# Mach - Zehnder Interferometer

3DOptiX

90004

# Introduction

The Mach-Zehnder Interferometer reference design is part of the 3DOptix™ Interferometer design series. Interferometers use the property of interference between two optical beams to accurately measure various optical properties. 3DOptix™ provides an easy and precise manner in which to build such devices.

The Mach-Zehnder interferometer uses two beam-splitters, which are partially transmissive mirrors that divide an optical beam into two separate beams - called arms. One of the beam-splitters is used to split the optical beam and the other is used to recombine them. Usually, the optical path lengths of the two beams are not equal and often an external delay line is added to one path to control its length. The difference between the path lengths of the two arms affect the interference pattern and can be adjusted by accurately moving one of the mirrors.

Our reference designs include the 3DOptix™ building-blocks, which are based on the BreadBox™ platform and its modular and versatile optomechanical mounts and adaptors. The advantage of 3DOptix™ devices are that they are modular and very robust. Once the reference designs are assembled they can be moved around as a unit while maintaining the accuracy of the device. The following design is for optical elements of Ø1"/25mm. With the following easy-to-use instruction manual and its associated instructional video, you can focus on experiments and not on alignments.

# Parts Description:

**Parts included in the reference design**

| Mach-Zehnder Ø1"/25mm - Parts Description | Item Number | Qty |
|---|---|---|
| Premium Box Frame - Floor/ceiling 9 (3X3) mount locations | 20020 / 20020-M | 3 |
| Premium Box Frame - Wall Frame 9 (3X3) mount locations | 20010 / 20010-M | 1 |
| Premium Box Frame - Wall Frame 4 (1X4) mount locations | 20018 / 20018-M | 3 |
| Premium Box Frame - Floor/ceiling 3 (1X3) mount locations | 20022 / 20022-M | 3 |
| Translator Box Frame – Floor/ceiling 9 (3X3) mount locations | 20600 / 20600-M | 1 |
| Fixed Mount - Triangular Ø1"/25mm Mirror/DM Mount | 20100 / 20100-M | 5 |
| Triangular Kinematic Mirror Mount Ø1"/25mm | 20200 / 20200-M | 4 |
| Iris Mount Ultimate | 20502 / 20502-M | 1 |

| Included Hardware and Screws | Qty |
|---|---|
| Imperial: 4-40 Cap Screw, 1/4" Long | 39 |
| Metric: M2.5-0.45mm Cap Screw 6mm Long | |
| 2.5mm 18-8 Stainless Steel Dowel Pins | 14 |
| Aluminum Unthreaded Spacer - 1/8" Long, 5/8" Outside Diameter | 2 |

The 3DOptix optomechanical elements are compatible with optical elements from any major company. Here we recommend third-party parts that should be purchased. These parts may vary depending on the specific spectral needs of your setup.

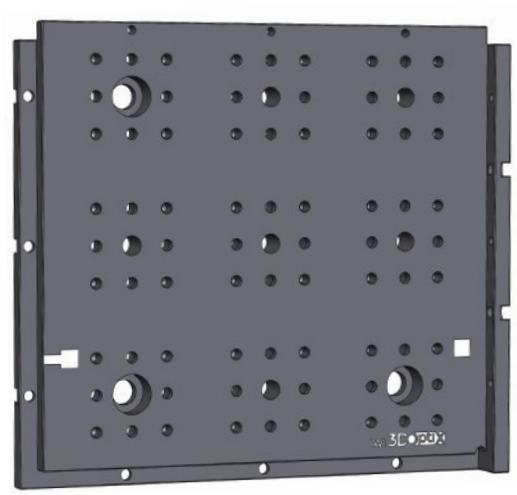
## Parts not included in the reference design

| Recommended third party optical/optomechanical elements | Qty |
|---|---|
| Metallic/Dielectric mirrors | 7 |
| Ø1"/25mm Beamsplitter 45° AOI | 2 |
| Threaded Iris Diaphragm, SM1 (1.035" - 40) | 1 |
| 1" Lens Tube, SM1 (1.035" - 40) | 2 |
| Retaining Ring, SM1 (1.035" - 40) | 2 |
| Fluorescing Alignment Disks | 2 |
| Travel Linear Translation Stage compatible with manual and motorized heads for 1" translator height - Spacers/Washers are provided as part of the reference design. Translator + Spacers/Washers height should be - 1.125" / 28.12mm | 1 |
| Ø1/2"/12.5mm Post Holder, 1.5"/37.5mm Long | 2 |
| Ø1/2"/12.5mm Post, 1"/25mm Long | 2 |
| 1/4"-20 Stainless Steel Cap Screw, 3/8" Long | 4 |

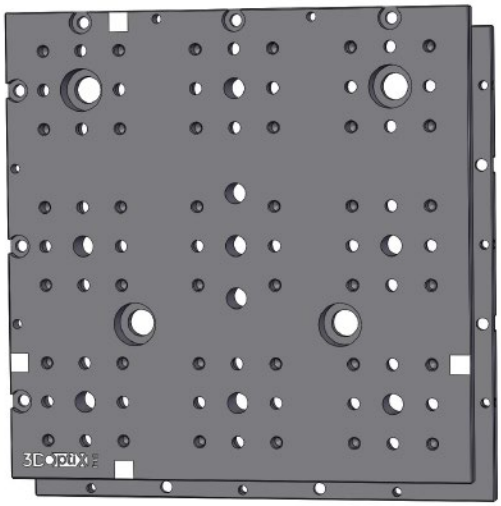
### Safety Note:

Our reference designs serve as guides for building common optical setups, often found in labs, with the 3DOptix™ parts. They provide a reference for your own designs and a good place to start learning how to build with the 3DOptix™ optomechanical elements. All reference design assembly instructions have passed our quality and safety procedures. Though, there are various ways to assemble the apparatus, we recommend to closely follow the provided assembly instructions as measures have been taken to ensure maximal safety.
Assembly of the optical elements inside the optomechanical parts should always be performed when the light source is blocked, otherwise unwanted reflections can occur. The accuracy of our products guarantees great precision of alignment, therefore make sure that the relevant holes of all structures are blocked in order to avoid stray light beams from passing through. When lasers are on always use proper laser safety eyewear for maximal protection.

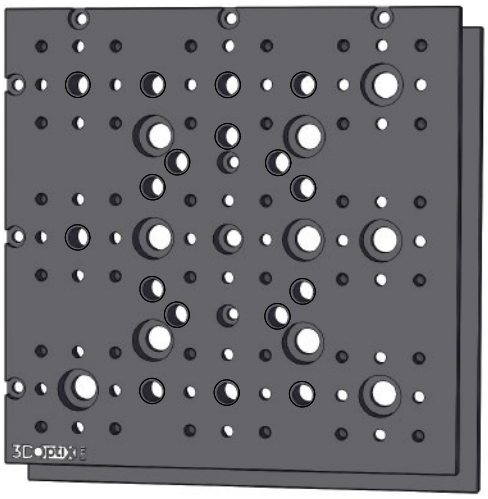
# Parts List



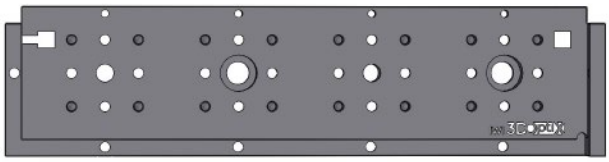
Premium Box Frame - Wall Frame 9 (3X3) mount locations **x1**



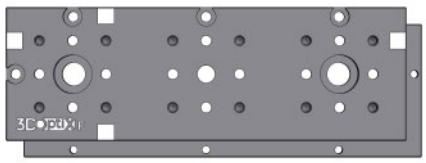
Premium Box Frame - Floor/ceiling 9 (3X3) mount locations **x3**



