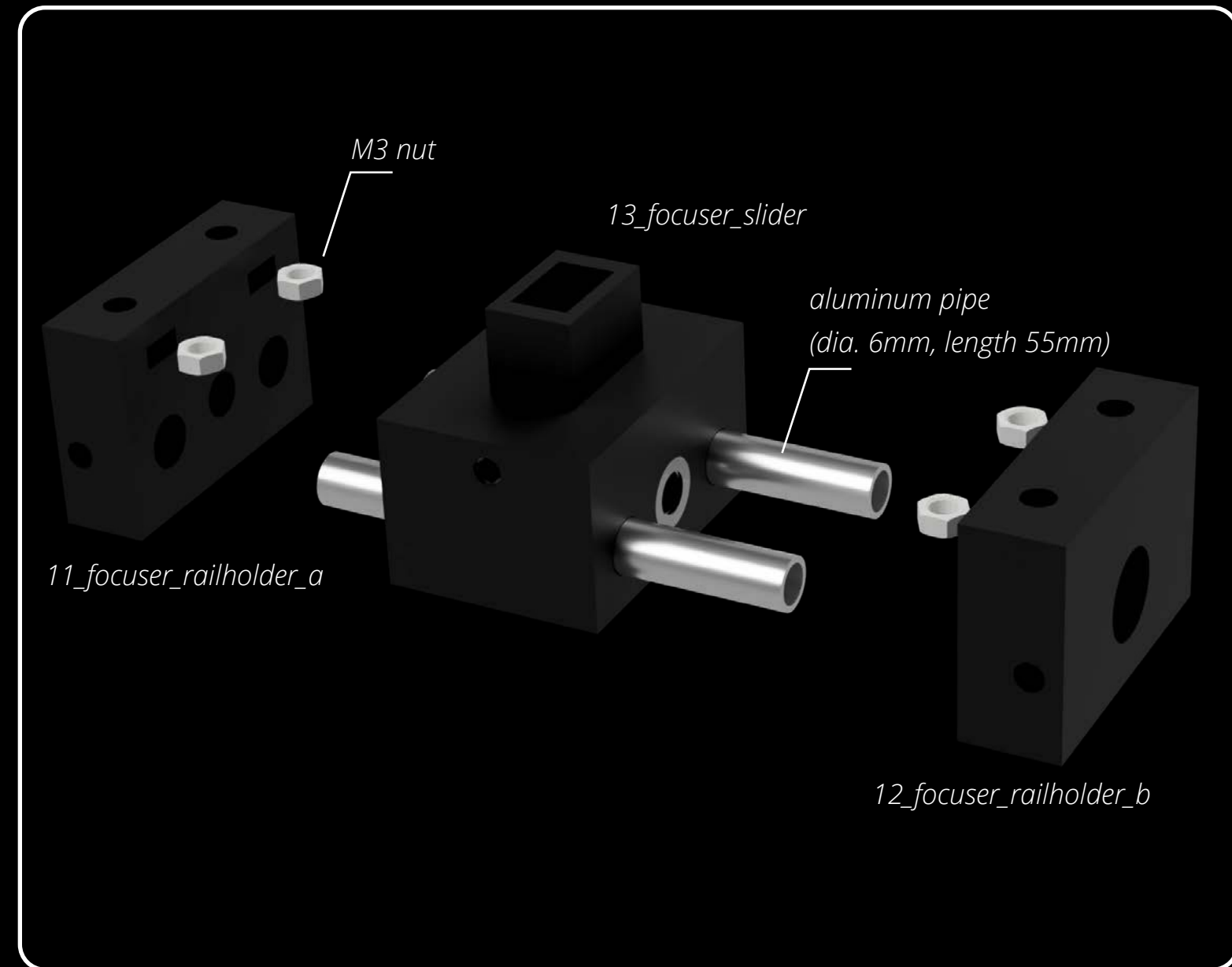


5

Insert the round coupling nut M5 x 25mm (mine had a diameter of 7.9mm) into the center hole of the focus slider (13_focuser_slider). It should be a tight fit and you may have to resort to some brute force.

If you want to make sure that stays in place, you can place a very small amount of super glue (cyanoacrylate glue) on the coupling nut just before you push it in.

After that, thread the small hole with a M4 Thread tool and screw in a M4 x 10 mm grub screw. It will be used to secure the lens holder late on in the build. So don't screw it in all the way.

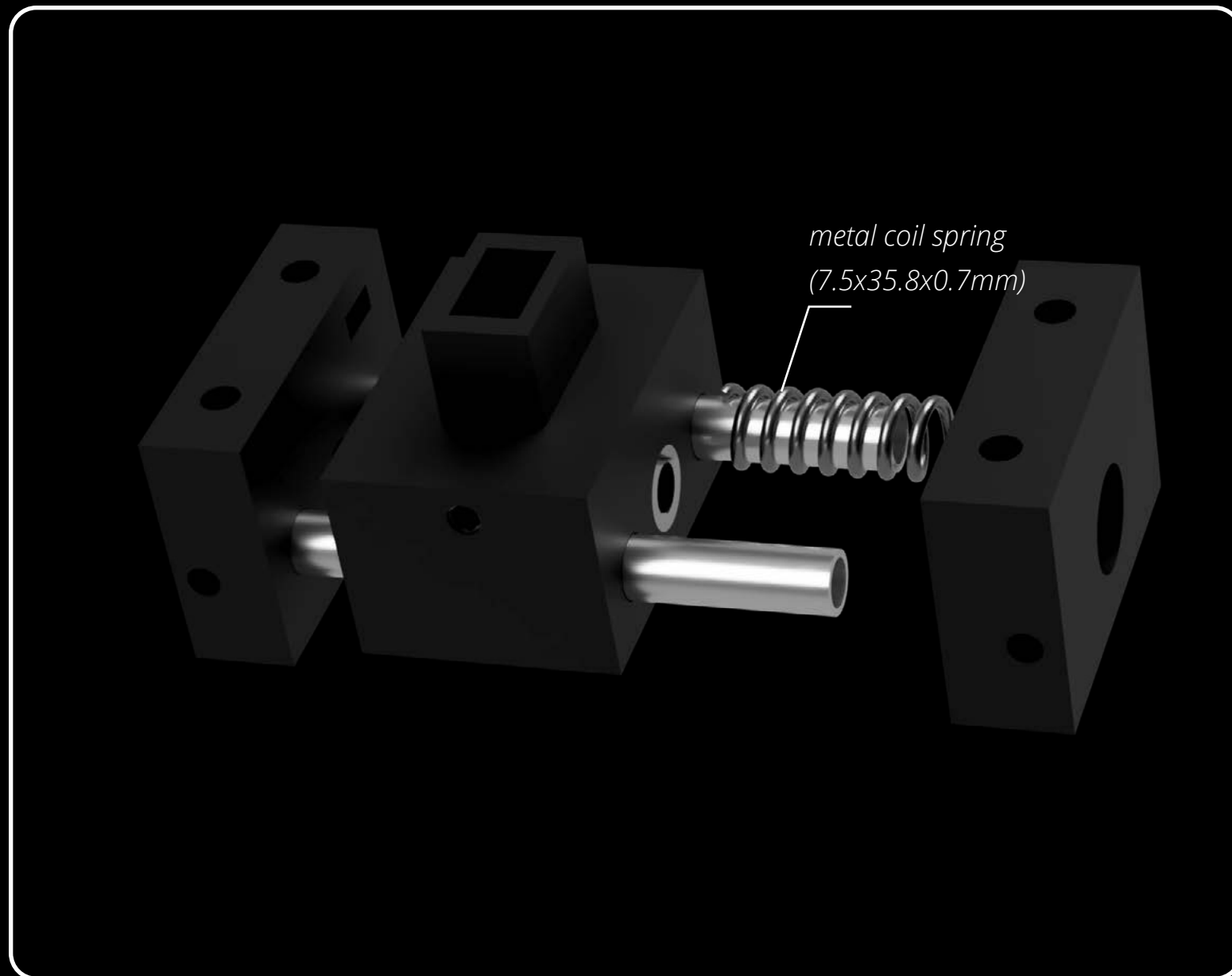


6

Push the M3 nuts into the slots (two in both rail holders).

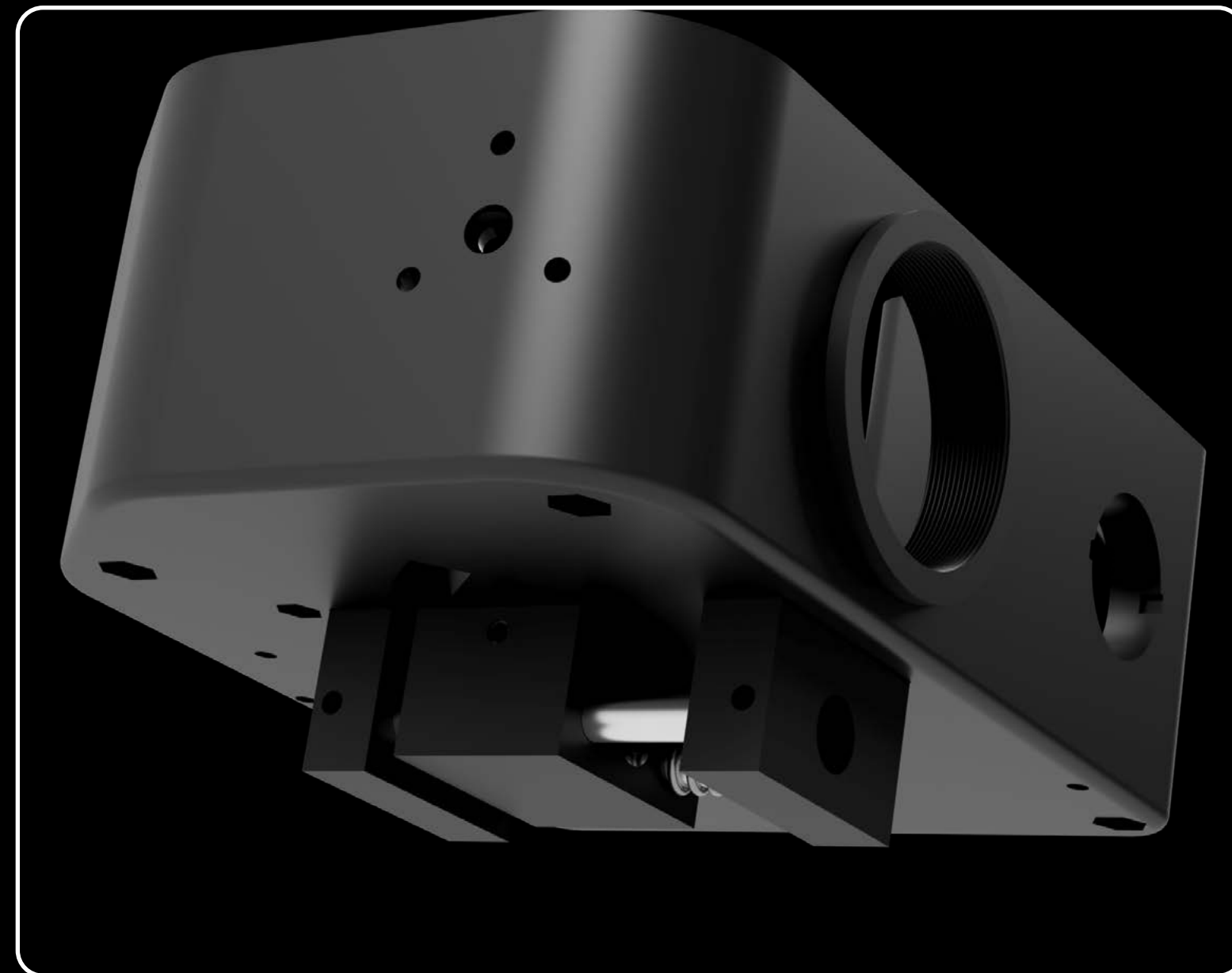
Cut two pieces of aluminum pipe (length 55mm, diameter 6mm) and slide them into the two other holes of the focus slider. Make sure that they can slide smoothly.

Note the orientation of the components.



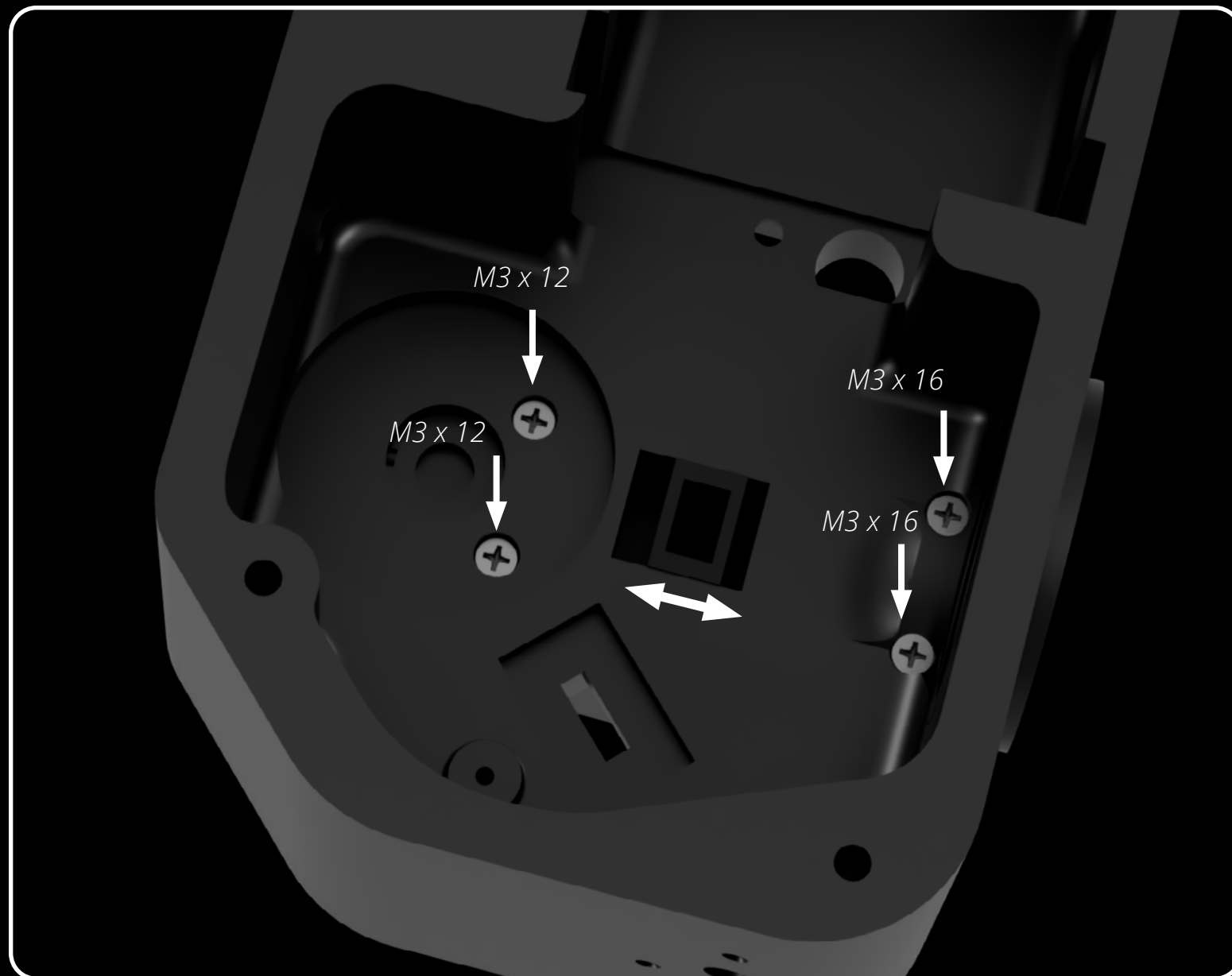
7

Slide one coilspring over one of the the aluminum tubes. Assemble this part by sliding both rail holders over the tube ends.