Translator Box Frame - Floor/ceiling 9 (3X3) mount locations **x1**

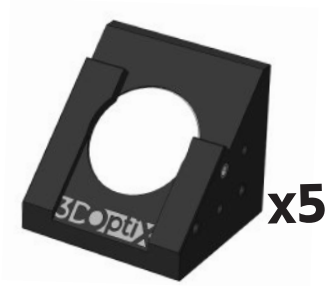


Premium Box Frame - Wall Frame 4 (1X4) mount locations **x3**

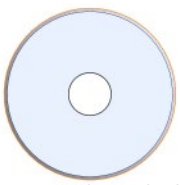


Premium Box Frame – Floor/ceiling 1 (1X3) mount locations **x1**

Elite Triangular Kinematic Mount - Ø1"/25mm **x4**



Fixed Mount - Triangular Ø1"/25mm Mirror Mount **x5**

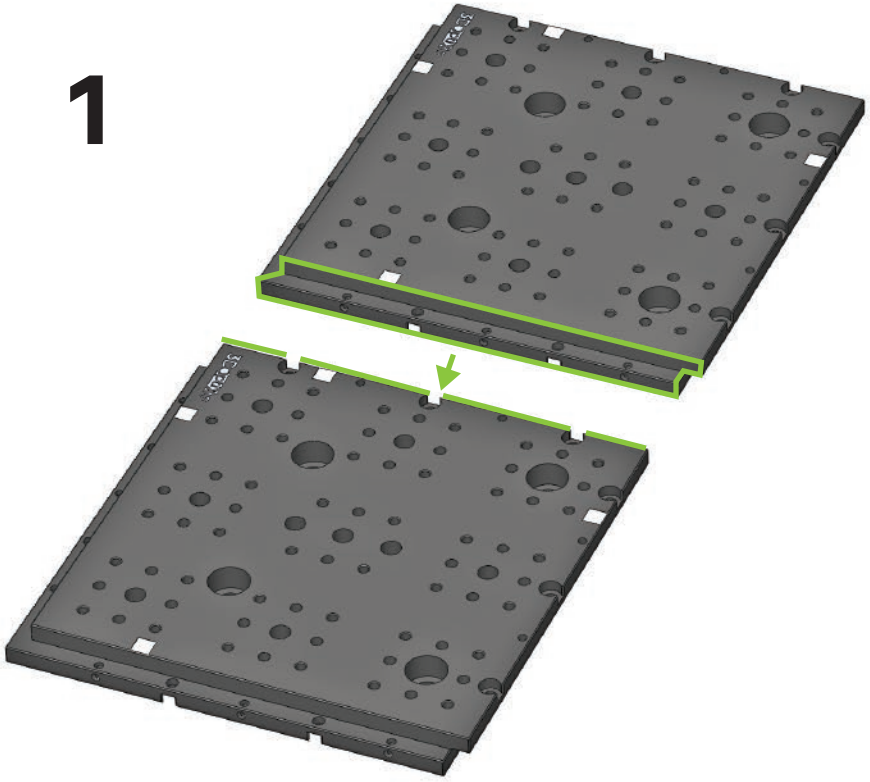


Aluminum Unthreaded Spacer **x2**

#4-40 / M-2.5-0.45 **x39**

DOWEL PIN **x14**

1



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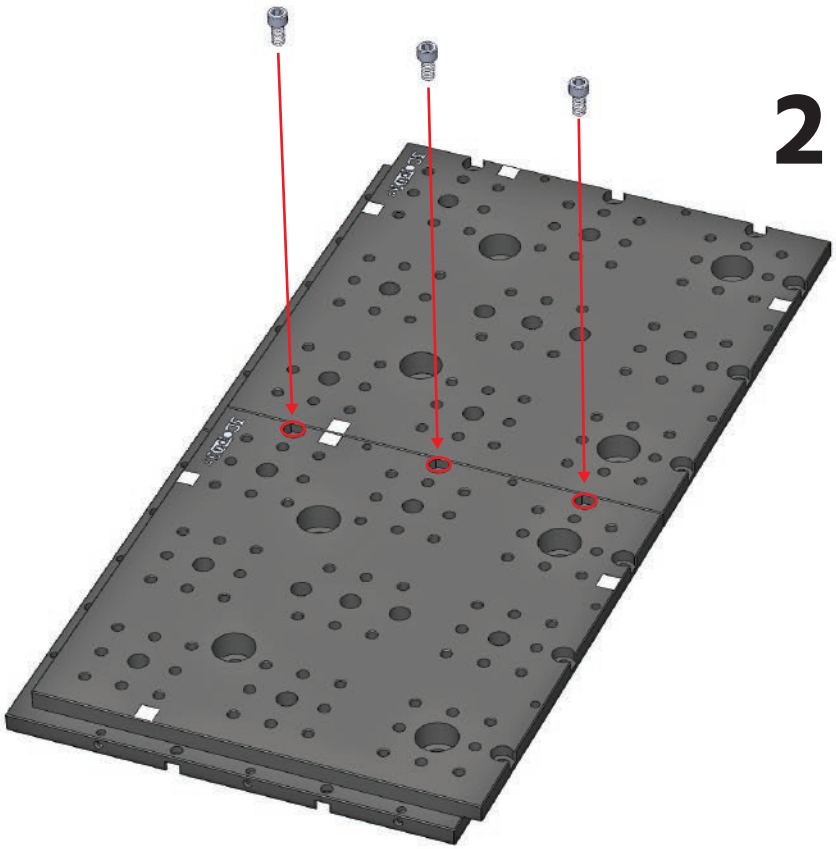

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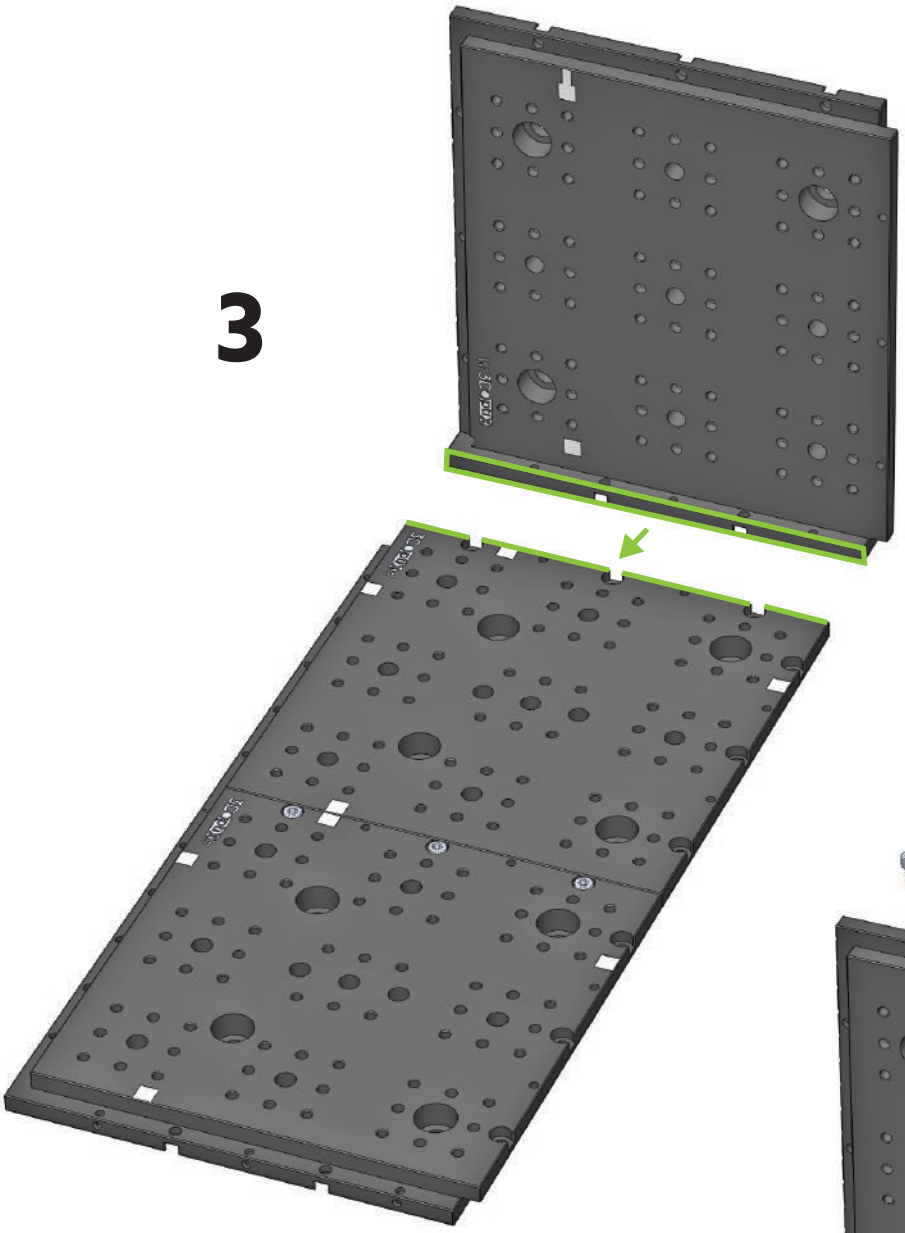

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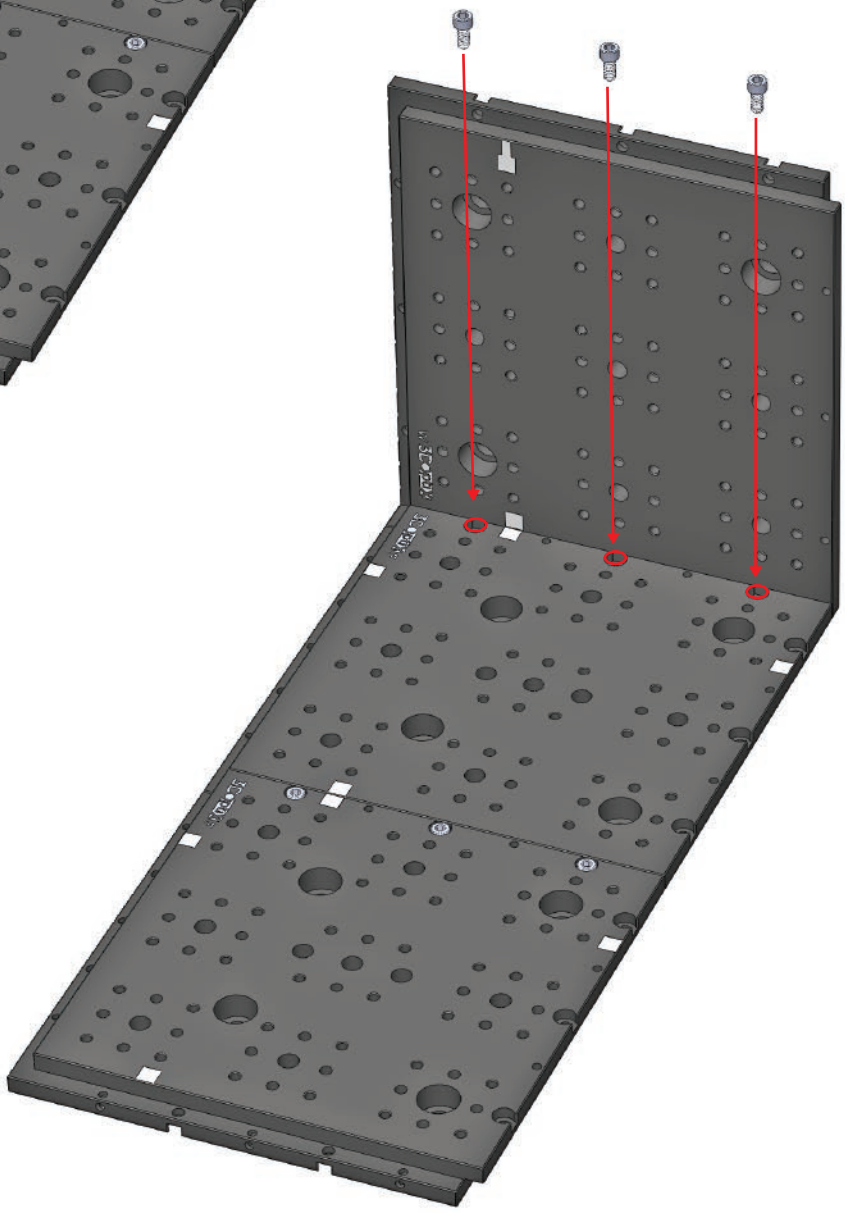

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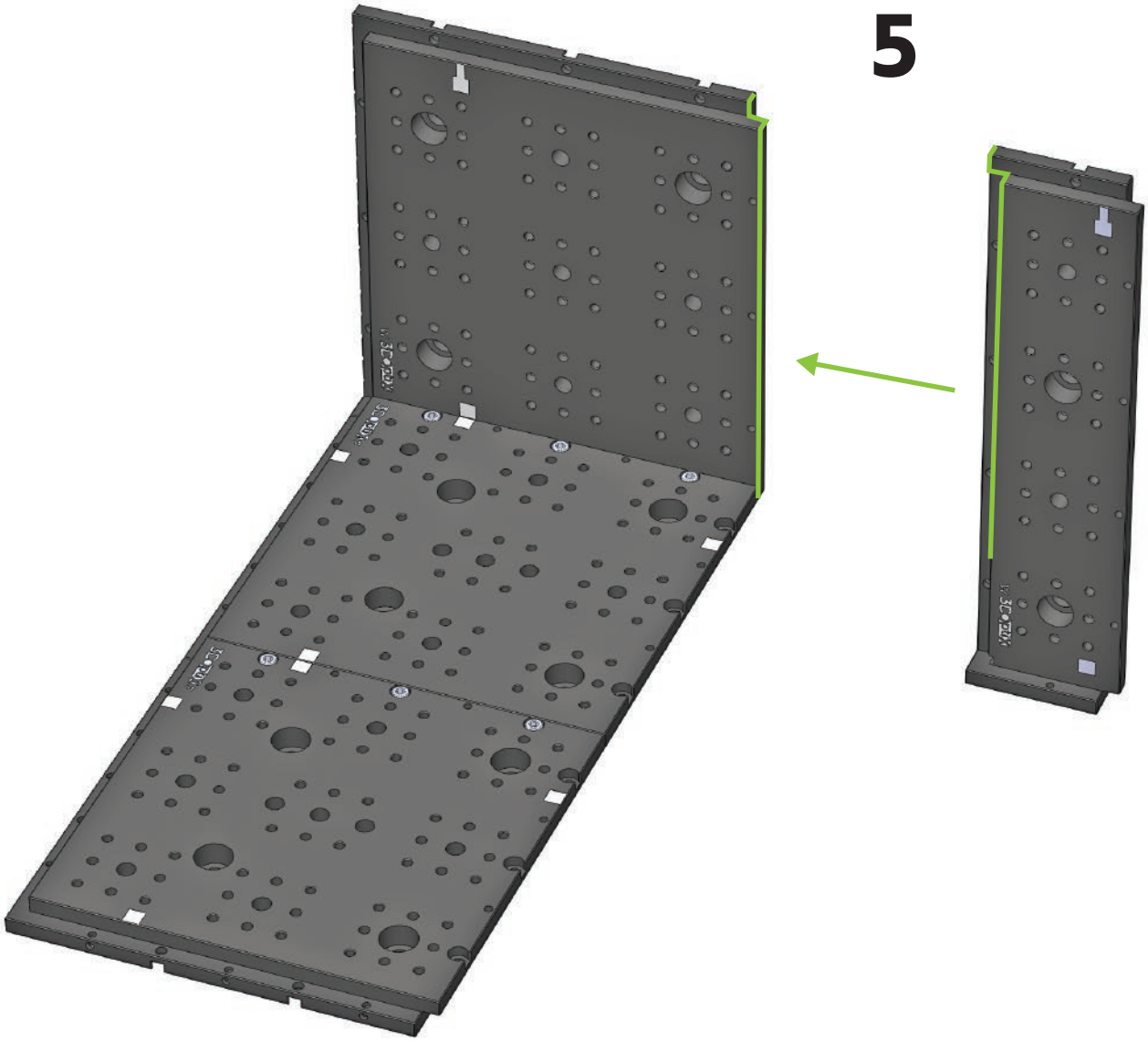