8

Make sure the whole focus part fits in the designated slots underneath the main body. If it does not then make sure that both sliding tubes are pressed far enough into the rail holders. Still no fit? Than you'll have to shorten both sliding tubes a bit.



9

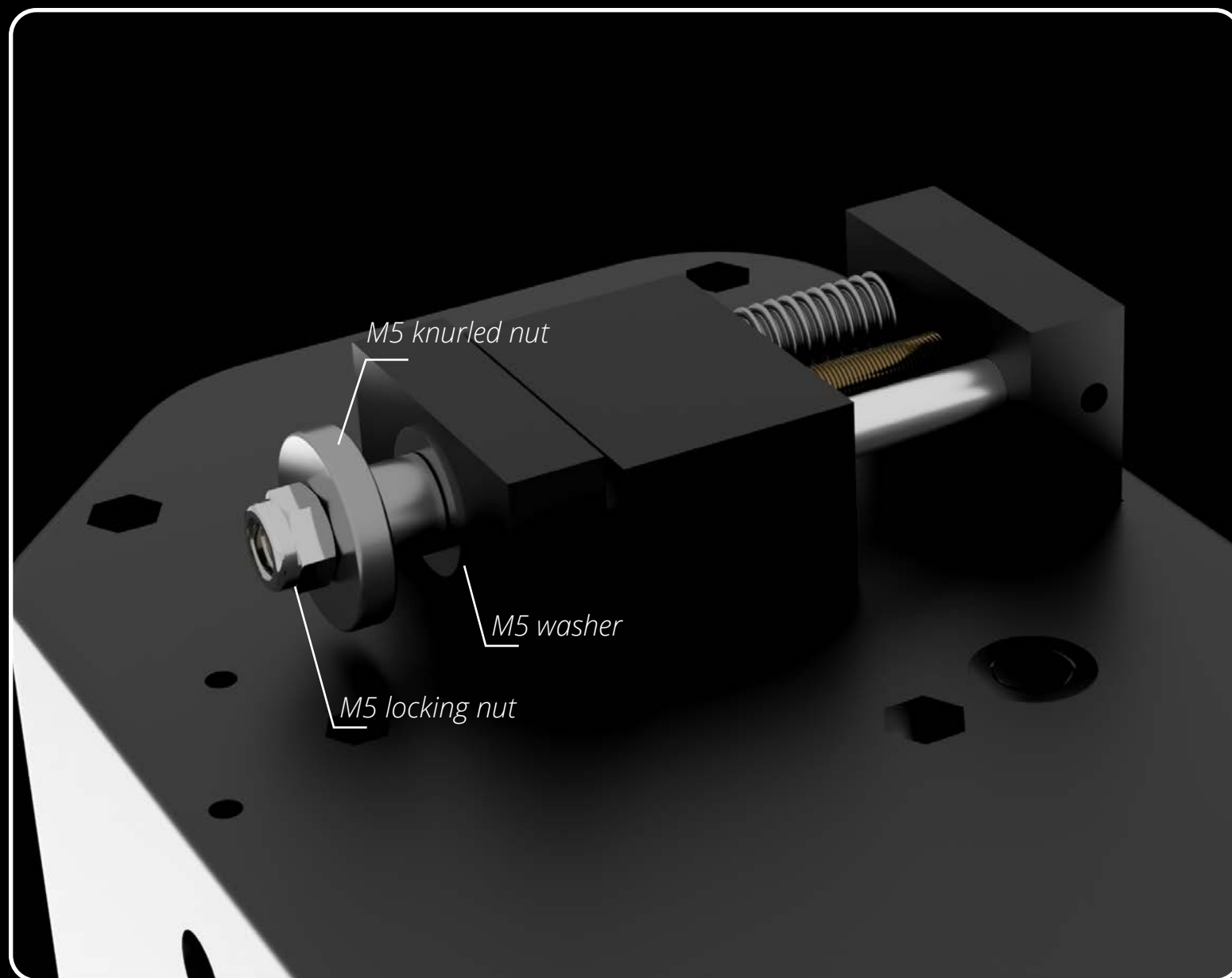
Screw it in place with four M3 cylinder screws.

Check that the focus slider can travel the whole length!



10

Take a M5 x 80mm cylinder screw and screw it all the way in.

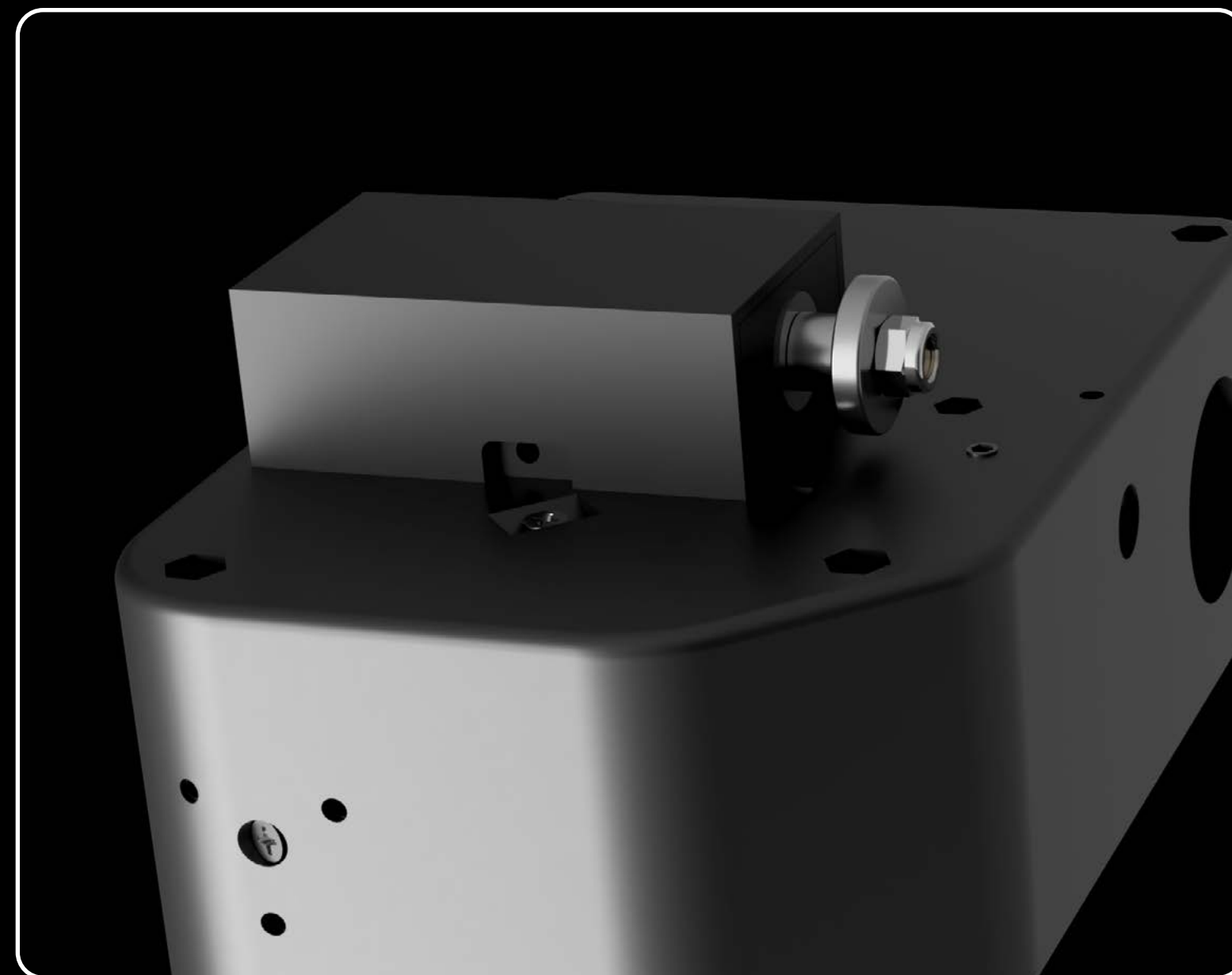


11

Place a M5 washer over the cylinder screw and screw on the Knurled nut. Make sure not to screw it to tight against the washer. The washer should be able to move a little bit.

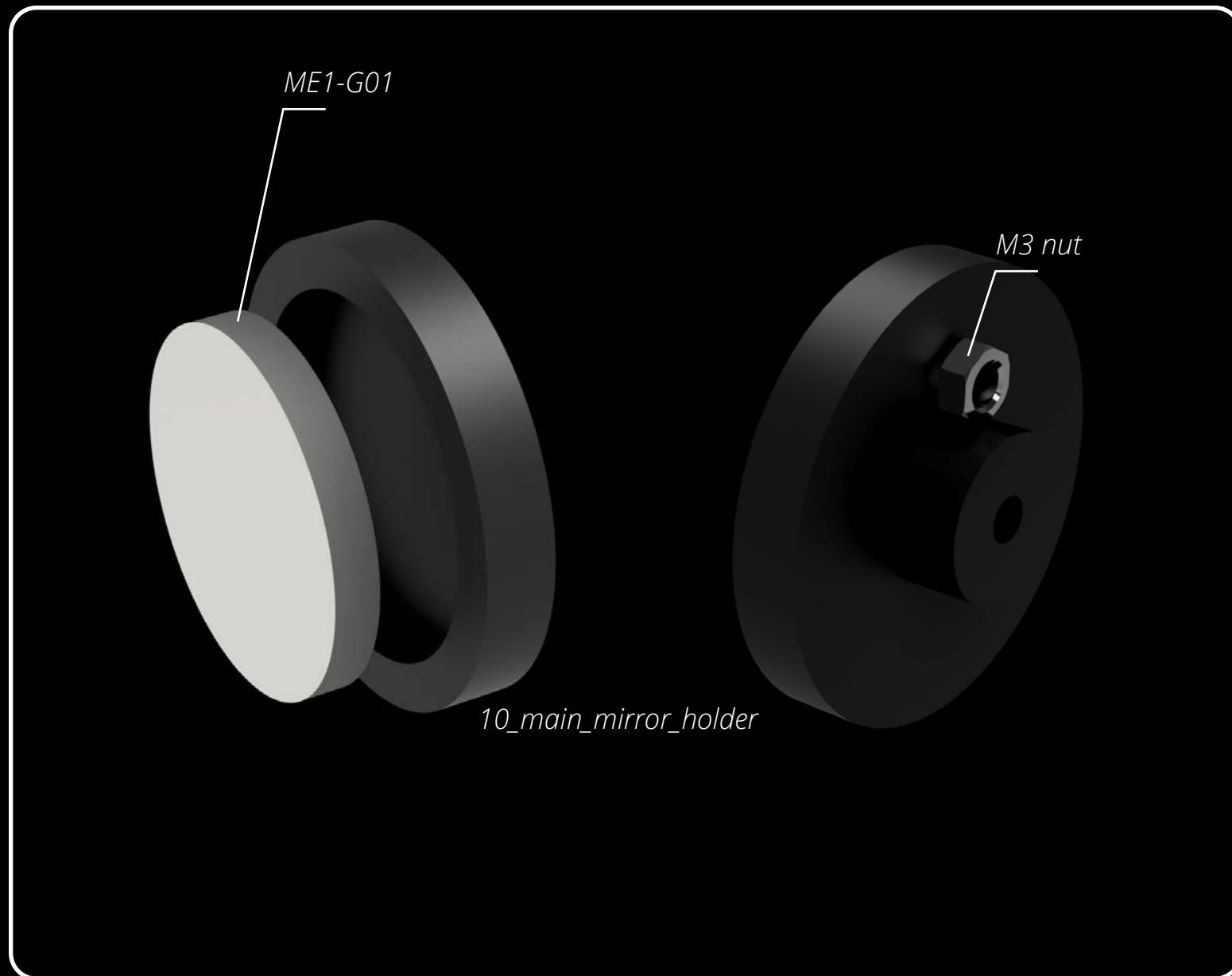
Finally screw the M5 locking nut tight against the knurled nut with a spanner while holding the M5x80mm cylinder screw in place with a screw driver.

Test the focus-unit by turning the knurled nut. It should turn relatively smoothly. If not, unscrew the locking nut and move the knurled nut slightly away from the washer. The tighten the locking nut again.



12

Place the 14_focuser_shield over the focusing assembly. Make sure the gap is on the side of the small hole in the focus slider. The position of the hole in relation to the gap will give you an indication of the focus position and range. It's also possible to fasten or loosen the camera lens holder via the small grub screw inside this hole.

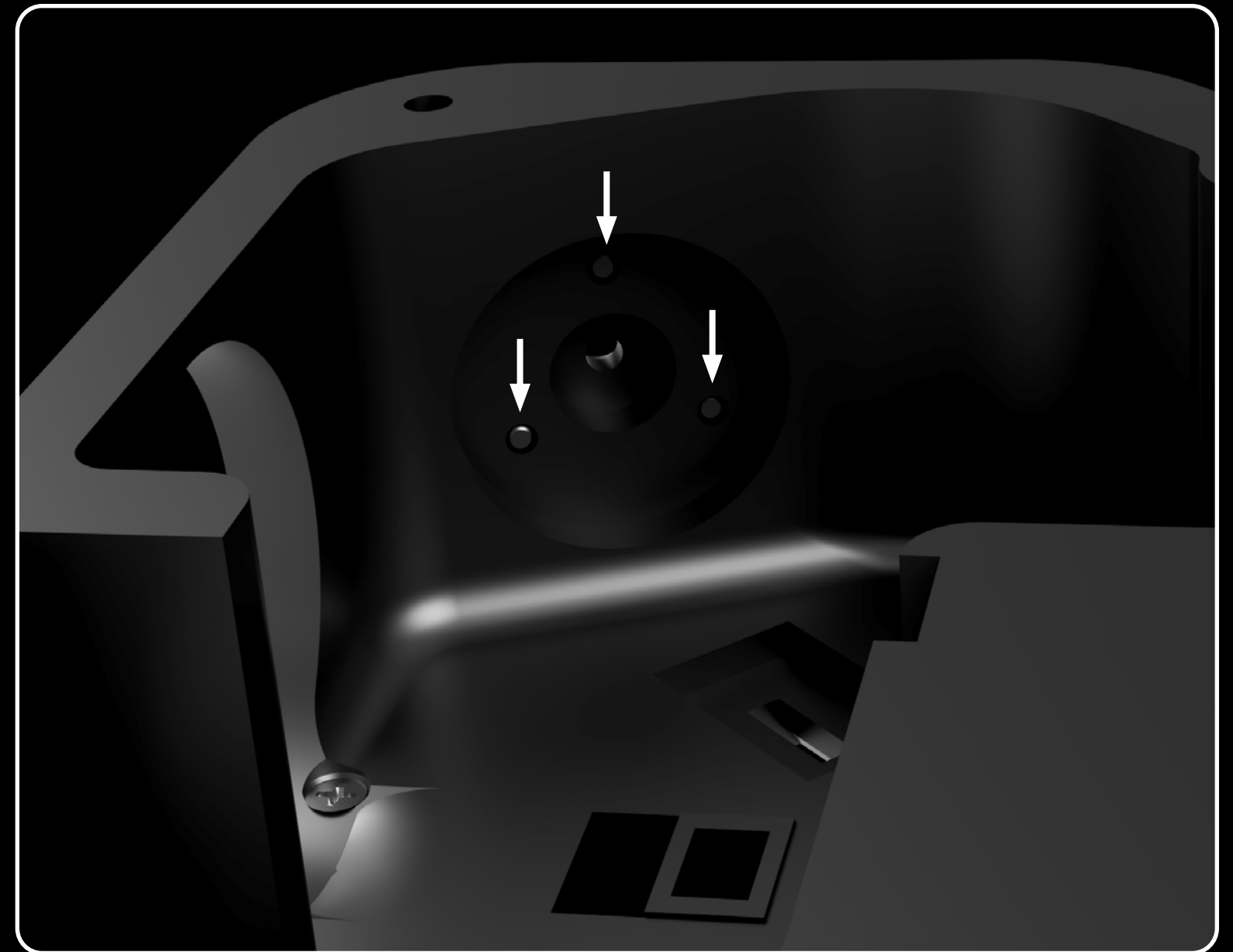


13

Press the mirror into the main mirror holder. Wear gloves so you will not damage the mirror! If you feel the mirror is not secure in it's holder, then use a small droplet of glue on the backend.

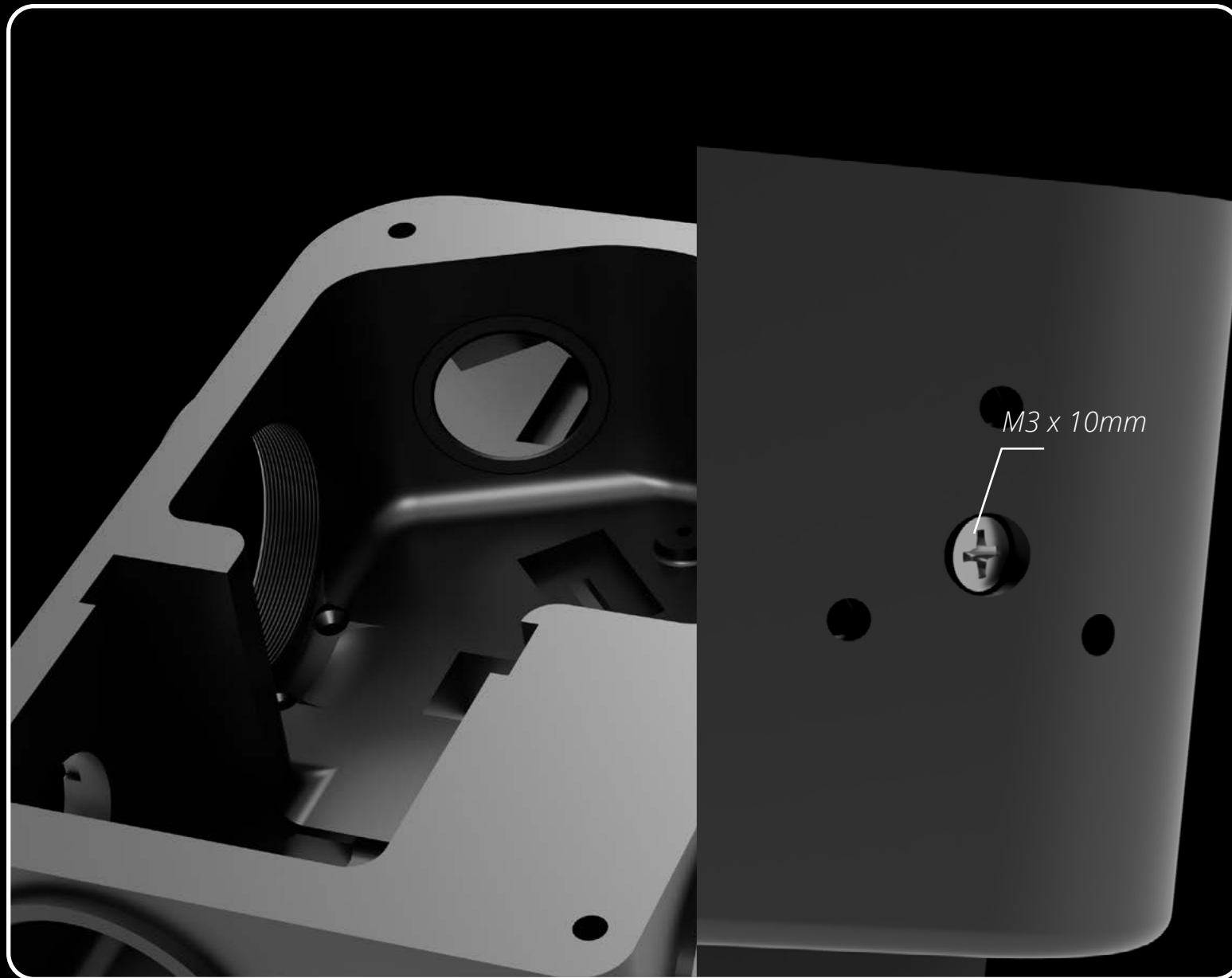
Also insert a M3 nut in the slot on the backside of the mirror holder.

If you've build the previous version of the LOWSPEC and want to re-build it into this updated version, then you can simply reuse this part.



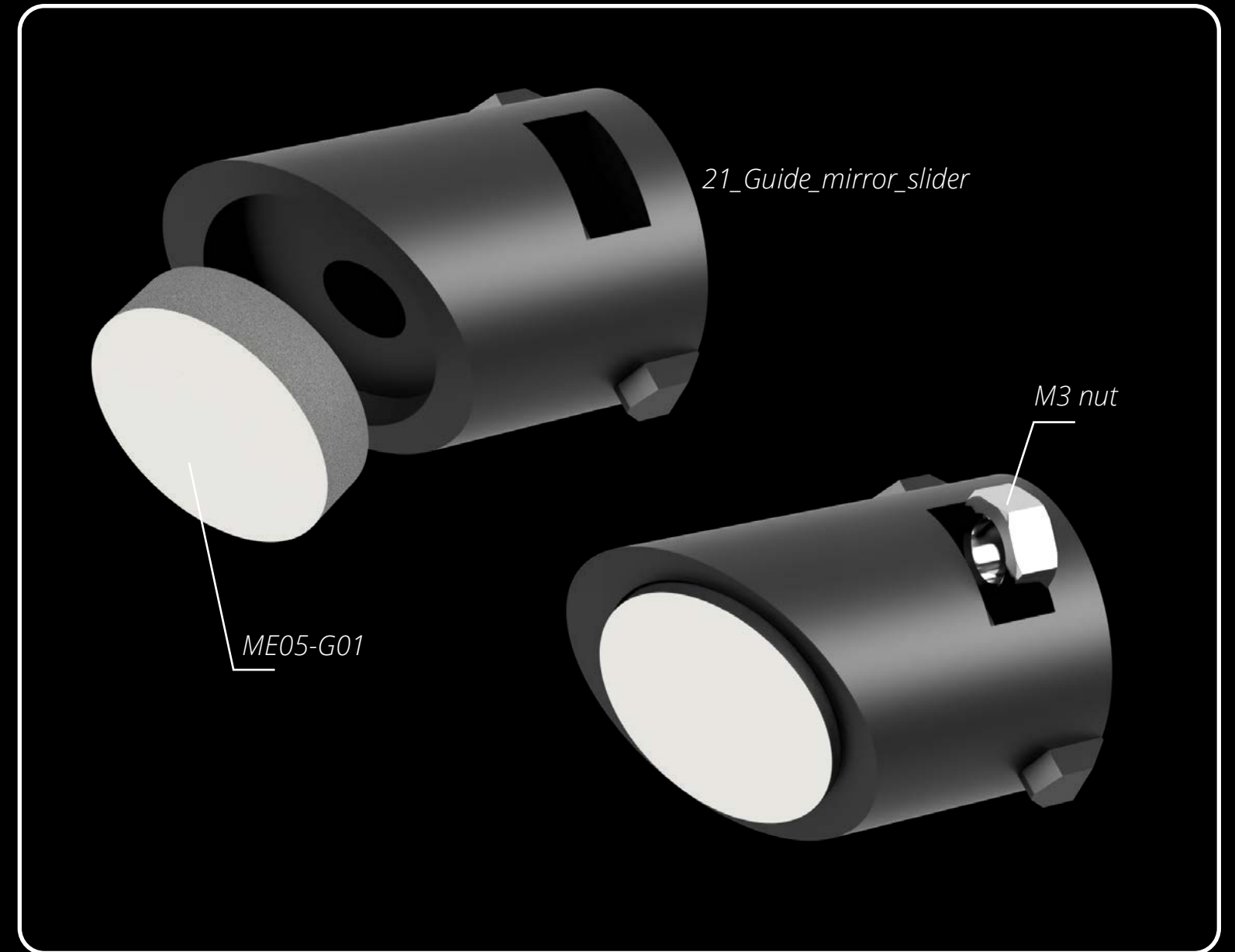
14

Make sure the Allen Grub Screws do not protrude before placing the mirror holder.



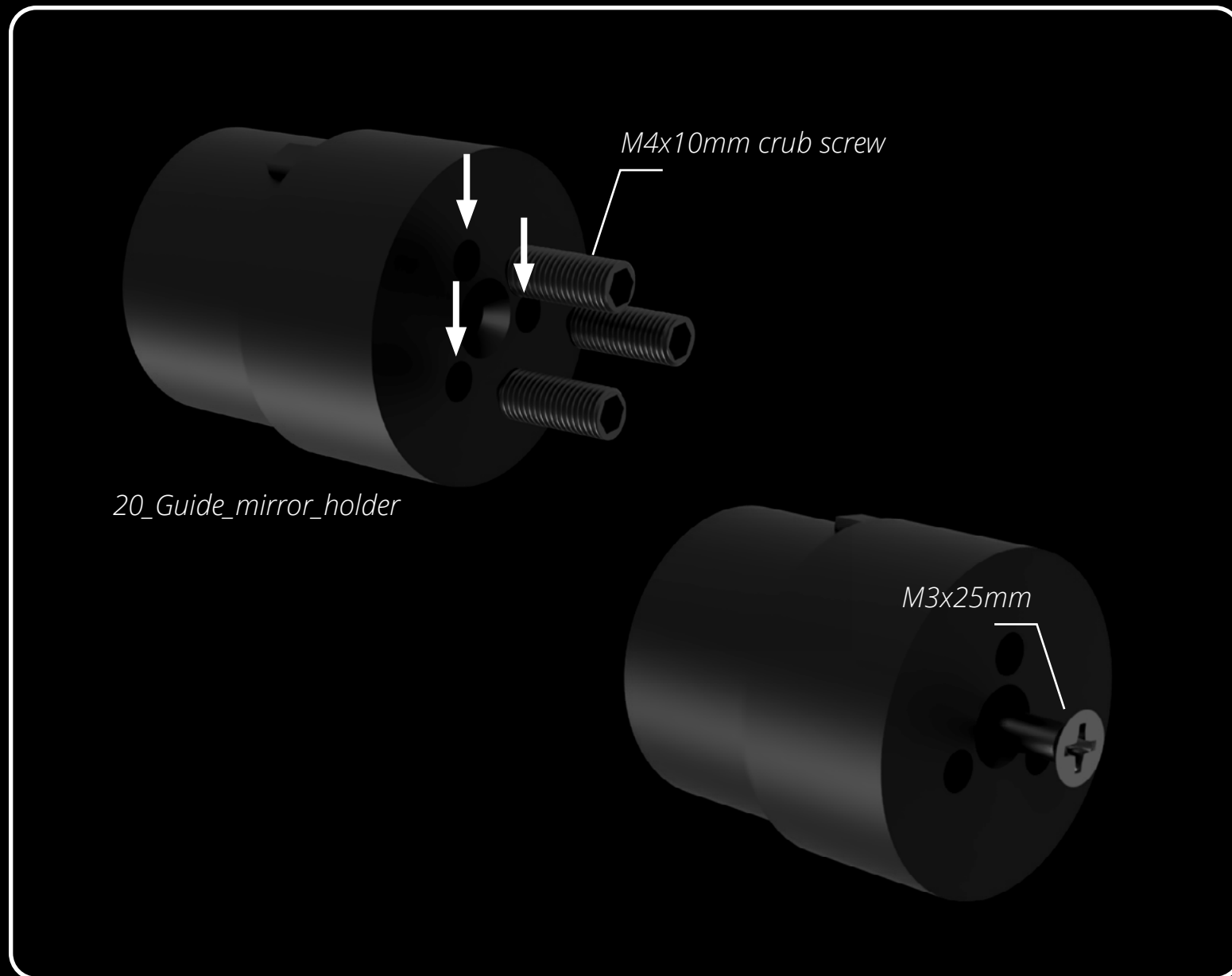
15

Place the mirror holder and secure it with a M3x10mm Philips screw. Take care not to over tighten the screw. The three Allen Grub Screws will be used later to change the tilt of the mirror.



16

Press the guide mirror into the guide mirror slider. Insert a M3 nut into the slot.