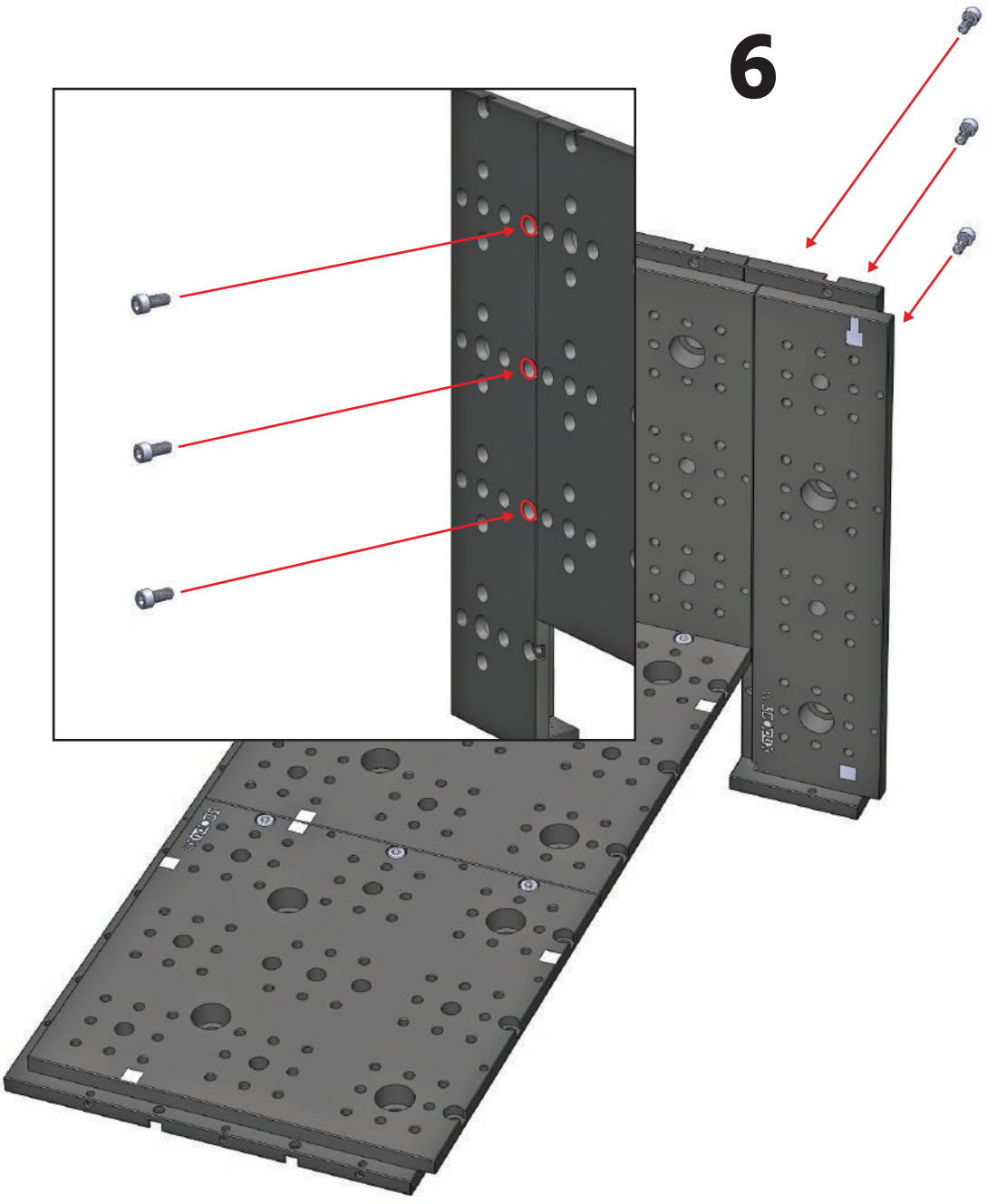
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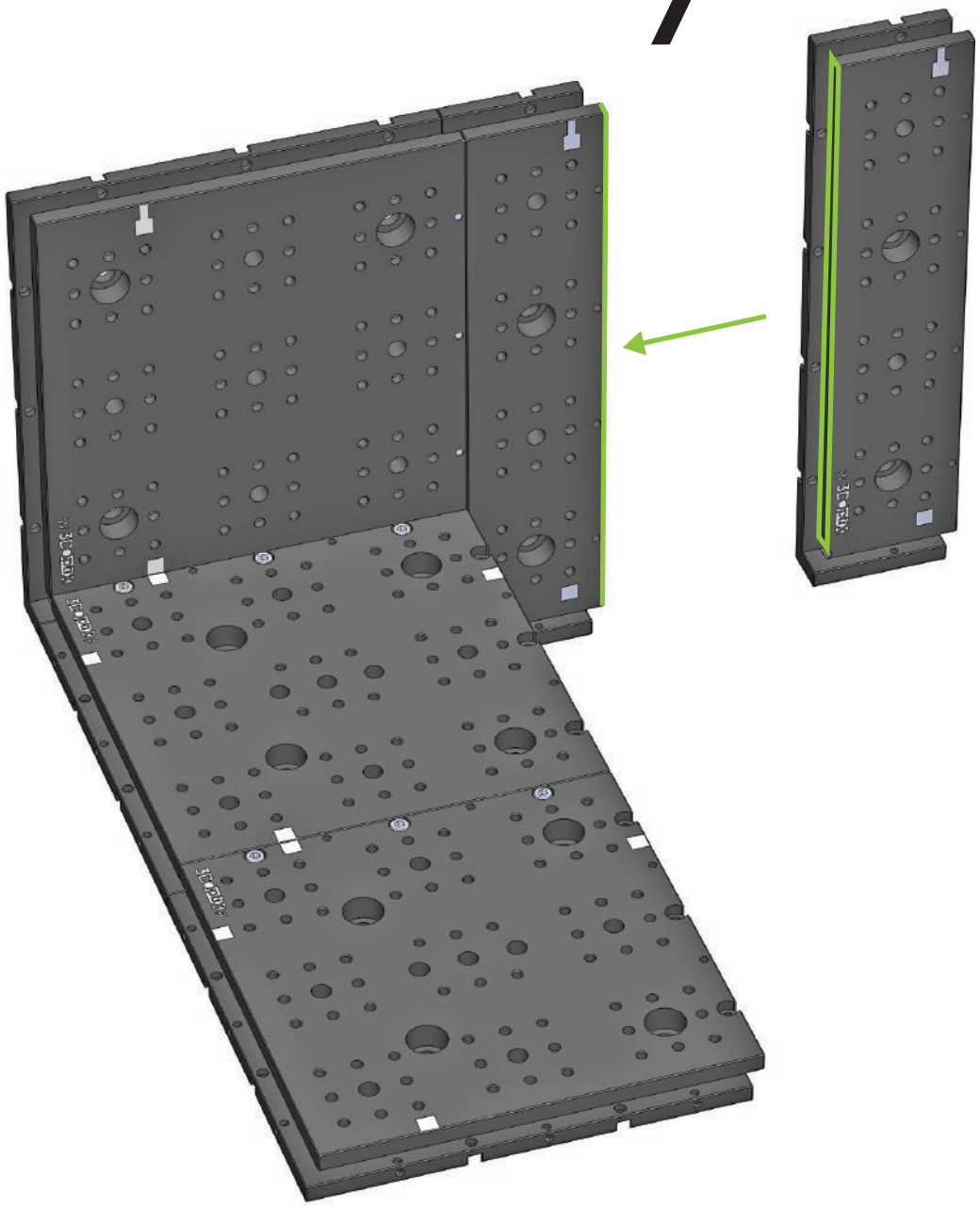

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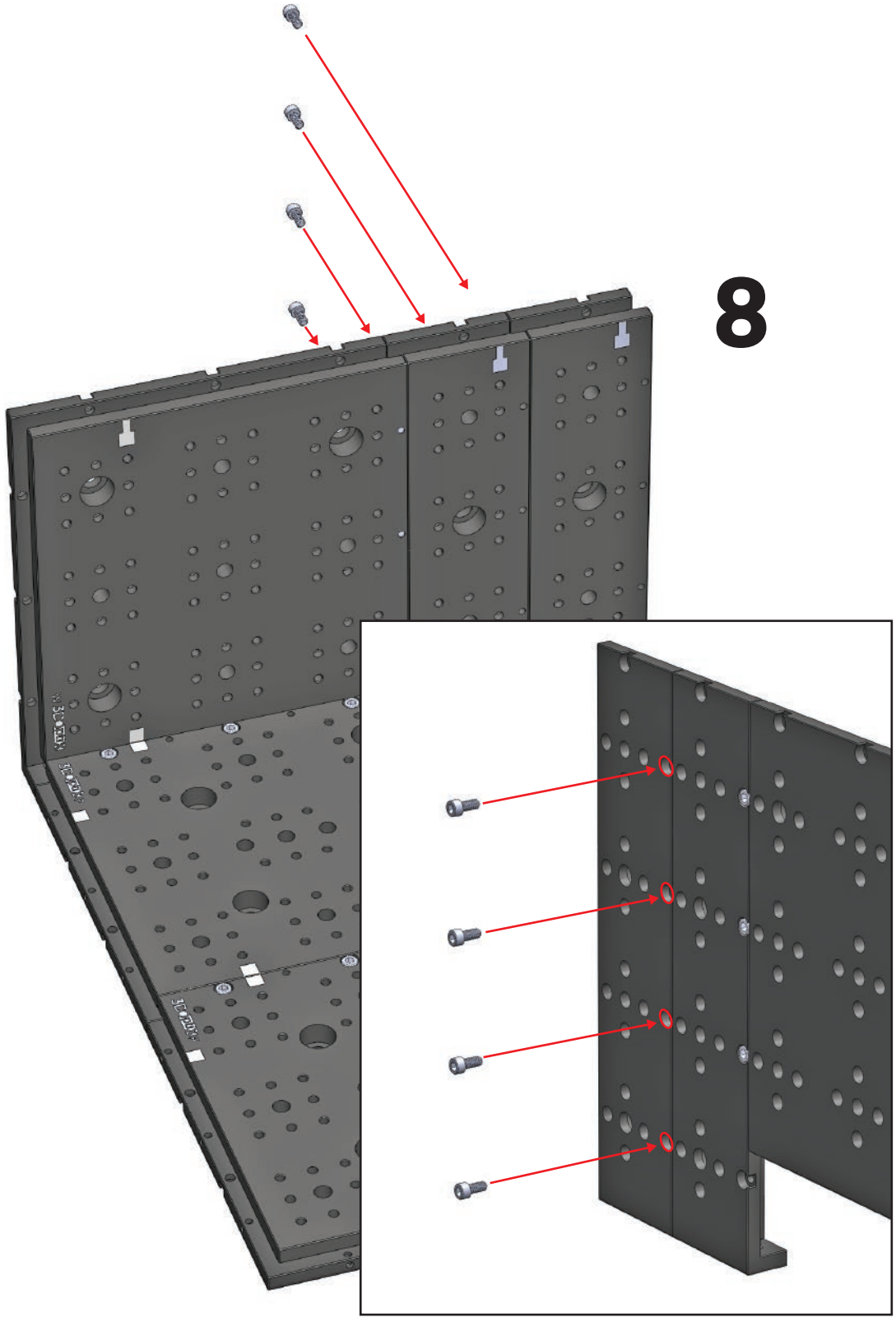