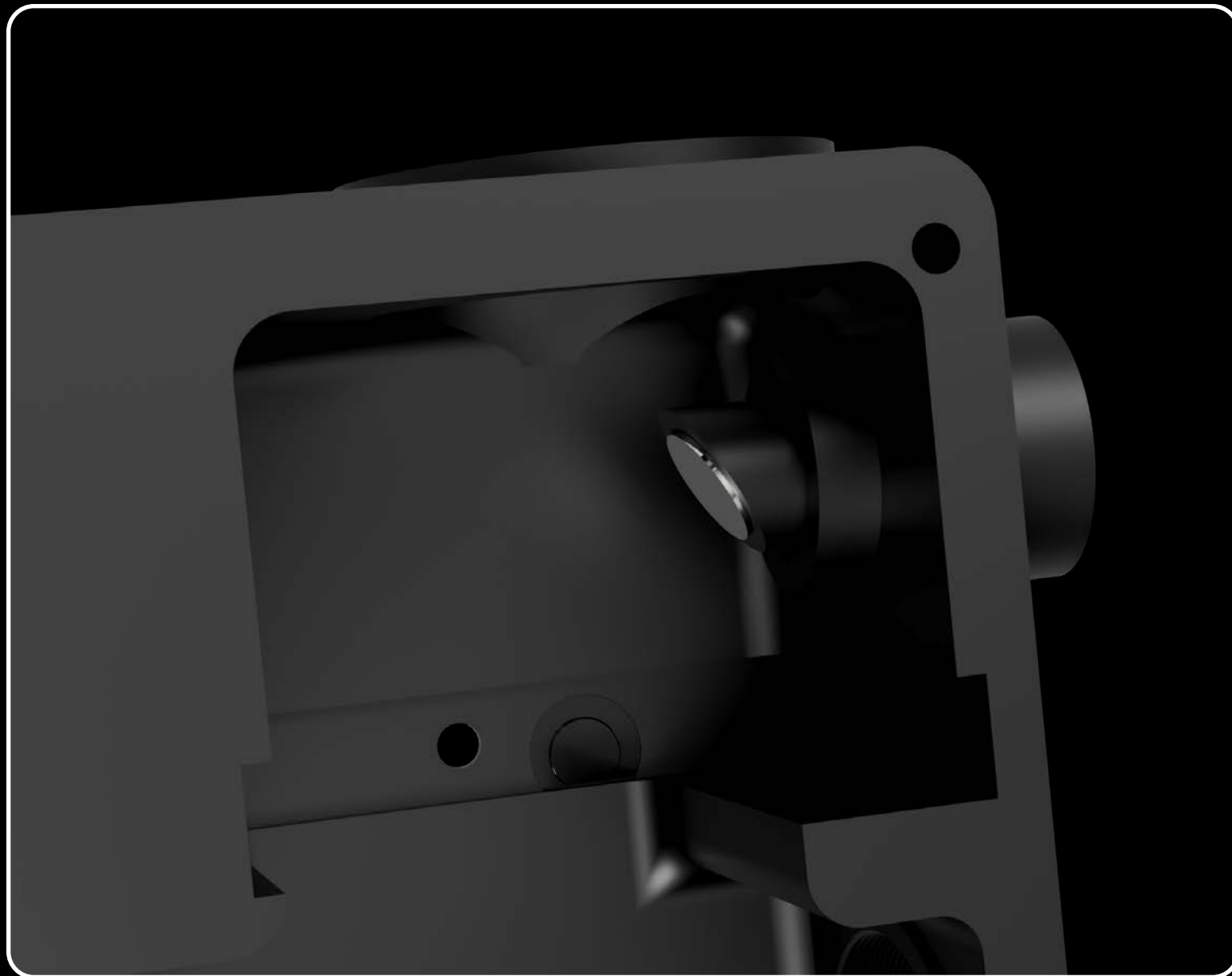
17

Thread the three holes (indicated with arrow) with a M4 threading tool and insert a M4x10mm grub screw in each of them. Next insert a M3x25mm Philips cylinder screw into the central hole.



18

Slide a ballpoint pen spring over the M3 cylinder screw and slide the Guide_mirror_slider into the holder note the orientation of the two components. Now turn the M3 cylinder screw with a screw driver until the mirror slider is being pulled into the holder. Keep turning until it roughly gets in the position shown above. Turn all the three grub screws until you feel them touching the back of the mirror slider. By loosening and tightening these little screws you'll be able to alter the orientation of the mirror. This will be of great help when you need to get the image of the slit correctly on the chip of the autoguider camera.



19

Place the mirror assembly into the main body. If it does not fit correctly, use some sanding paper to slightly enlarge the hole of the main body.

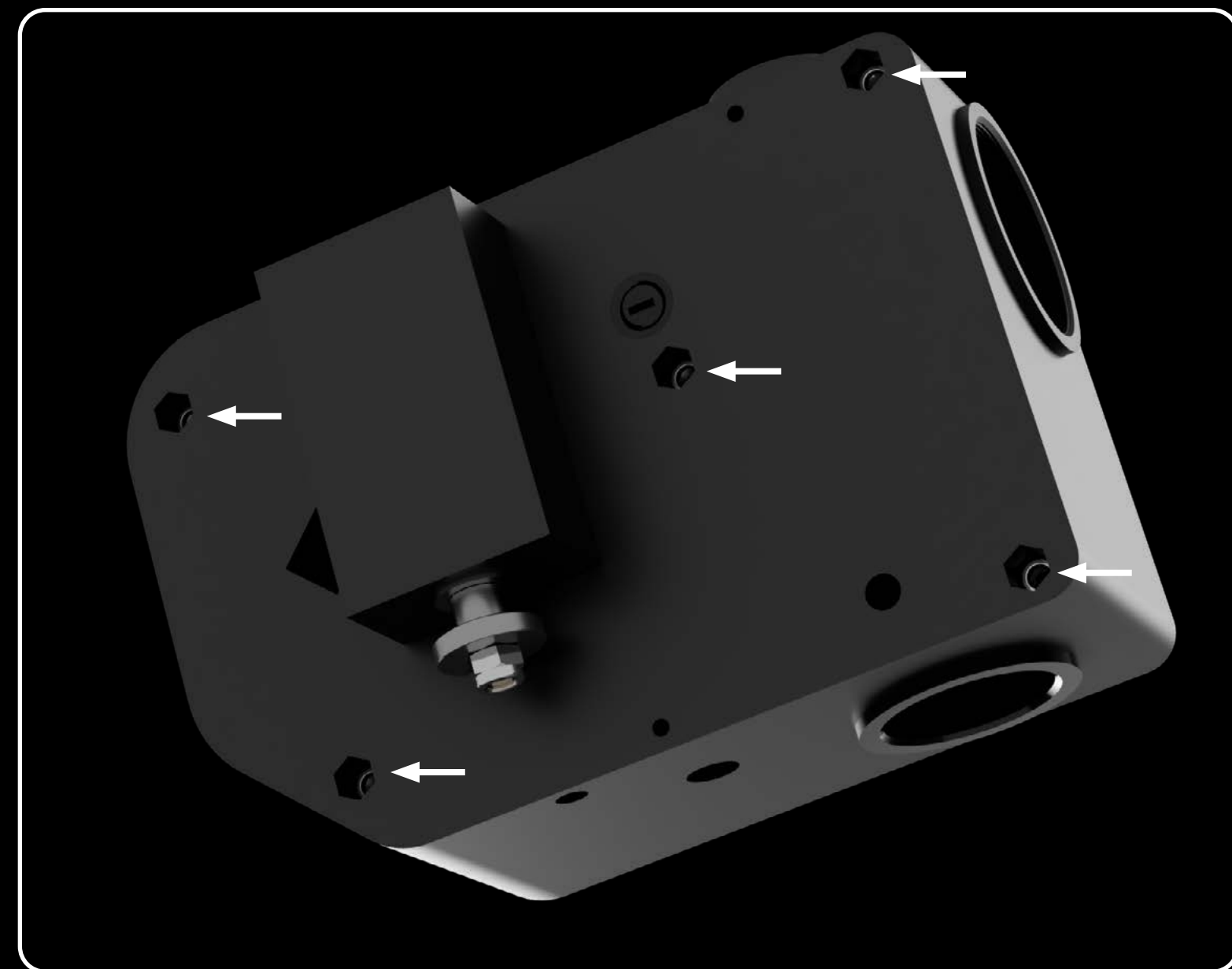


20

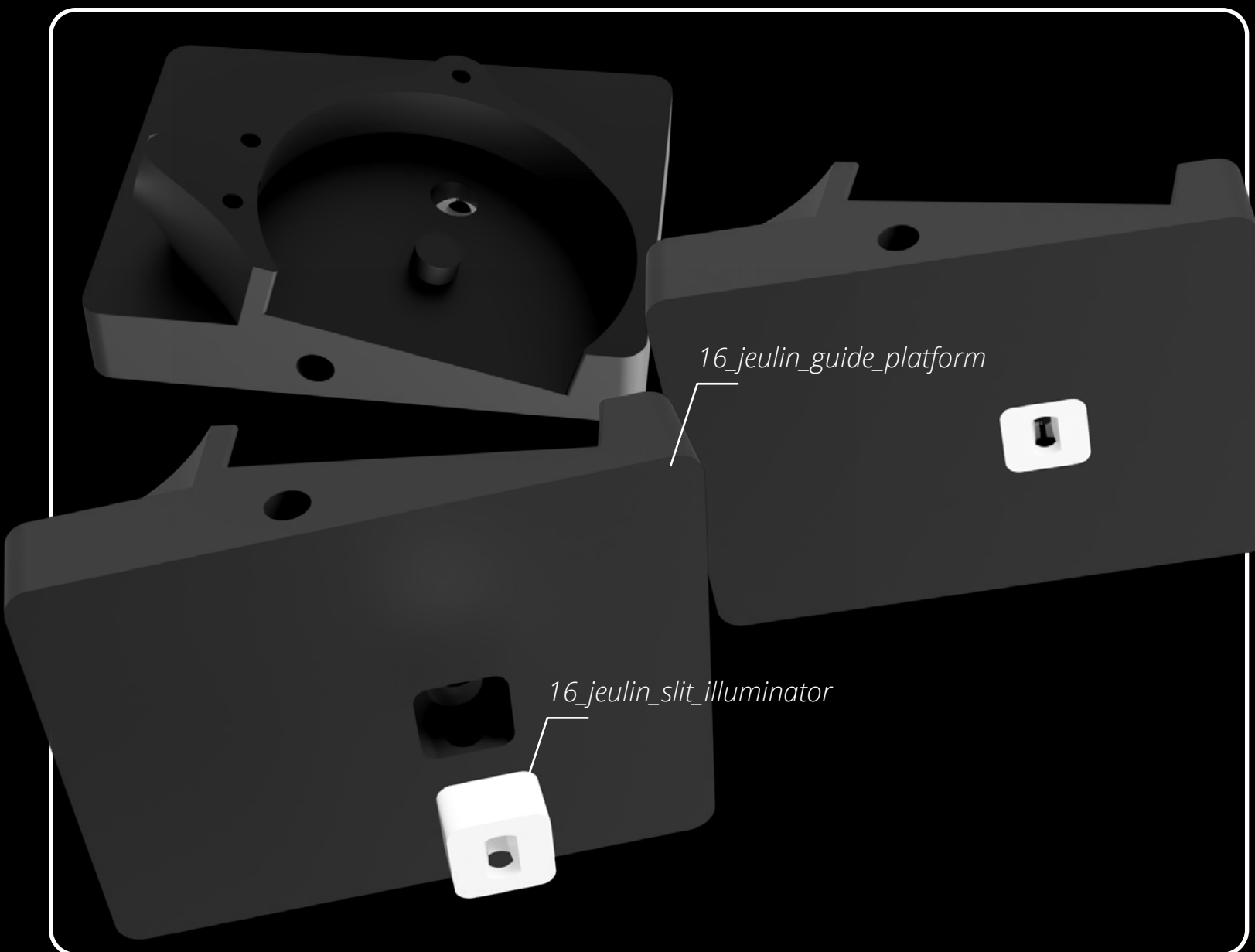
Turn the little grub screw (indicated by the arrow) to secure it.



- 21** Push the autoguider relay lens into it's holder. Note the orientation of the lens. Then push the holder into it's position in the main body. The more bulge side of the lens should face the small mirror.



- 22** Place the LOWSPEC on a flat surface with the backside facing up. Put a small amount of glue (epoxy or superglue) in each of the holes. Make sure not to use to much. It's just to keep the M4 locking nuts in place so they don't fall out every time you'll have to open the lid of the LOWSPEC.
Make sure the nuts are lying flat.

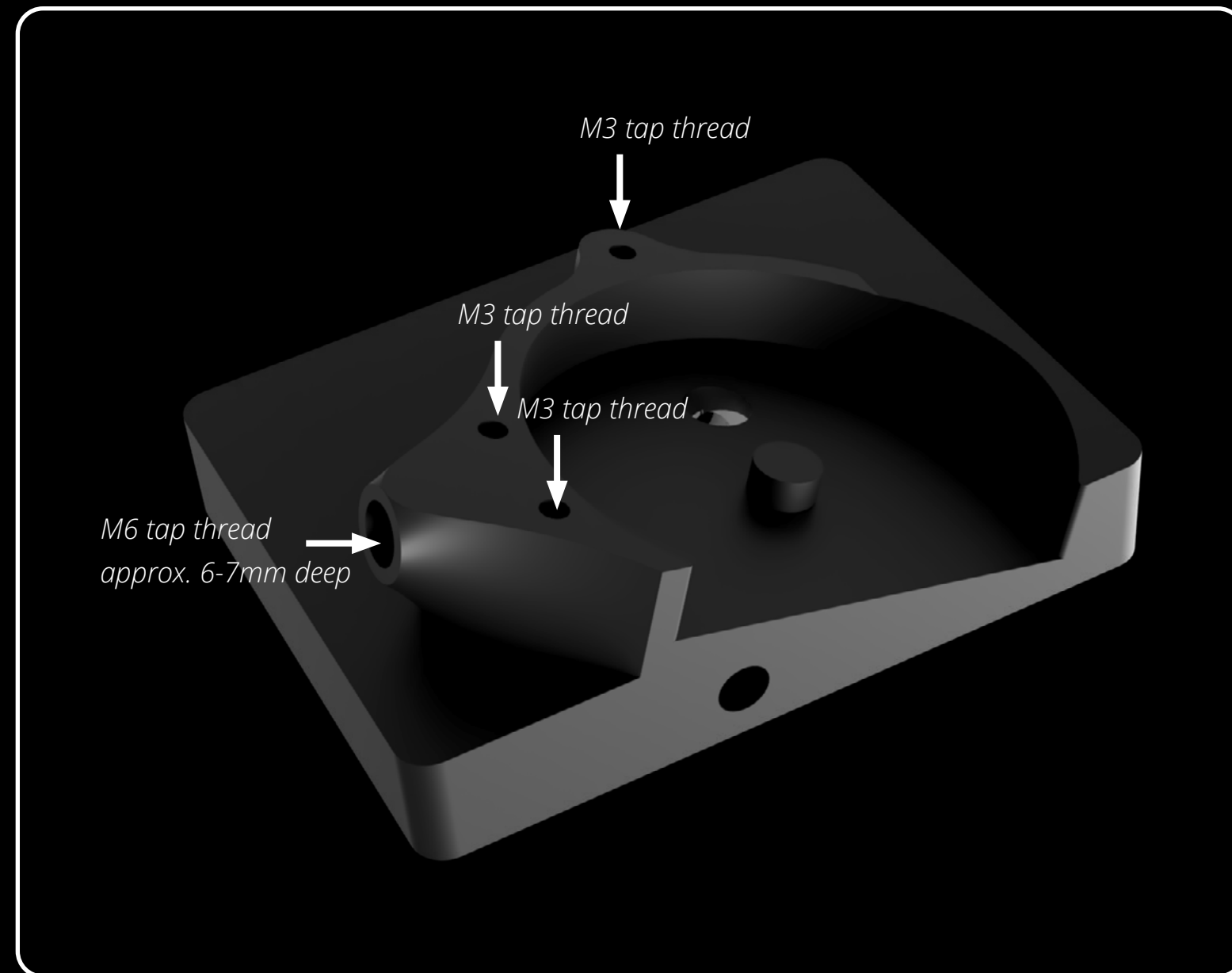


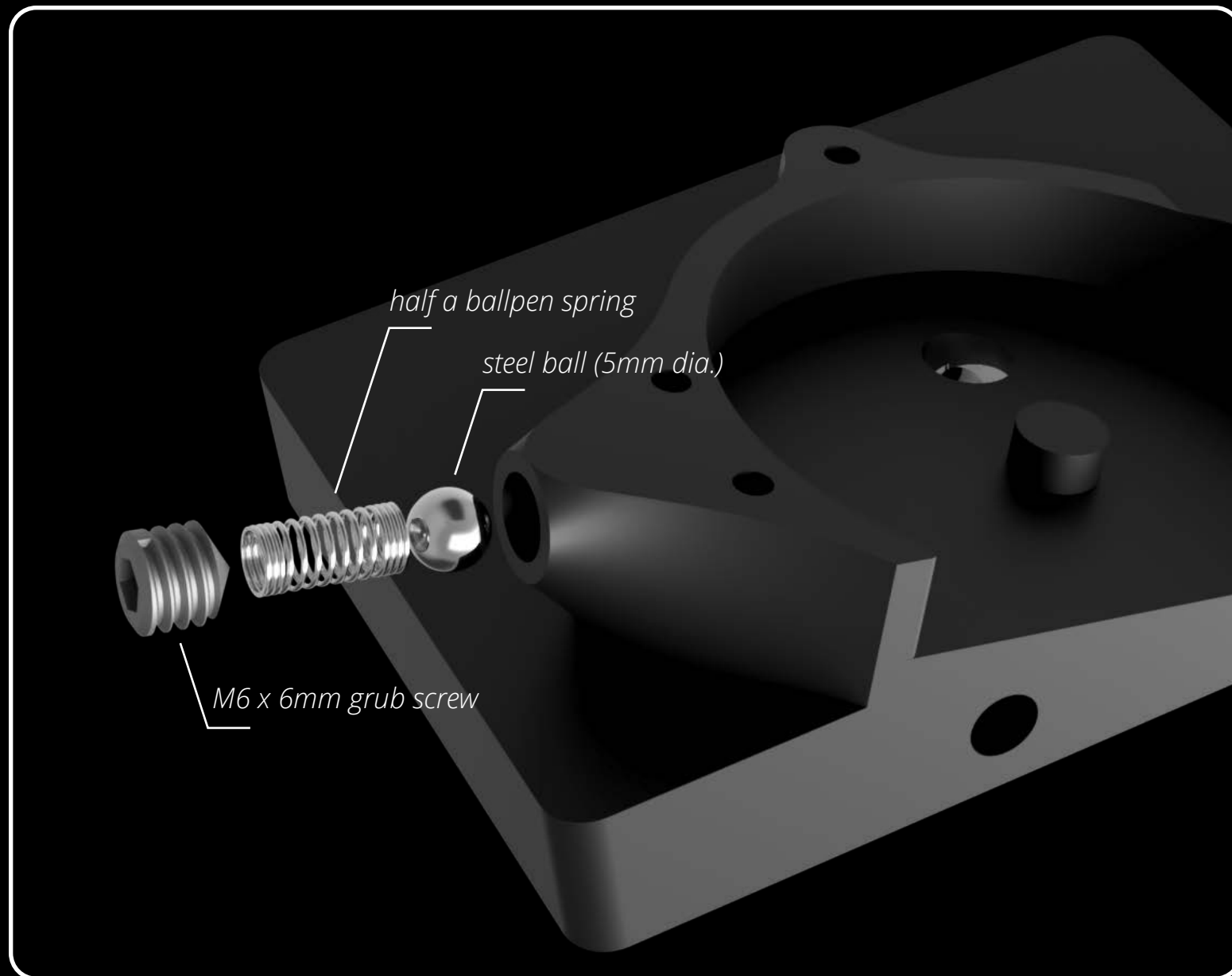
23

The Jeulin guide platform is a two-part piece. The slit illuminator and guide platform are designed to be printed in one go with a dual extruder printer. If you don't have one, just print it as a separate piece. It should be printed with a white filament as it will need to reflect the light from the optional crosshair illuminator. I used HIPS as a filament. When printed separate you will need to sand it to make it fit. If you do not plan to make use of slit illumination then you can just leave out this piece all together.

24

Use a thread tap to tap the holes that are pointed out in the illustration above.



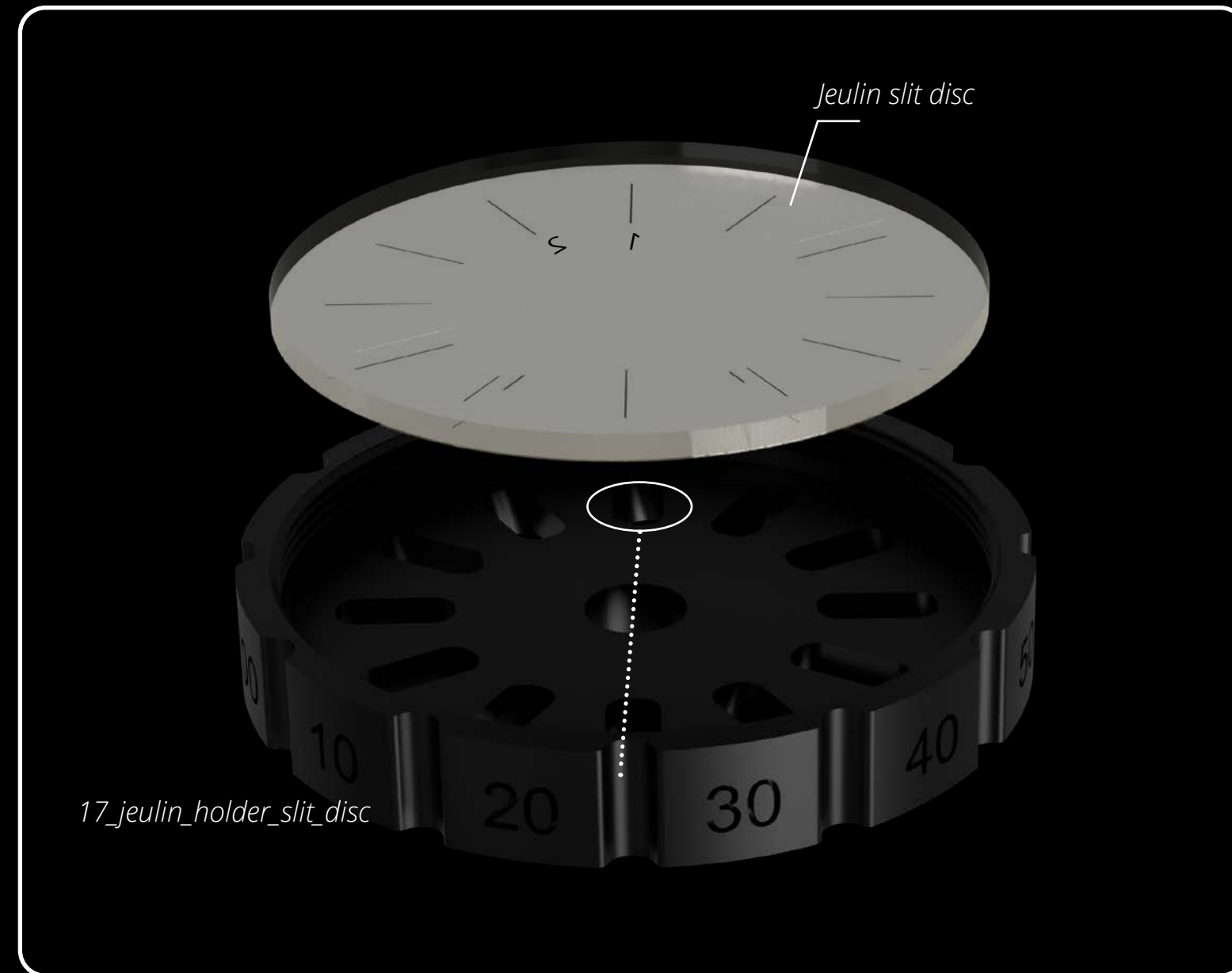


25

The Jeulin slit module uses some additional hardware:

- a steel ball (diameter 5 mm)
- half piece of a ball pen spring
- M6x6 mm Allen grub screw

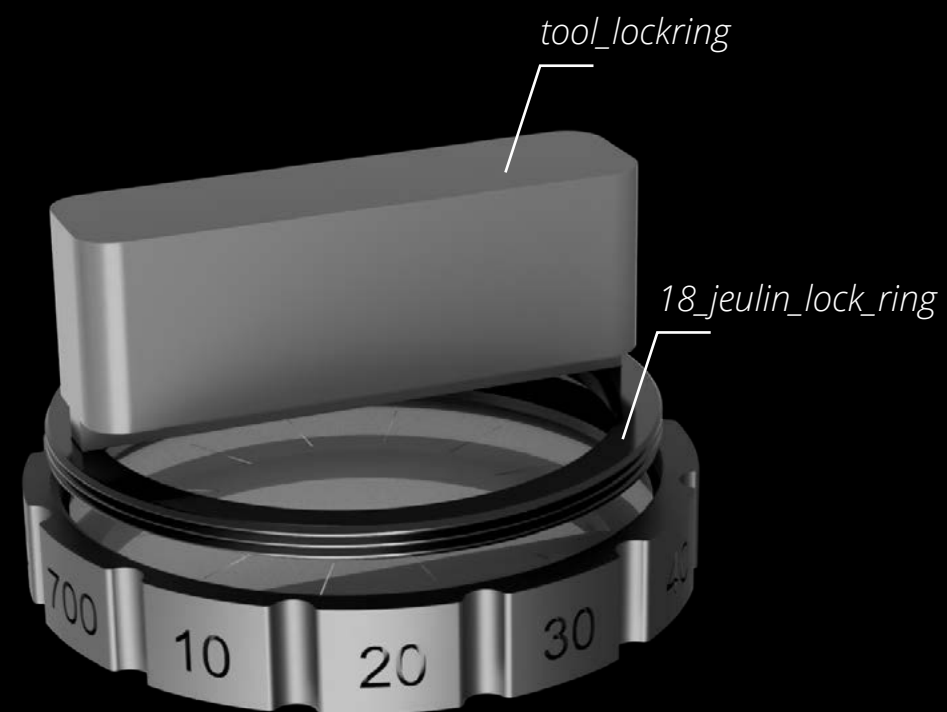
Insert the ball and the spring into the hole and screw in the M6x6 grub screw. With this screw you can adjust the force that the spring exerts on the steel ball.



26

Keep the Jeulin slit plate as clean as possible. Preferably wear cotton gloves.

Place the disc into the holder. Take note of the orientation! Make sure that slit number 1 is above the hole in the white circle. Also make sure the disc is 'upside down' so the numbers are in mirror image.



27

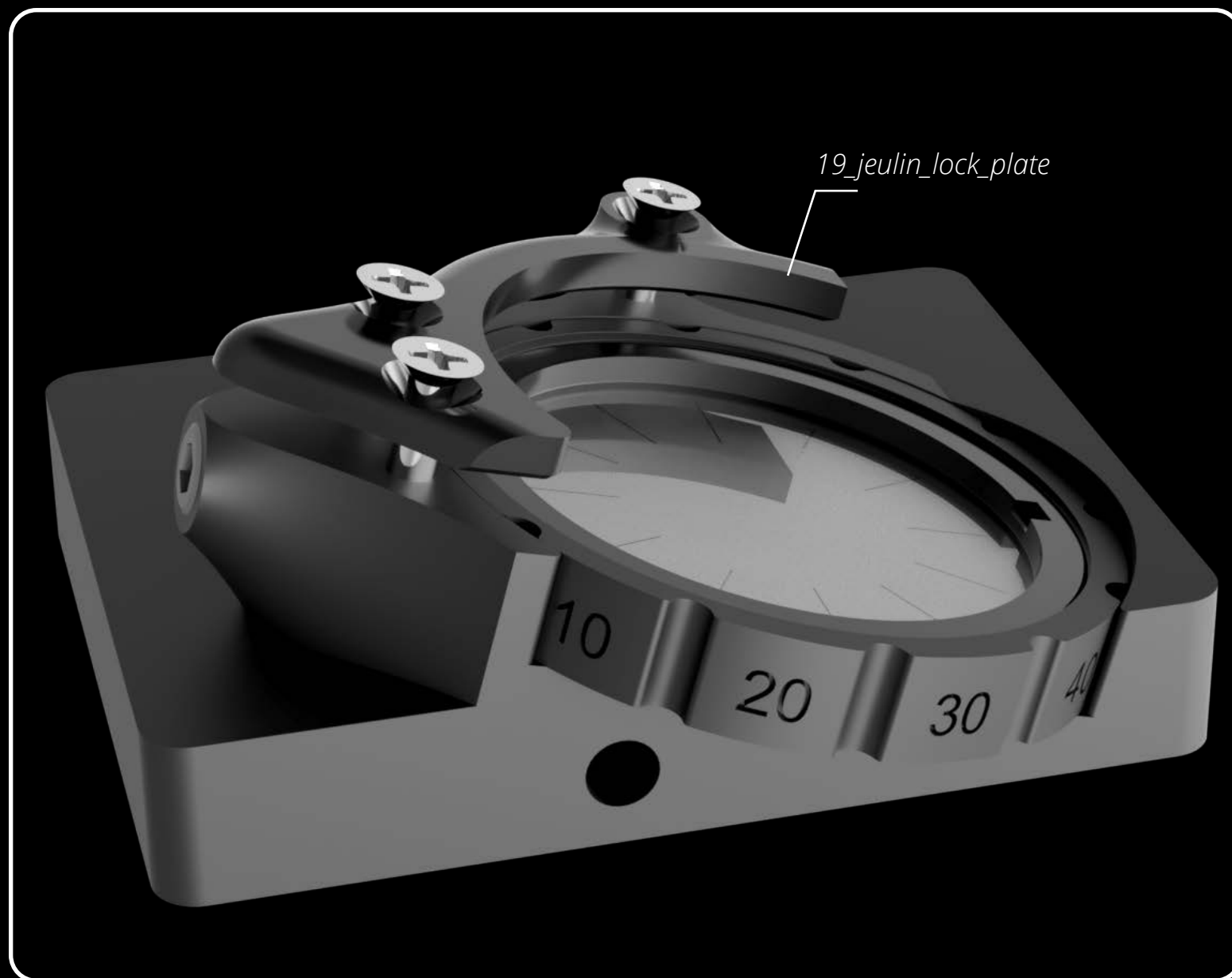
Screw in the locking ring (use the 'locking tool'). Make sure the Jeulin slit plate is kept in place by holding it down while you tighten it. It's a tricky procedure so take your time. Check the alignment of the slit and adjust the slit plate if necessary.



28

Place the slit holder in the platform. It's easier if you orient it in such a way that a notch is in the same position as the steel ball is. Make sure that there is no movement when you apply a small amount of rotational force to it. If it does, screw in the M6 grub screw to increase the force on the steel ball. If that does not work, check the opening of the steel ball. It could be a bit too small (due to the 3D printing process the top of the opening (white arrow) can be a bit too flat) so that the steel ball does not protrude enough. Carefully remove small amounts of material to enlarge it. Reassemble it and check again.