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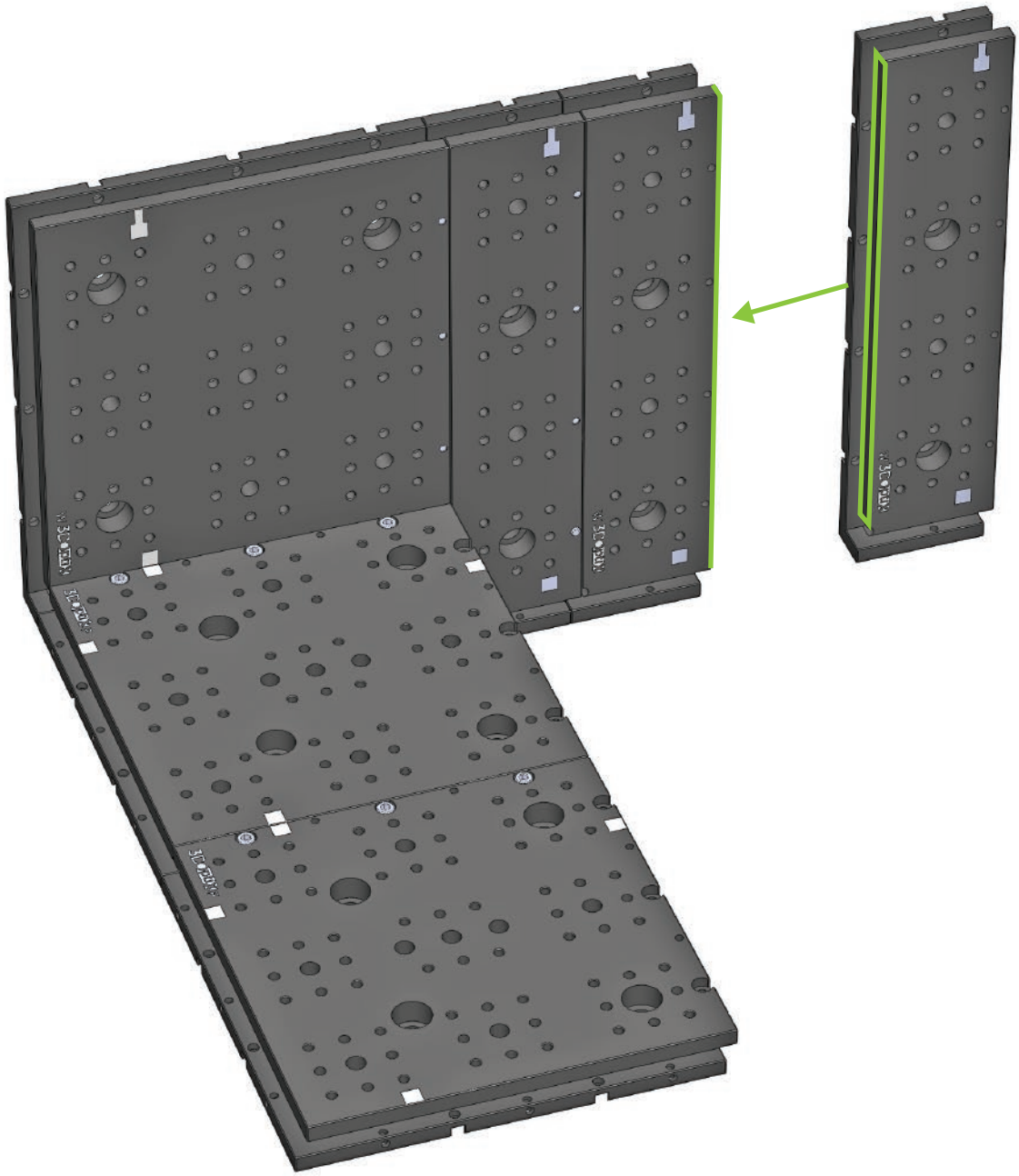

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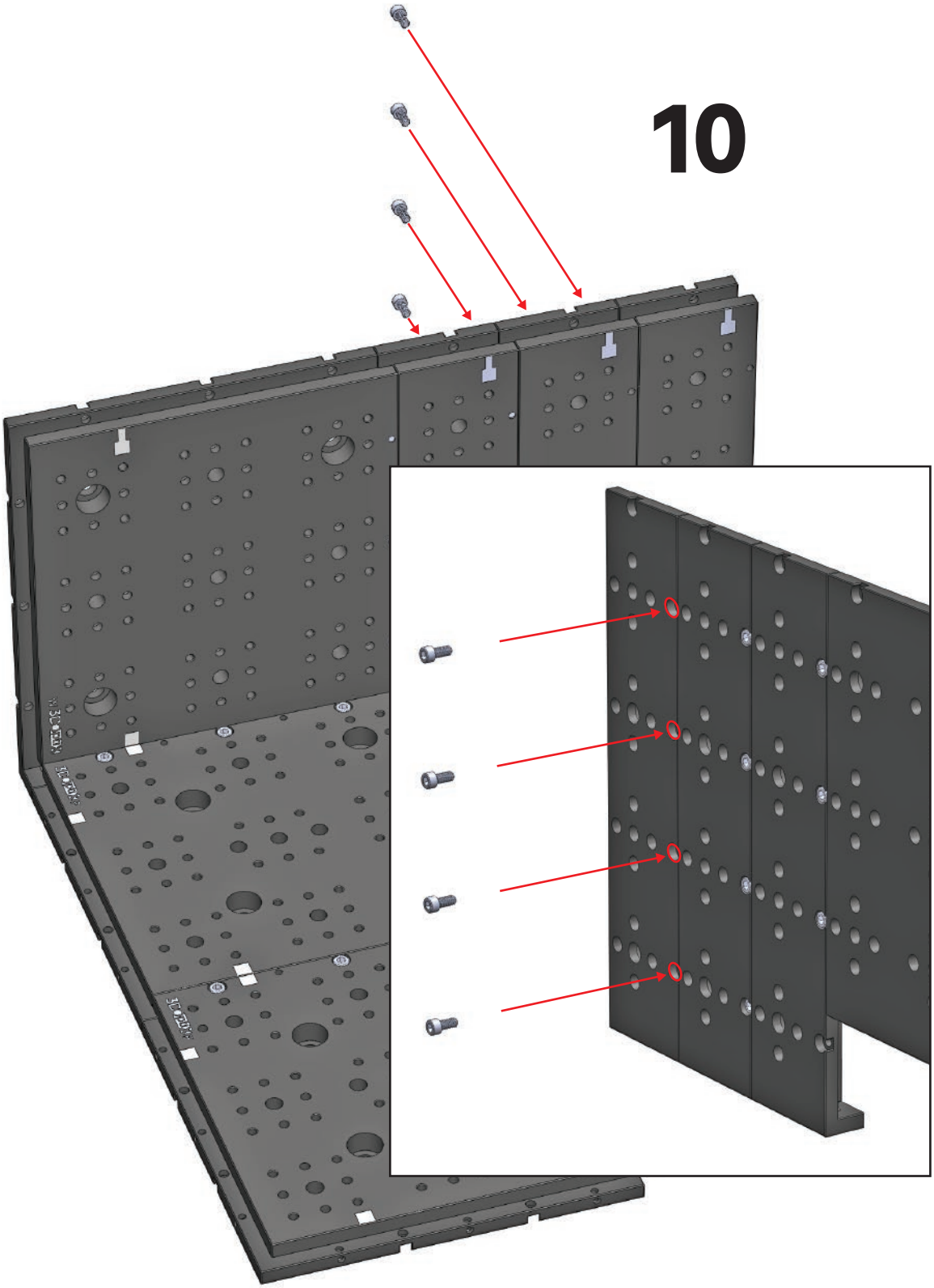

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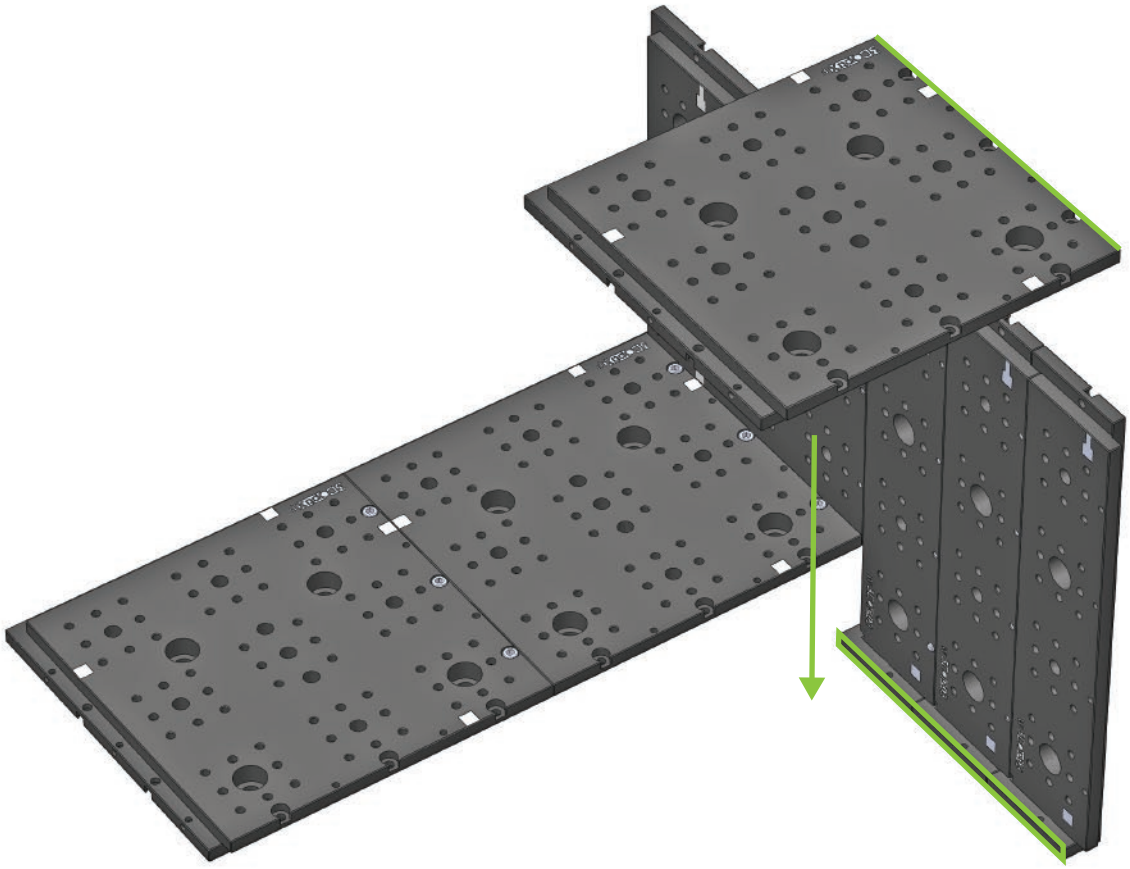

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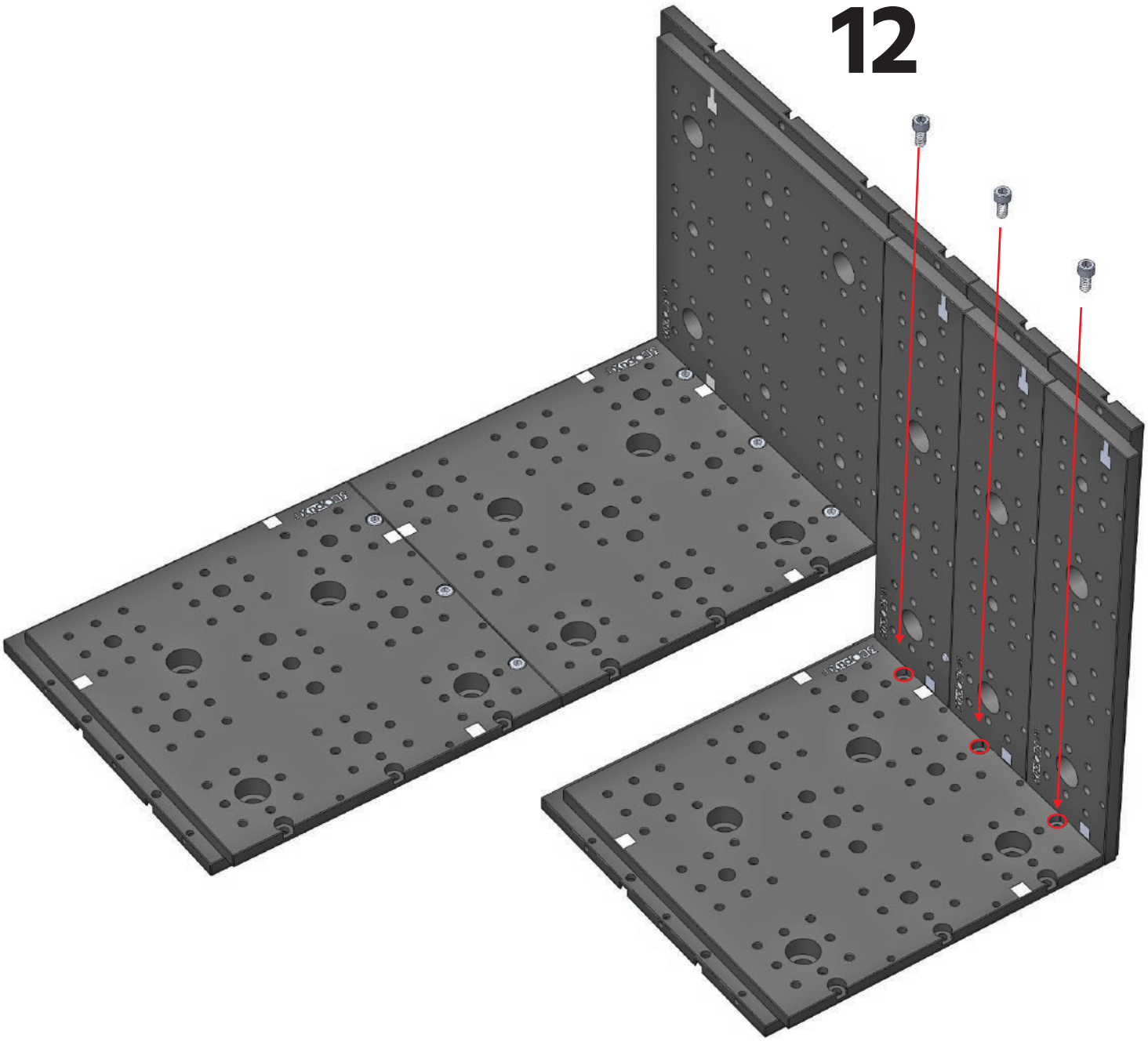
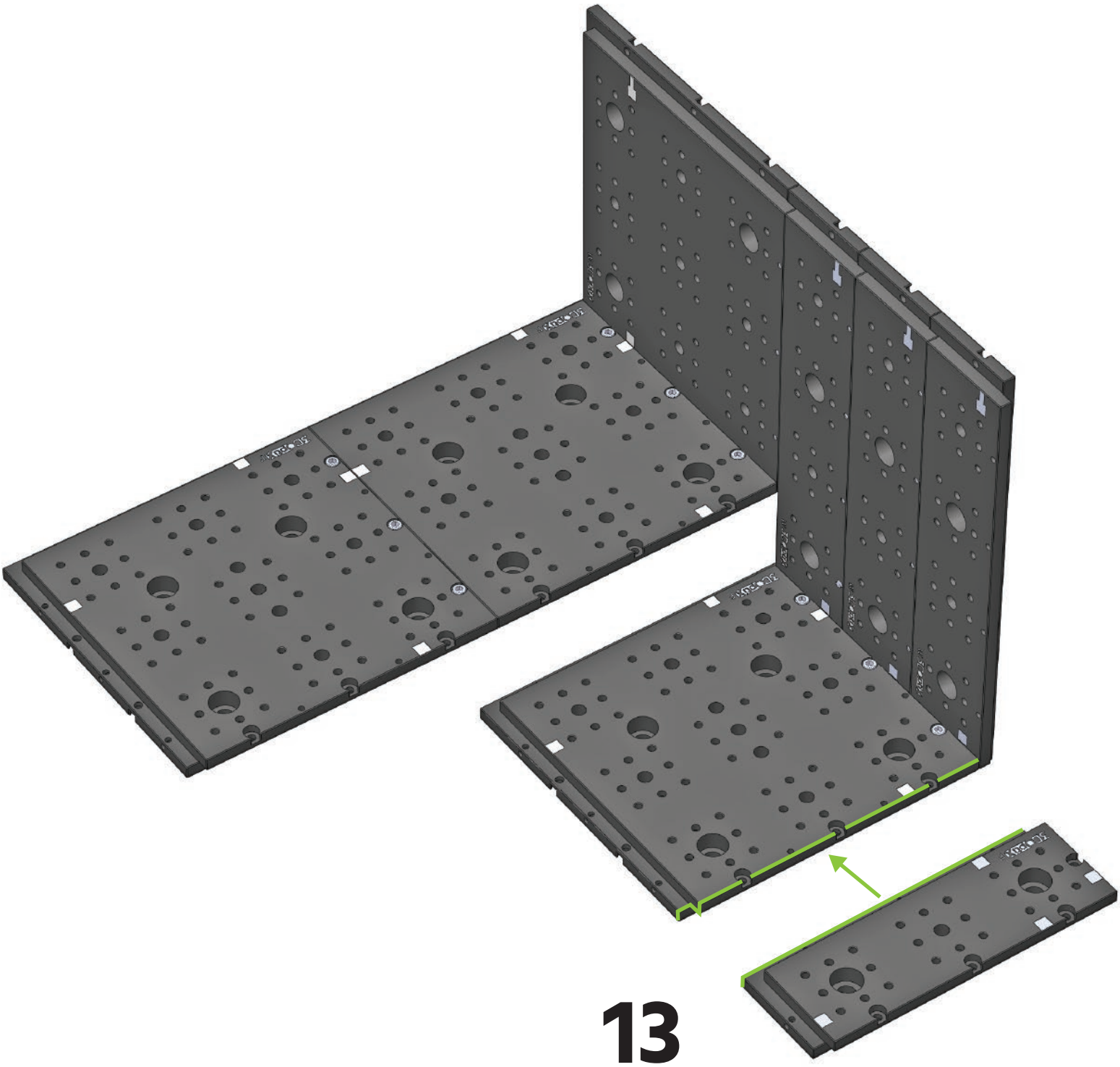
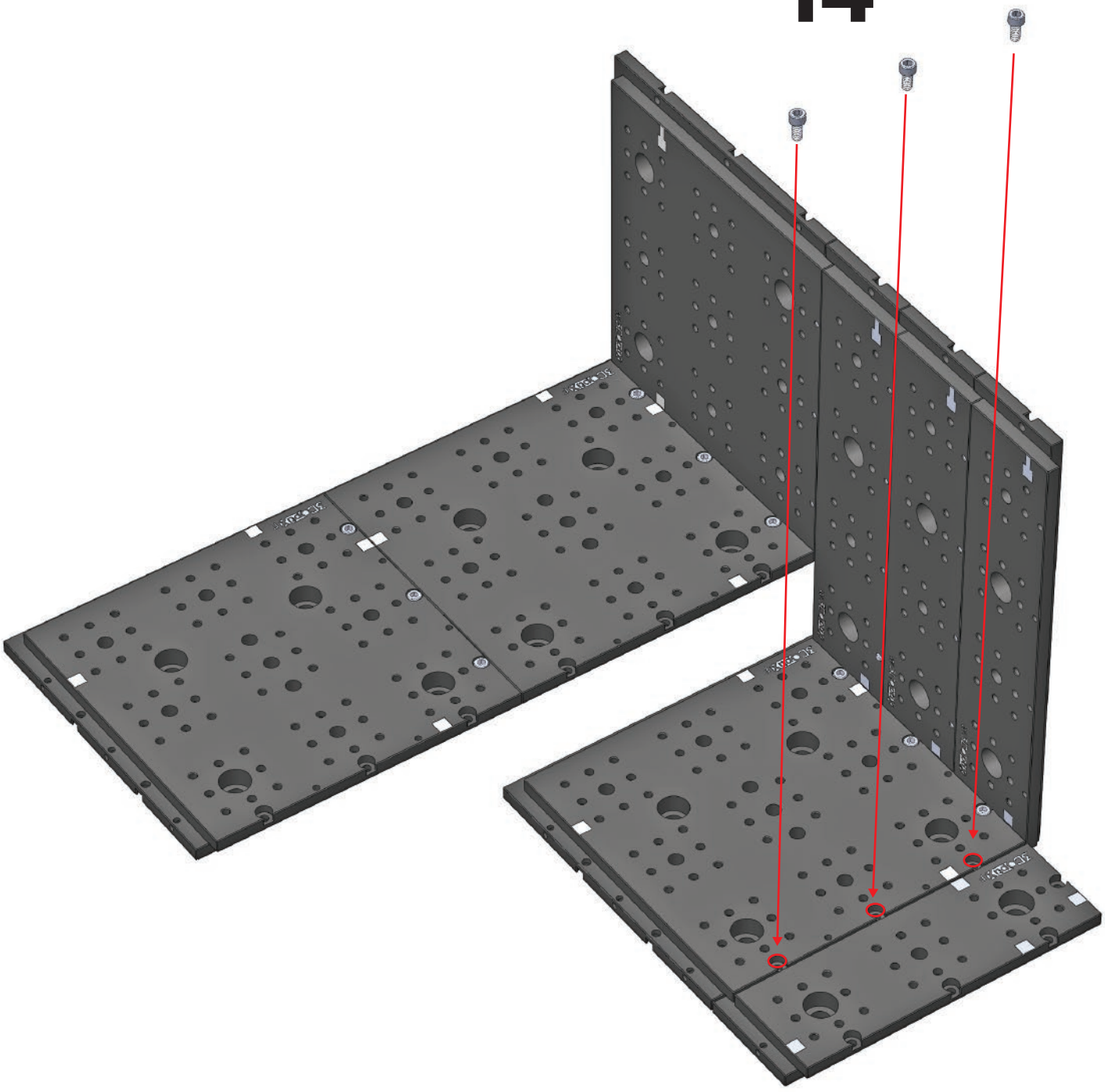