Also check the alignment of the slit and adjust the slit plate if necessary.



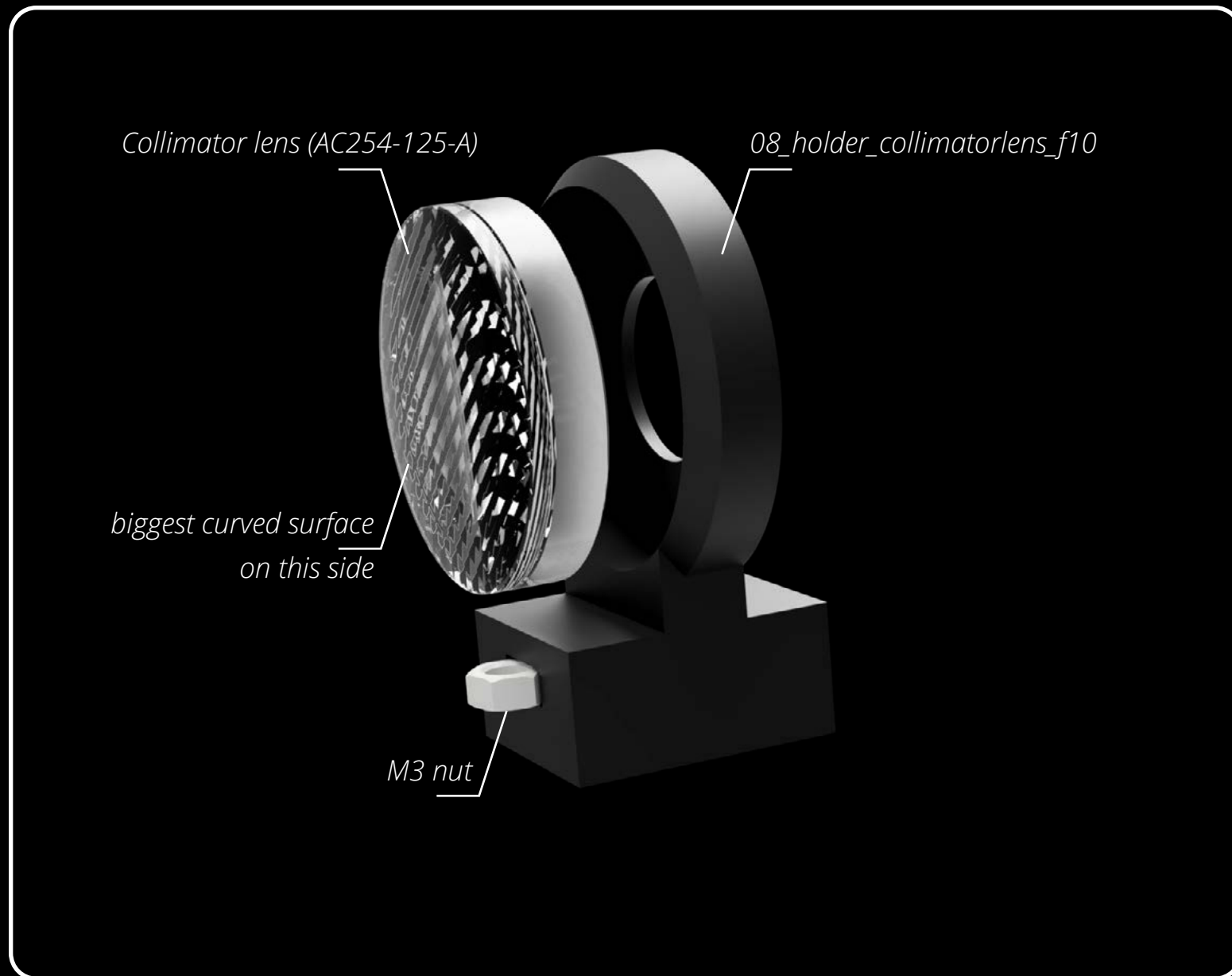
29

Attach the locking plate with three M3x10mm Philips screws. Check that the ring can rotate and that it clicks into position.



30

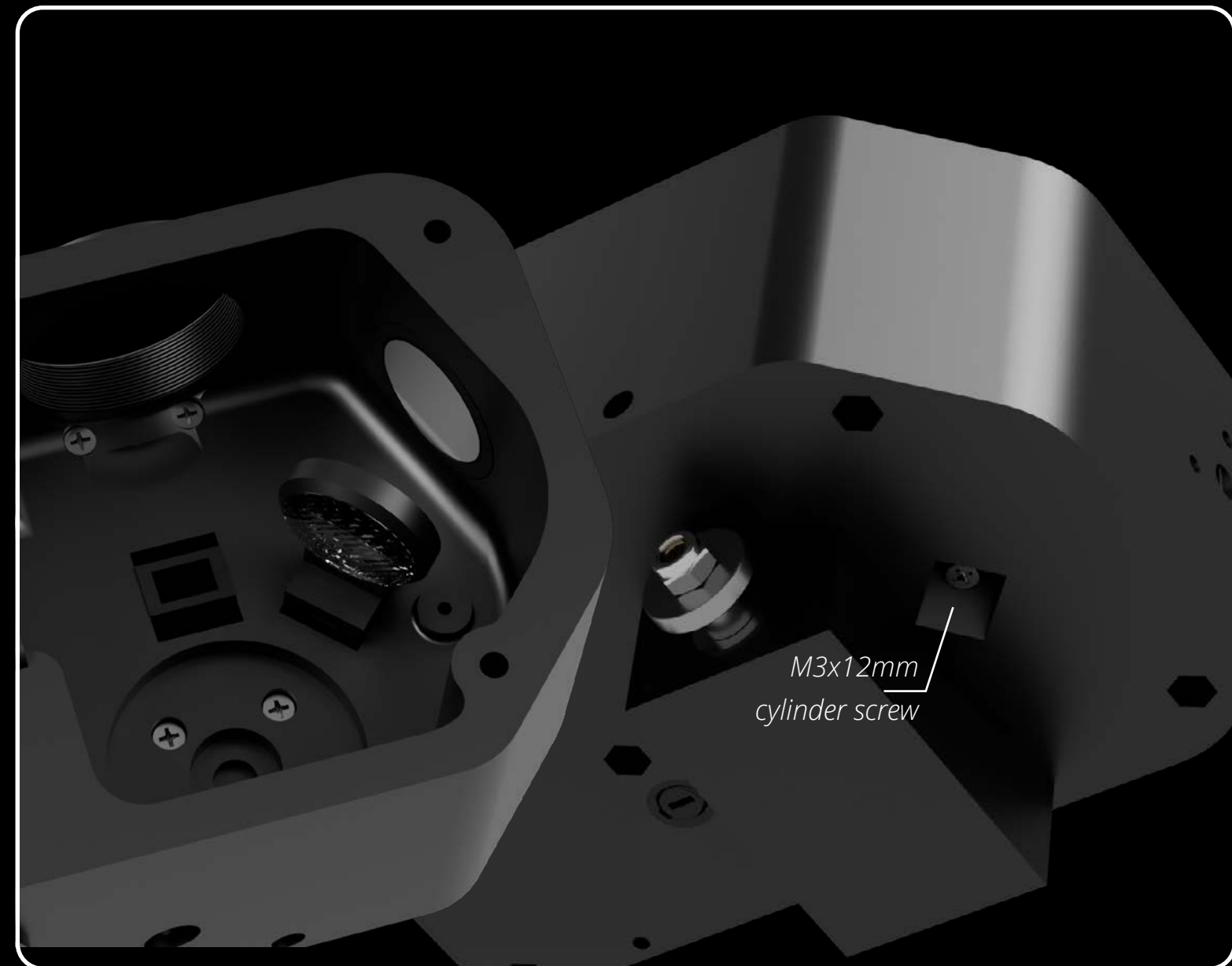
Slide the whole unit into it's position of the main body.



31

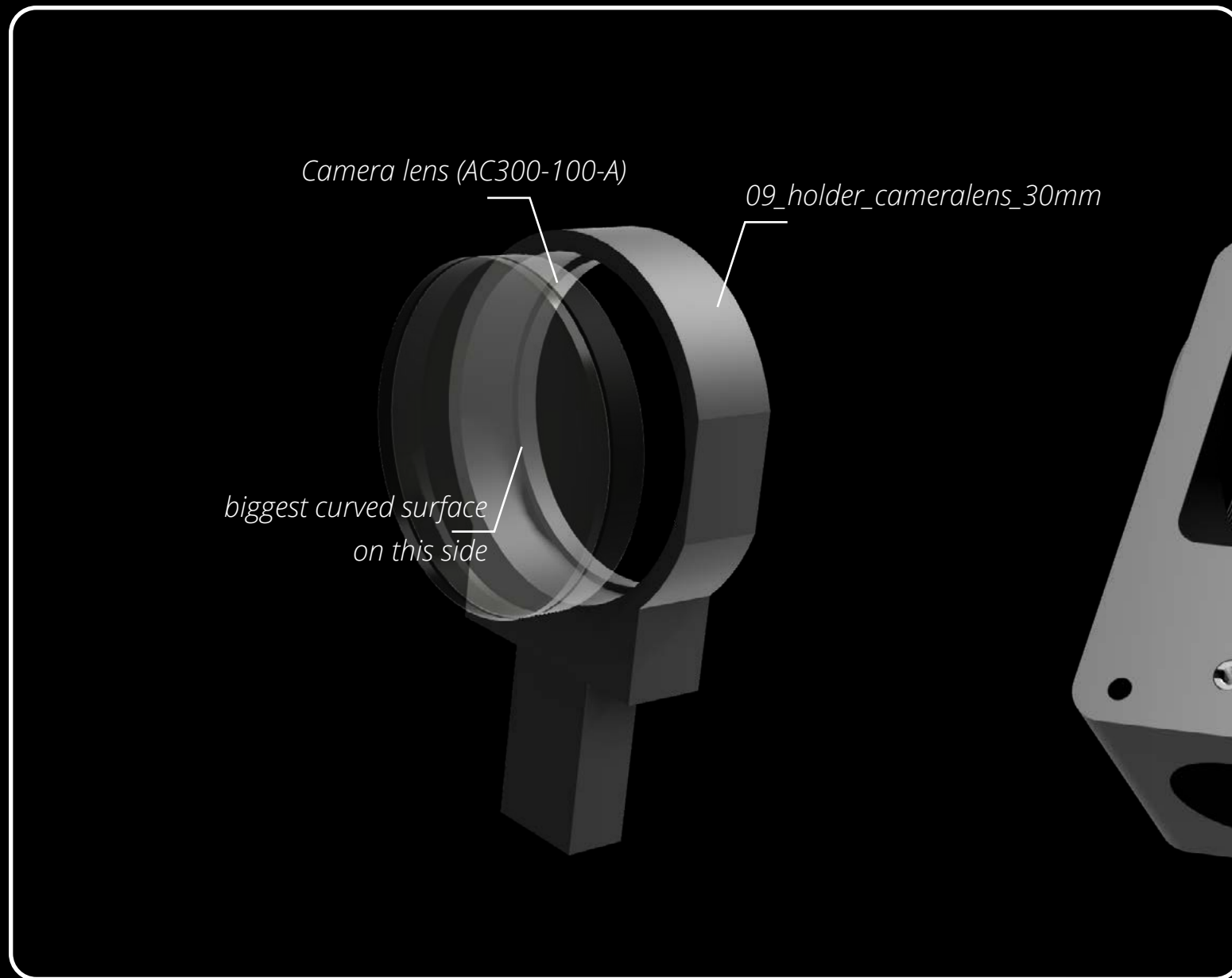
Press the collimator lens into its holder. Wear cotton gloves to protect the surface of the lens. Note the position of the parts. Insert a M3 nut all the way into its slot.

This holder is stopped down to f/10 for the 1800 l/mm grating. Using a faster telescope in that configuration will result in loss of light (which does not fall on the grating) . When using a 300 or 600 l/mm grating you could try the f/6 holder that's also included in the files.



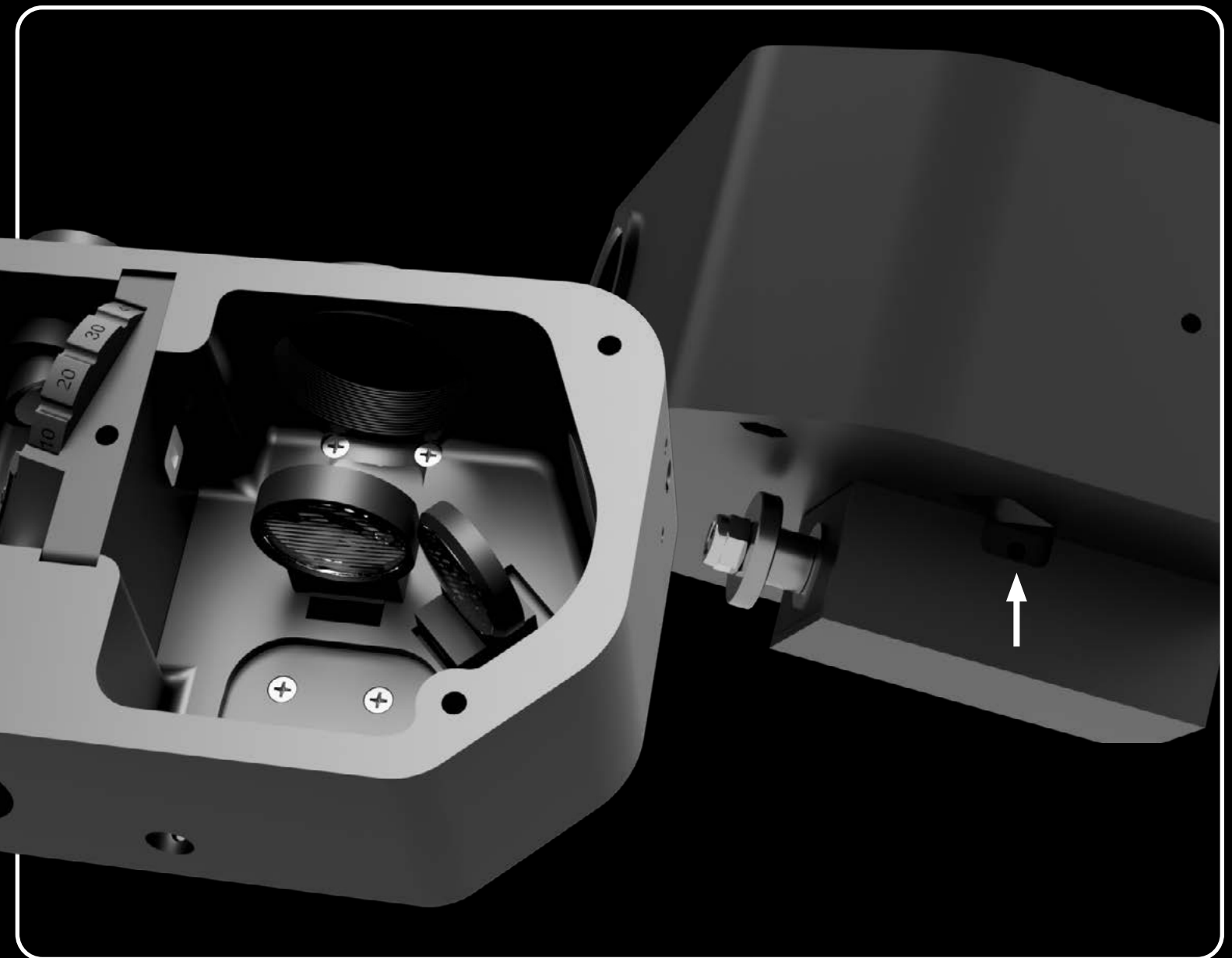
32

Place the collimator holder in the slot at the bottom of the main body. Take note of the orientation. Use a M3x12mm philips cylinder screw to keep the collimator in place. By loosening this screw a bit you are able to slide the collimator back and forth.