**13**

# 14



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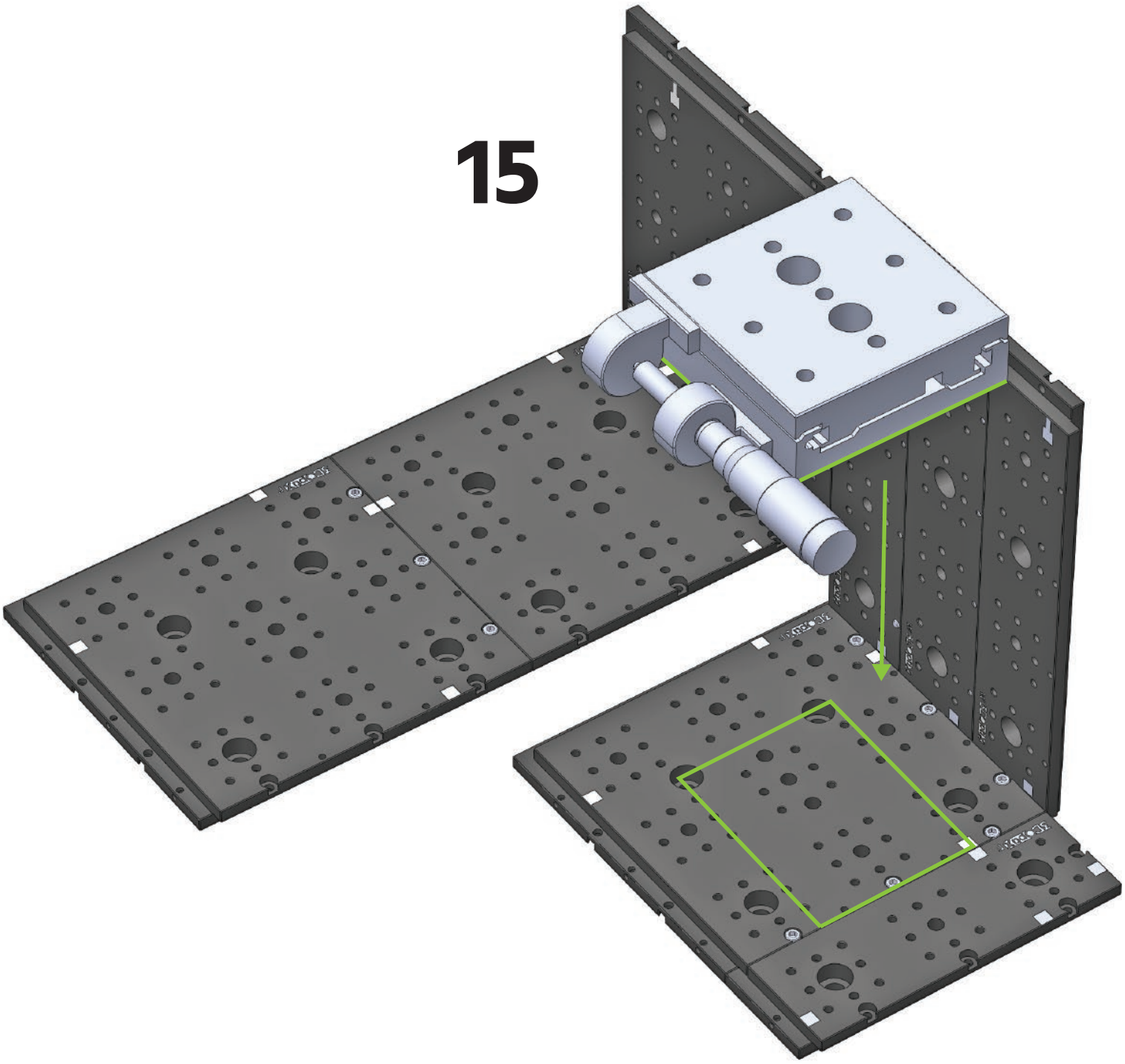
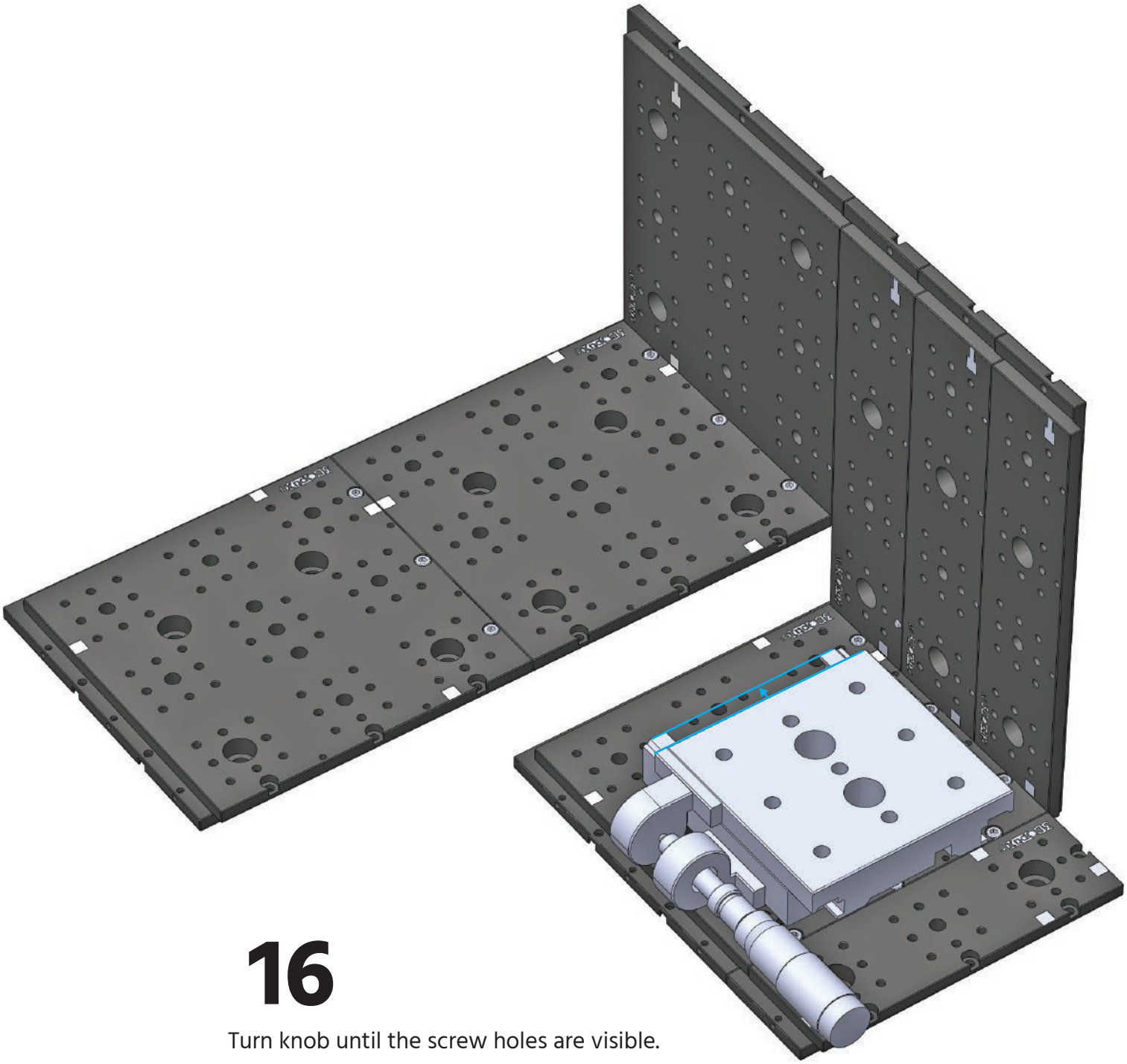
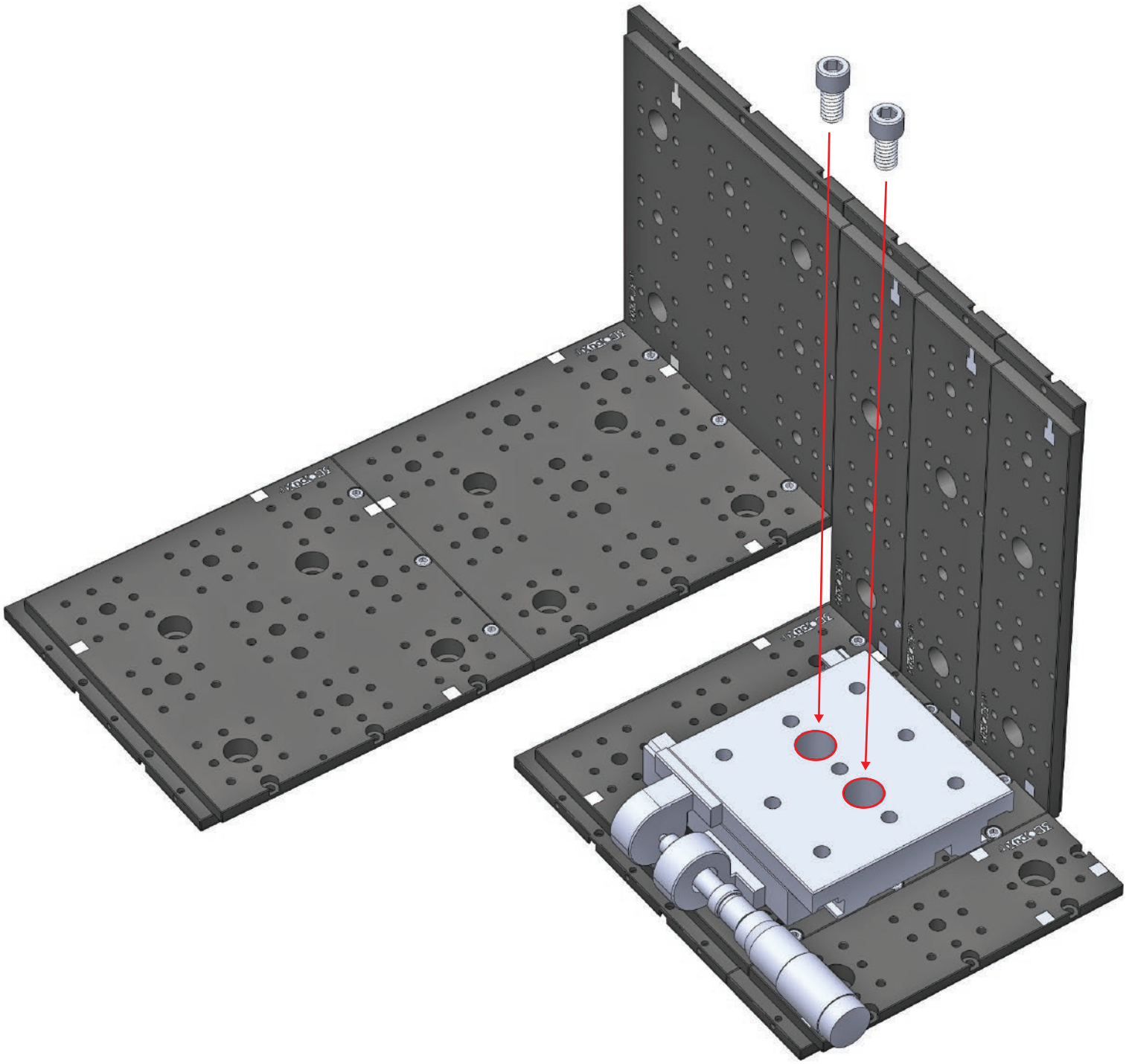




# 16

Turn knob until the screw holes are visible.

# 17 1/4"-20 Stainless Steel Cap Screw, 3/8" Long



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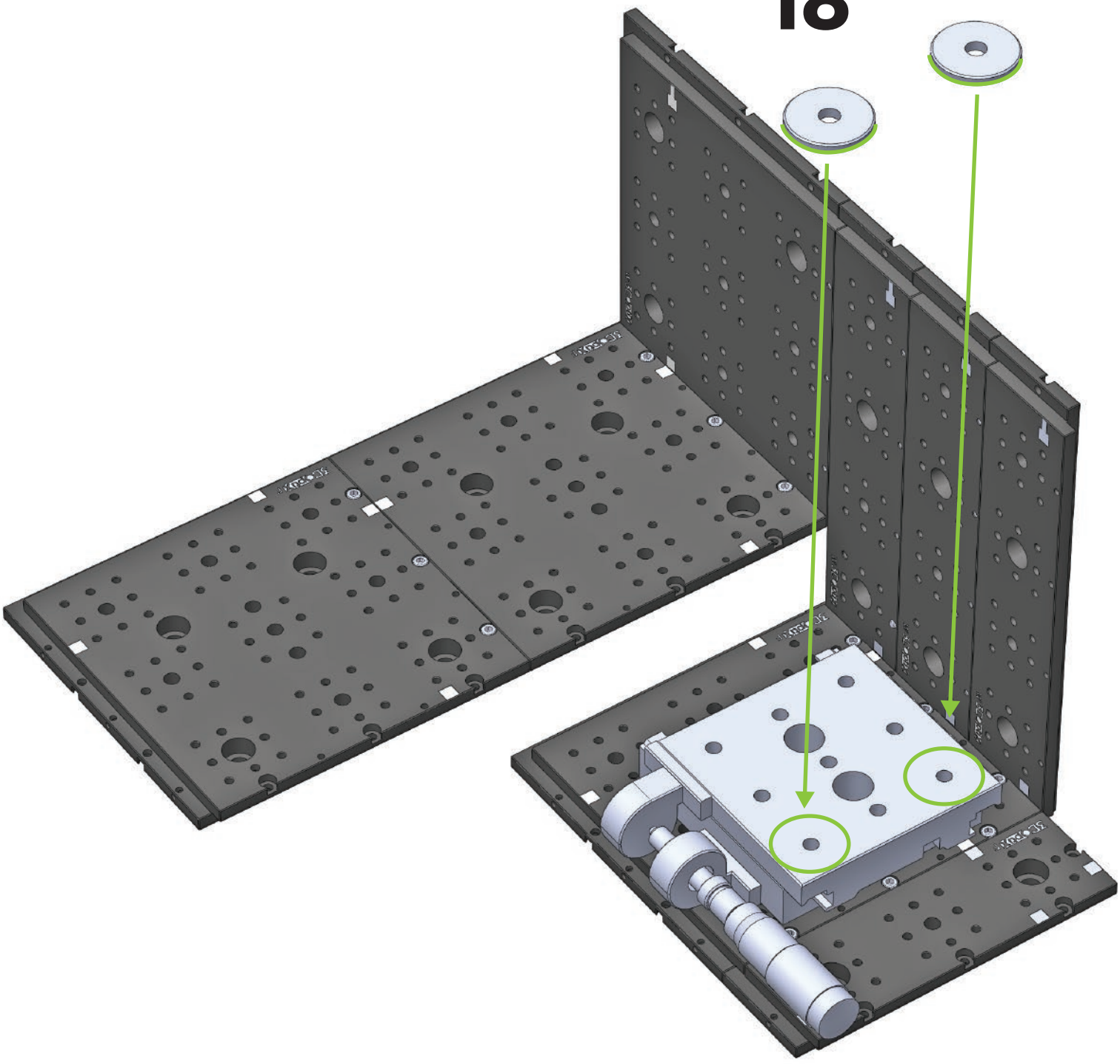
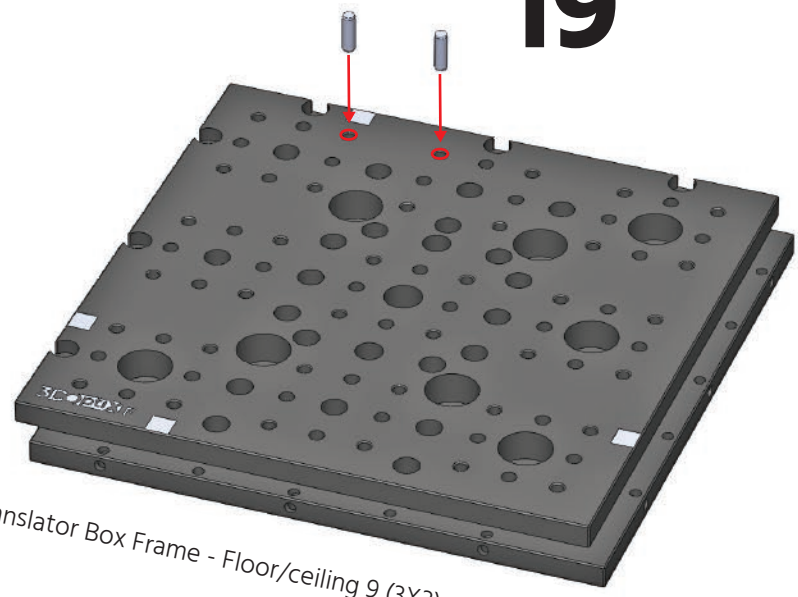