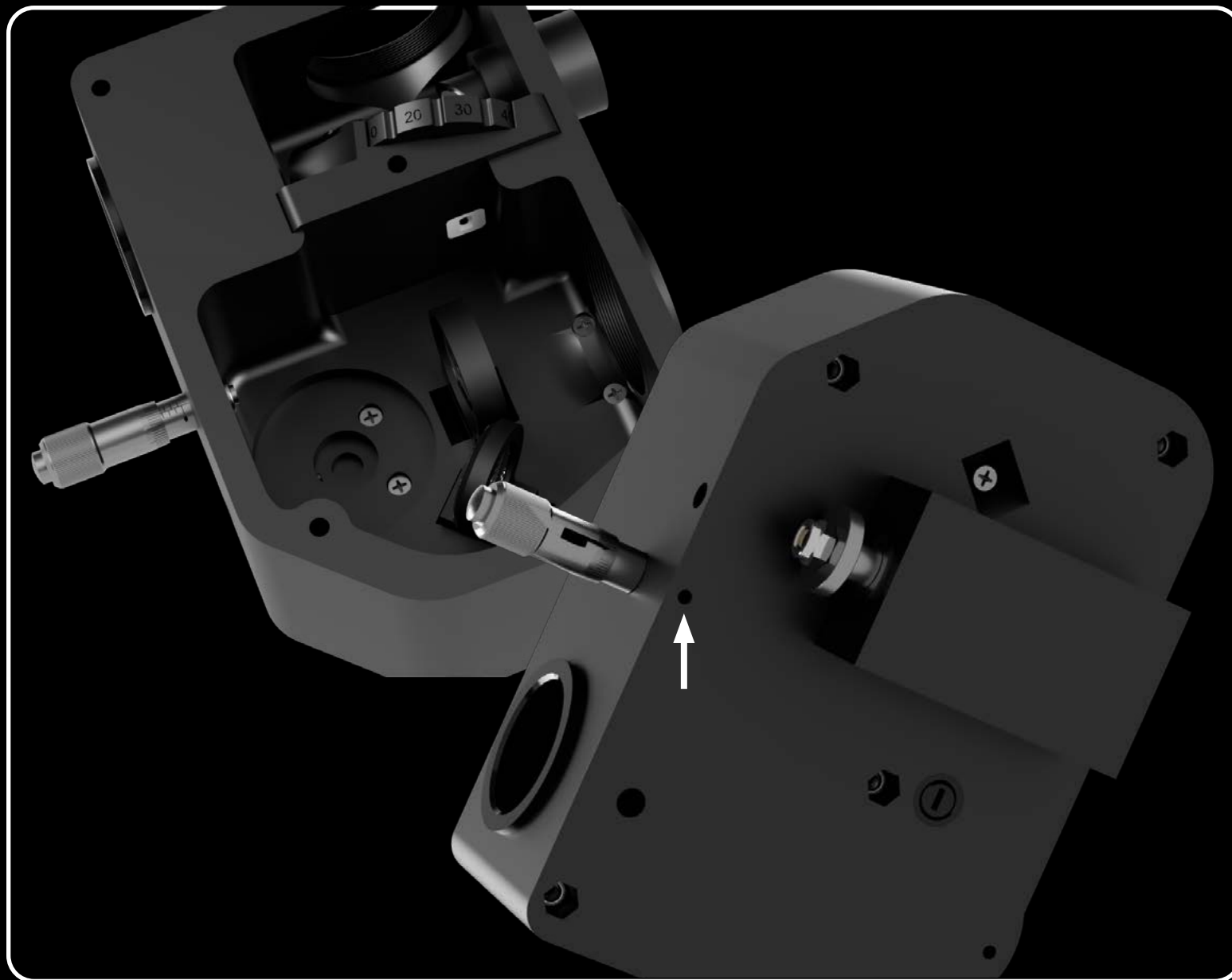
33

Push the 30mm camera lens (AC300-100-A) into it's holder. Note the orientation of the lens and holder.



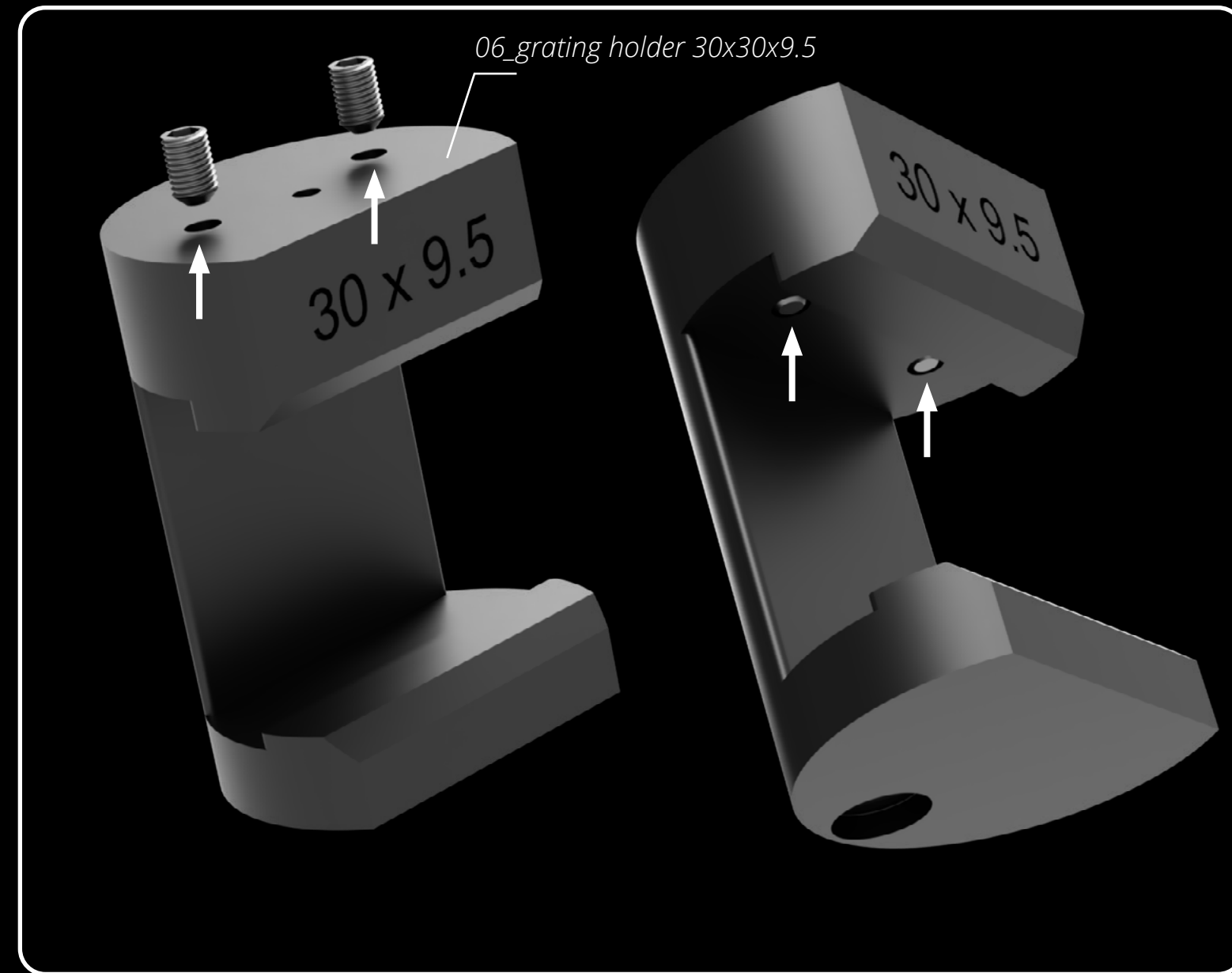
34

Place the lensholder in the slot and secure it by screwing the small grub screw (see white arrow) against it.



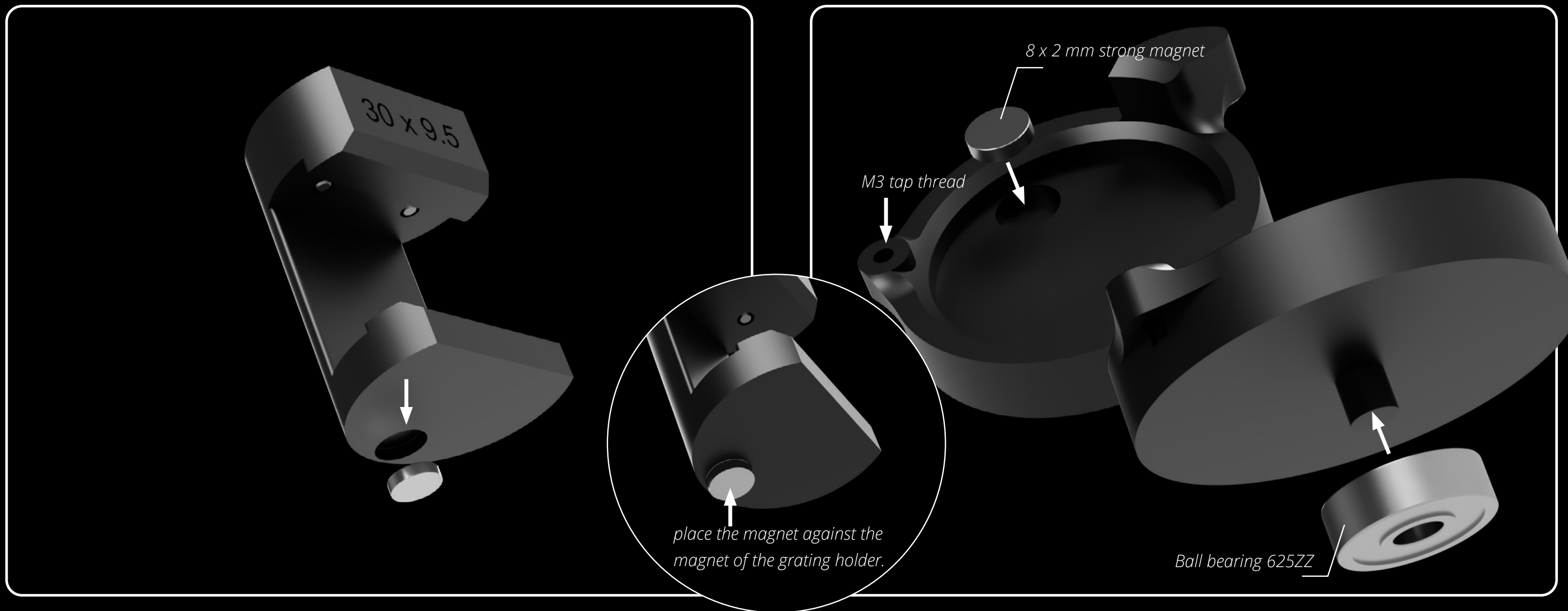
35

Place the micrometer and secure it with the Allen Grub Screw (arrow). The micrometer used has a mounting diameter of 9.5mm and a travel of 1-13mm.



36

There are 3 sizes of grating holders supplied. Which one you use depends on the physical dimensions of the grating you want to use. In the picture above the markings tell that this holder is for a 30 x 30 mm grating with a thickness of 9.5 mm. There is also a 25 x 6 and 25 x 9.5 size. Use a M4 threading tool to thread the two outer holes on the topside of the grating holder. For the middle hole use a M3 threading tool. The preprinted centre hole is 9 mm deep so take care not to thread it deeper than that. Next screw a Allen Grub Screw (M4x6mm) into each of the threaded outer holes. Make sure they do not protrude at the bottom as you'll have to slide the grating into position later on and you don't want them in the way



37

Put a small amount of glue (epoxy) in the hole at the bottom of the grating holder. Insert the small permanent magnet (diameter 8 mm, thickness 2 mm) in the hole. Make sure it does not stick out. The bottom of the holder needs to be flat.

38

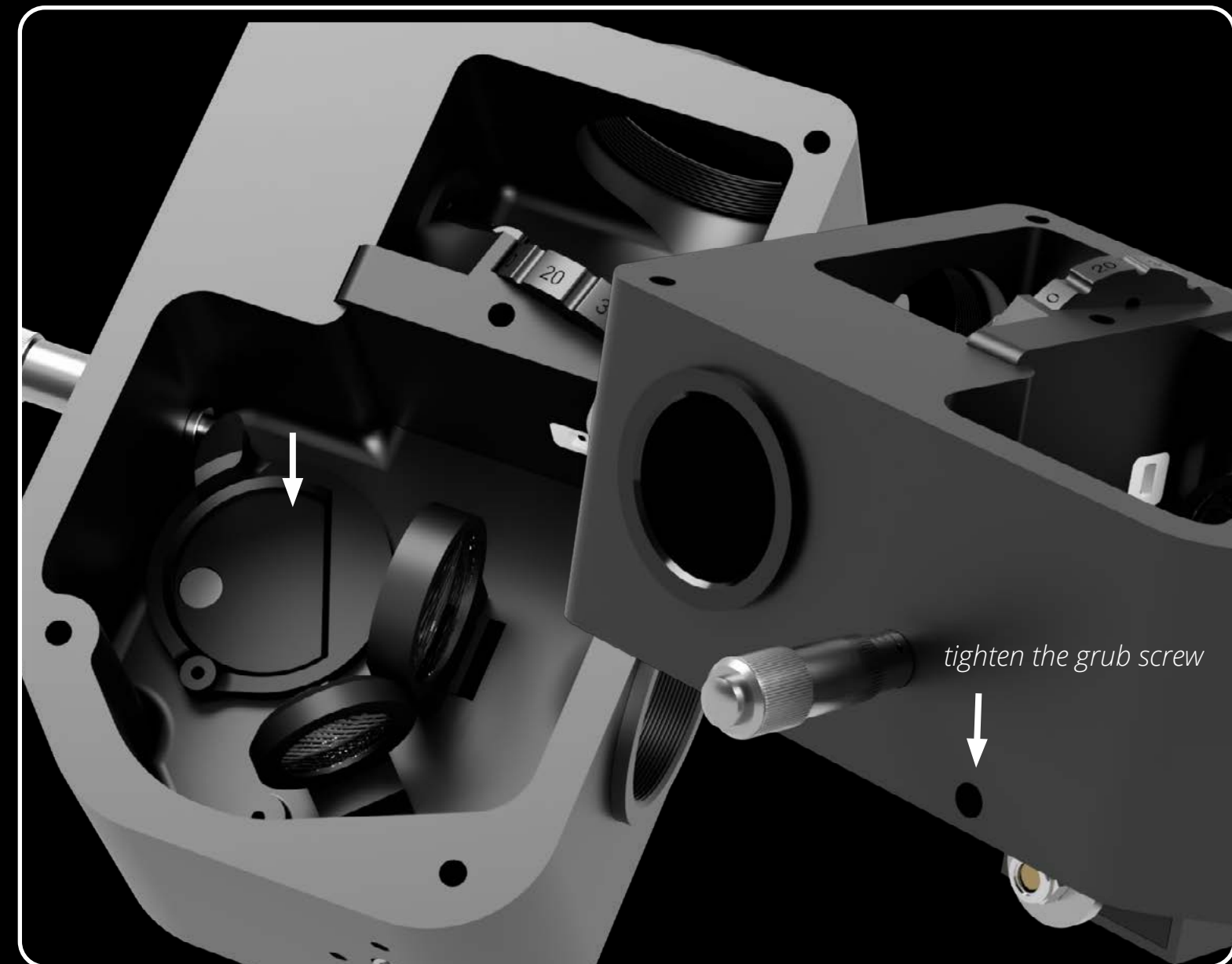
Thread the small hole at the side of the turn table with a M3 threading tool. You are now going to place a magnet at the bottom of the turntable. But before you do, make sure the orientation of that magnet is correct! Take that magnet and place it against the magnet of the grating holder. Mark it so you'll know how to place it correctly into the turn table. Place a small amount of glue at the bottom of the hole and push the magnet in. Make sure it's sitting flat and does not stick out.

On the bottom side push the 625ZZ ball bearing over the pin. You can use a small amount of glue but be aware that you only glue the bearing to the pin. Press it all the way up until it contacts the bottom of the turn table.



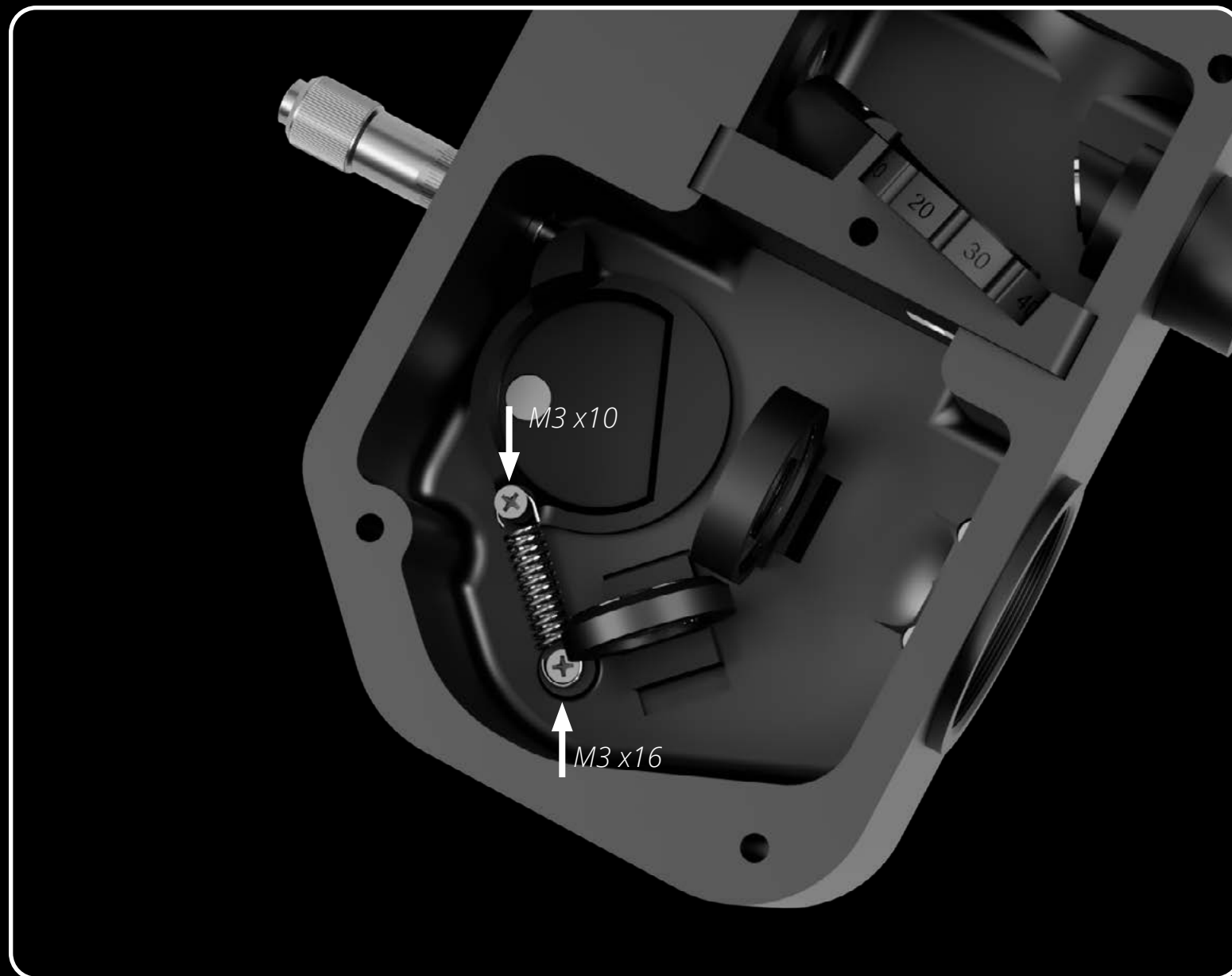
39

Test that there is a good fit between the grating holder and the turn table. Make sure that the two magnets place the grating holder correctly into the turn table.



40

Place the turn table into the main body (see picture) and tighten the grub screw. Check that the turn table can rotate smoothly.

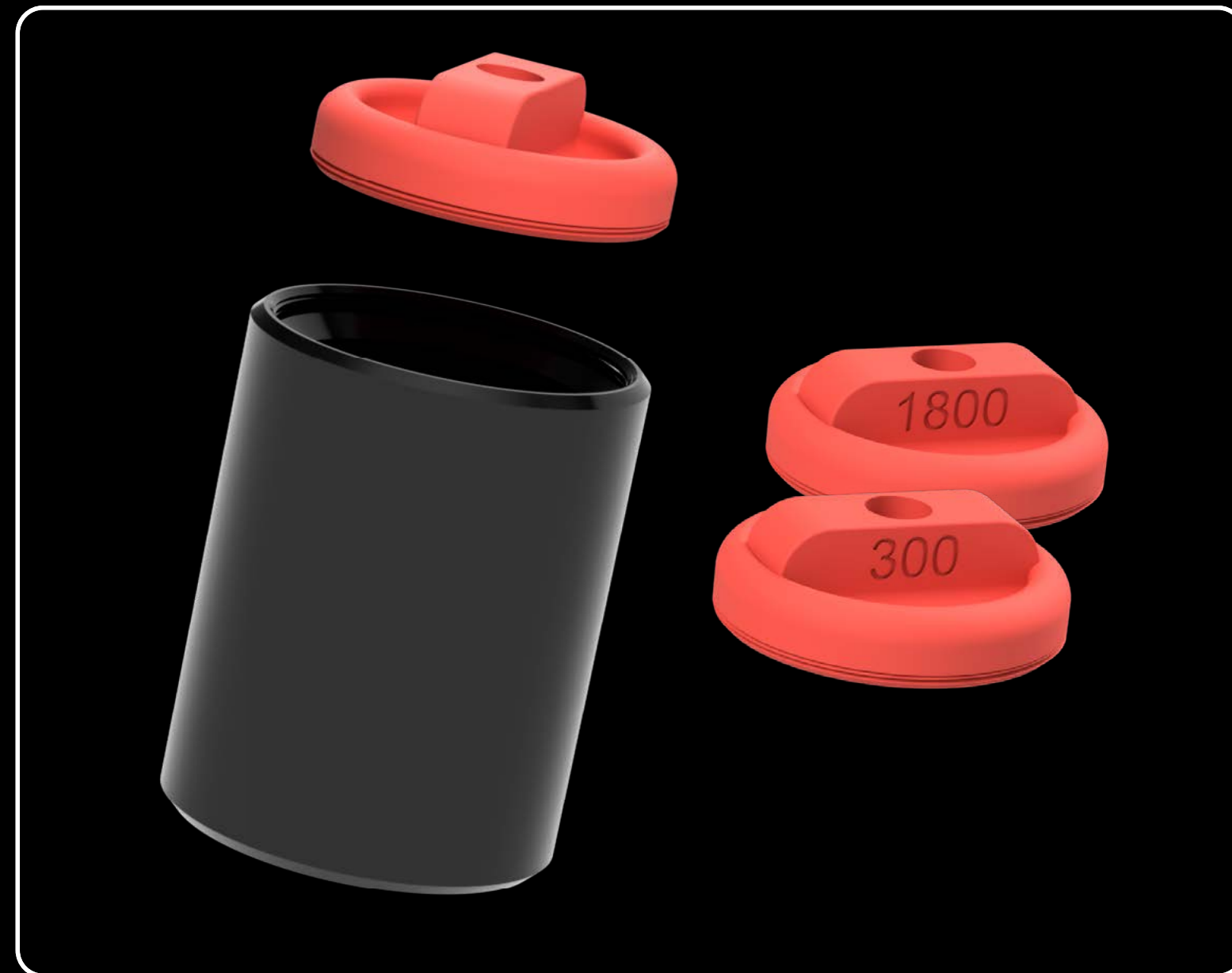


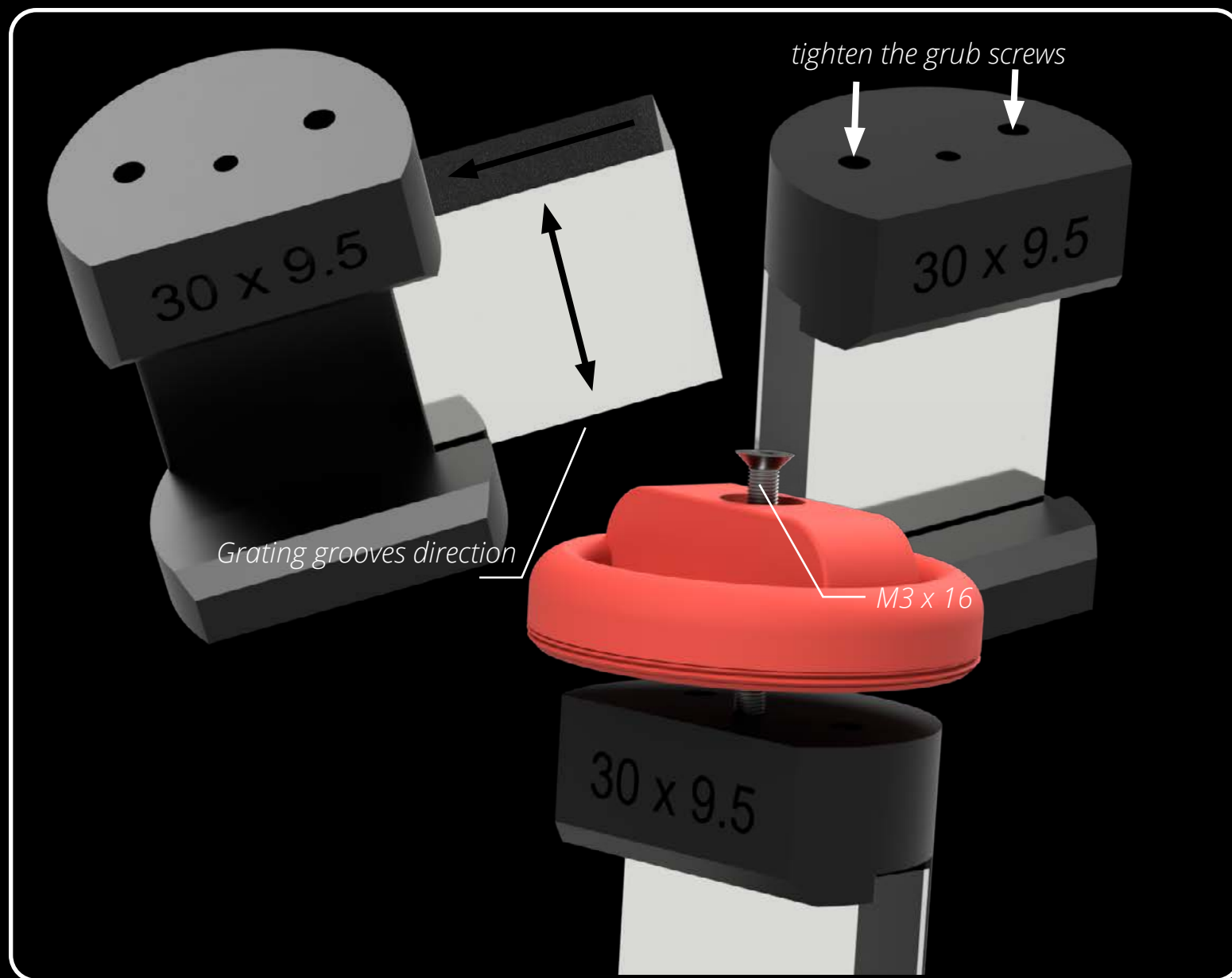
41

Install the coil spring with two M3 cylinder screws. In order not to inadvertently damage the lenses it may be a good idea to temporarily remove them. Make sure the turn table functions properly by turning the micrometer screw.

42

Now, before you proceed with the next step, make sure you've printed the grating container and the grating holder cap. That's because you'll have to store the the grating holder with the grating you are about to install in a safe place so it cannot be damaged. There are a few files of caps that have numbers on them that correspond to the line density of your grating so it's easy to identify them later.





43

During this step it's very important that you NEVER, EVER touch the ruled reflective side of the grating!! Grease from your fingers can damage the surface and it's not possible to clean this surface. So hold the grating only at its sides and gently slide it in the grating holder. Make sure that the grating is orientated in such a way that the grooves are in the right direction and the reflective surface is facing out. Some gratings are blazed, meaning that the grooves are shaped in such a way that most of the energy is directed to the first order spectrum. These gratings often have a small arrow on their side. In most cases the arrow should be pointing in the direction as illustrated above. Tighten the two grub screws so that the grating is secure in the holder. Next take the grating cap and slide an M3 x 16 mm cylinder screw through it. Screw it into the top of the grating holder and make sure it's perpendicular to its top surface.



44

Grab the grating holder assembly by the cap and lower it into its container. Screw the cap tight so that your grating is safely stored for future use.



45

Place the lid and secure it with five hexagon socket head cap cylinder screws (M4 x 60). Also screw in the knurled screw (M4 x 25mm) or any other M4 screw.



46

Get the grating holder out of it's container and lower it into the opening. Make sure that the grating is facing the camera opening. The magnet should pull the grating holder onto the turn table. Screw the cap into the lid.



47

If you want to make use of the slit illumination and have the Baader crosshair illuminator then unscrew the plug (arrow) and screw in this small device.

48

You've done it! Your LOWSPEC is ready!