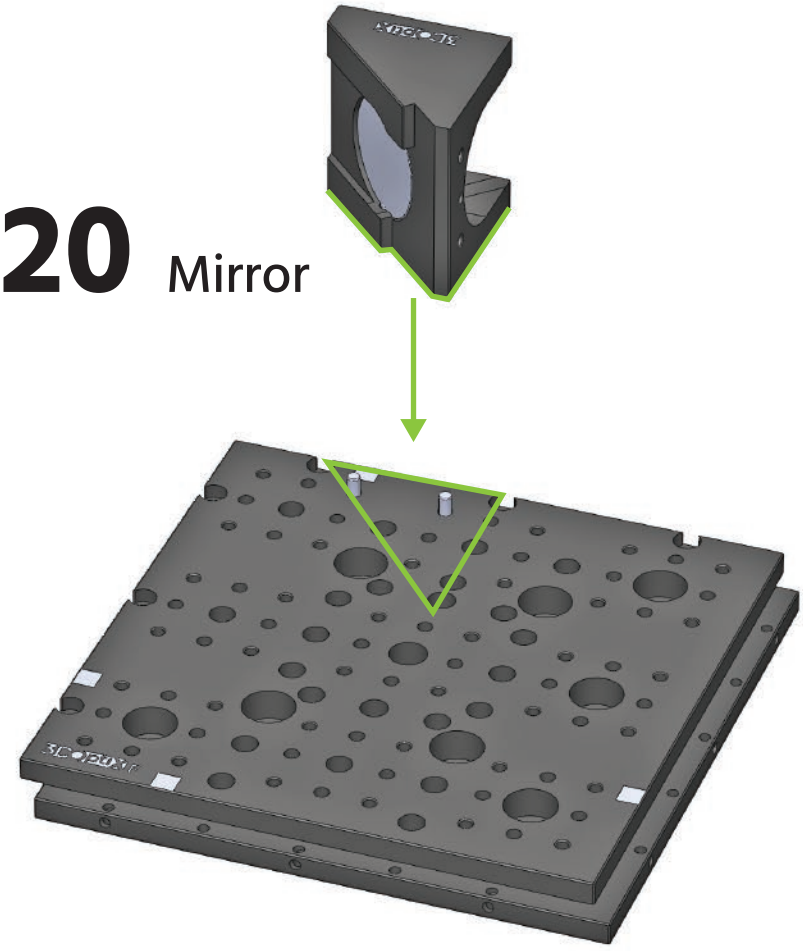
# Delay Assembly

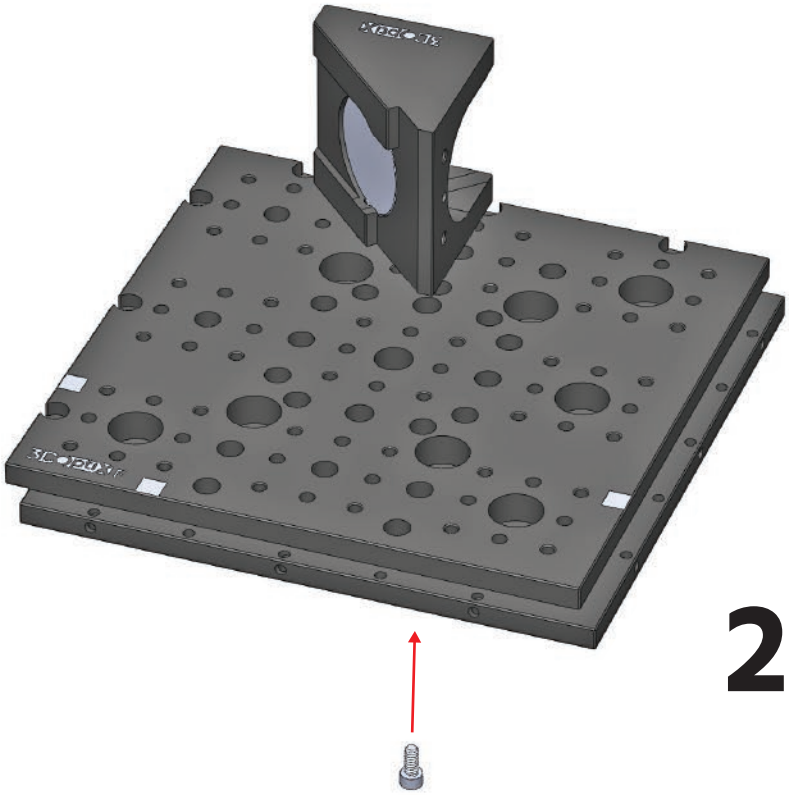
## 19



Translator Box Frame - Floor/ceiling 9 (3X3) mount locations

## 20 Mirror





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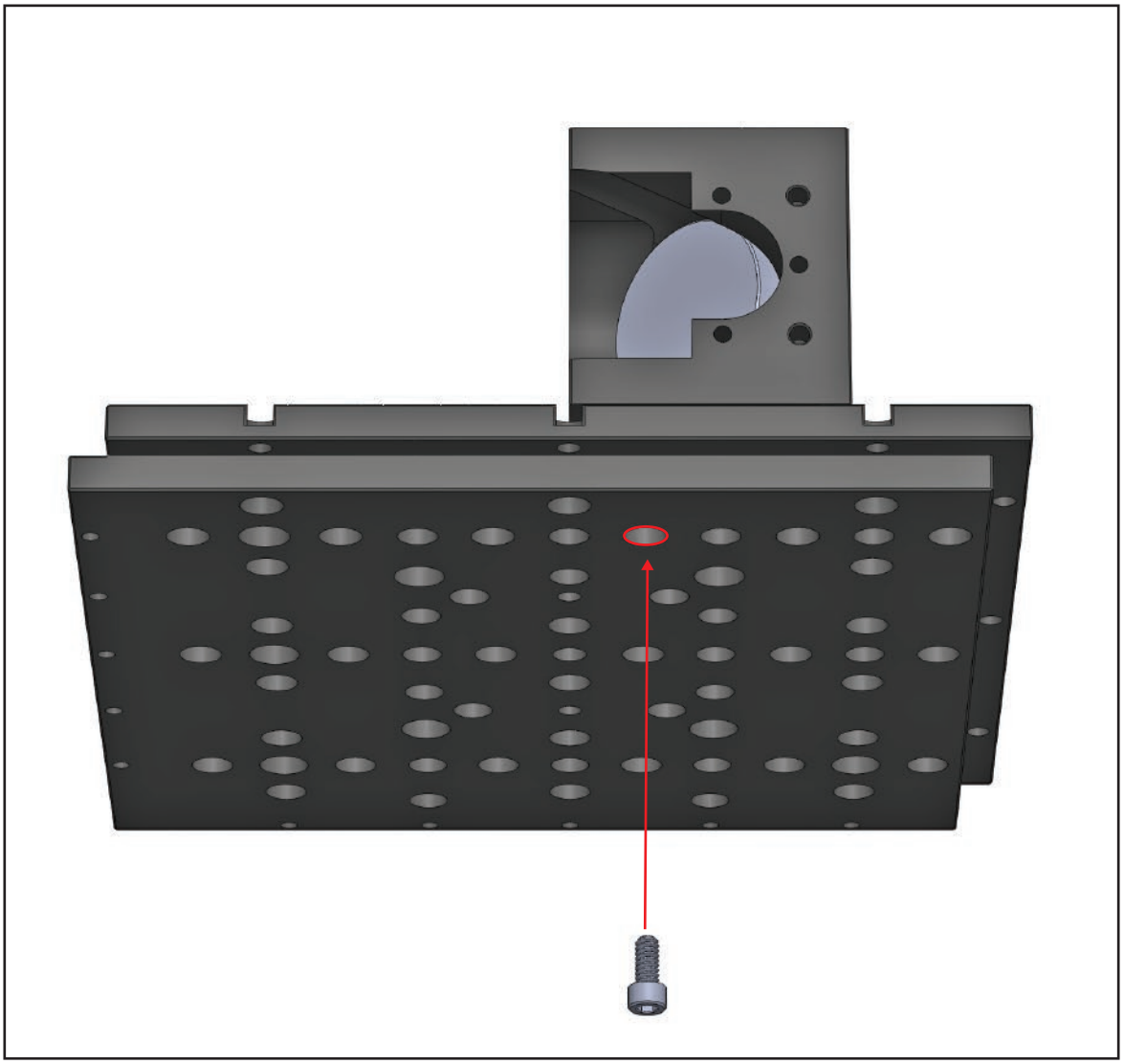

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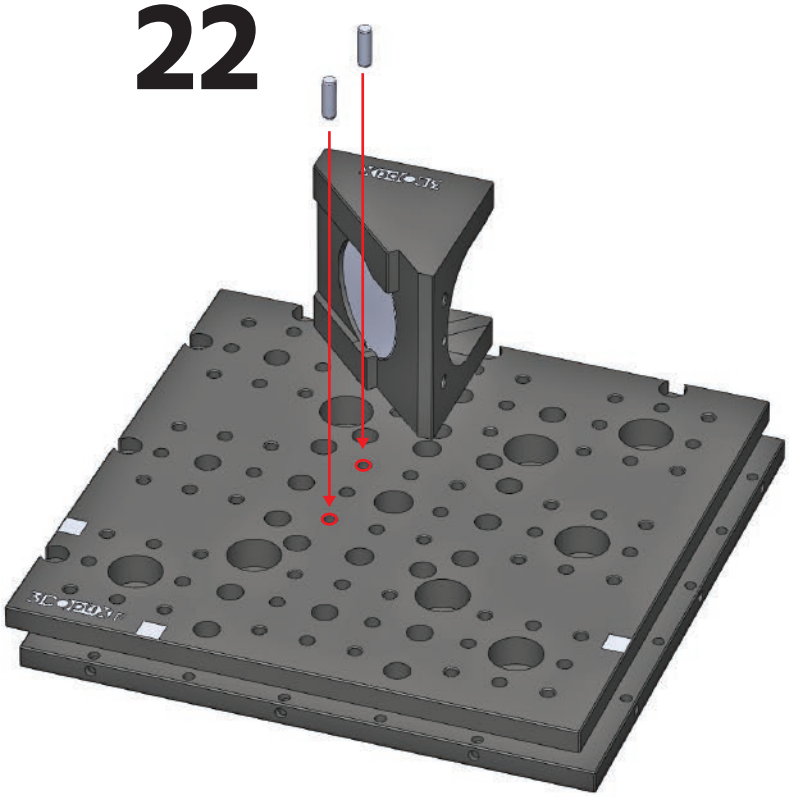

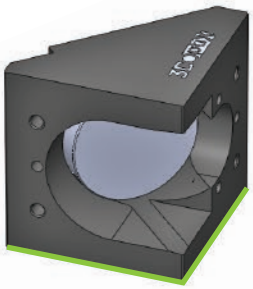

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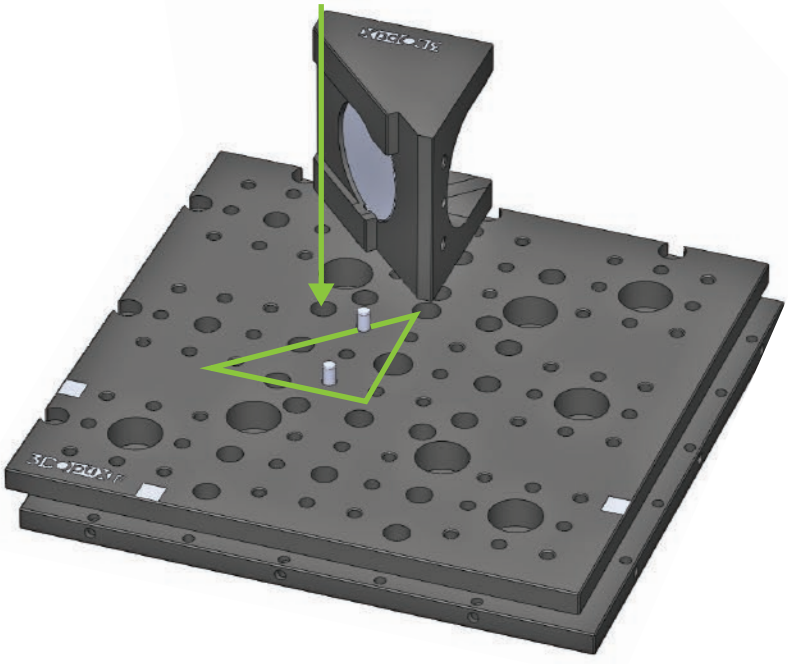

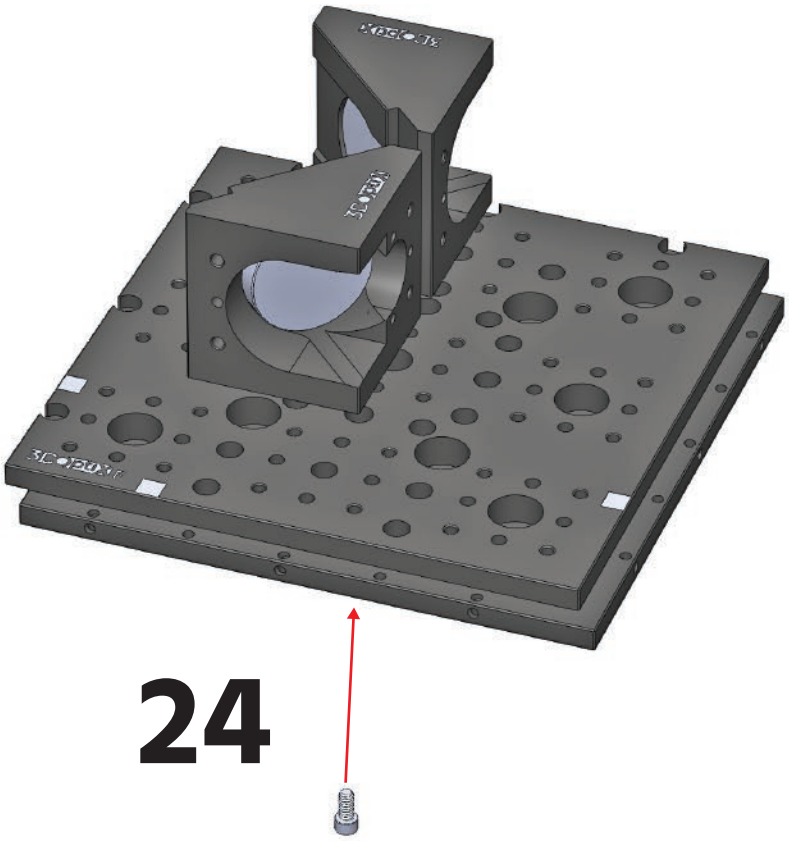

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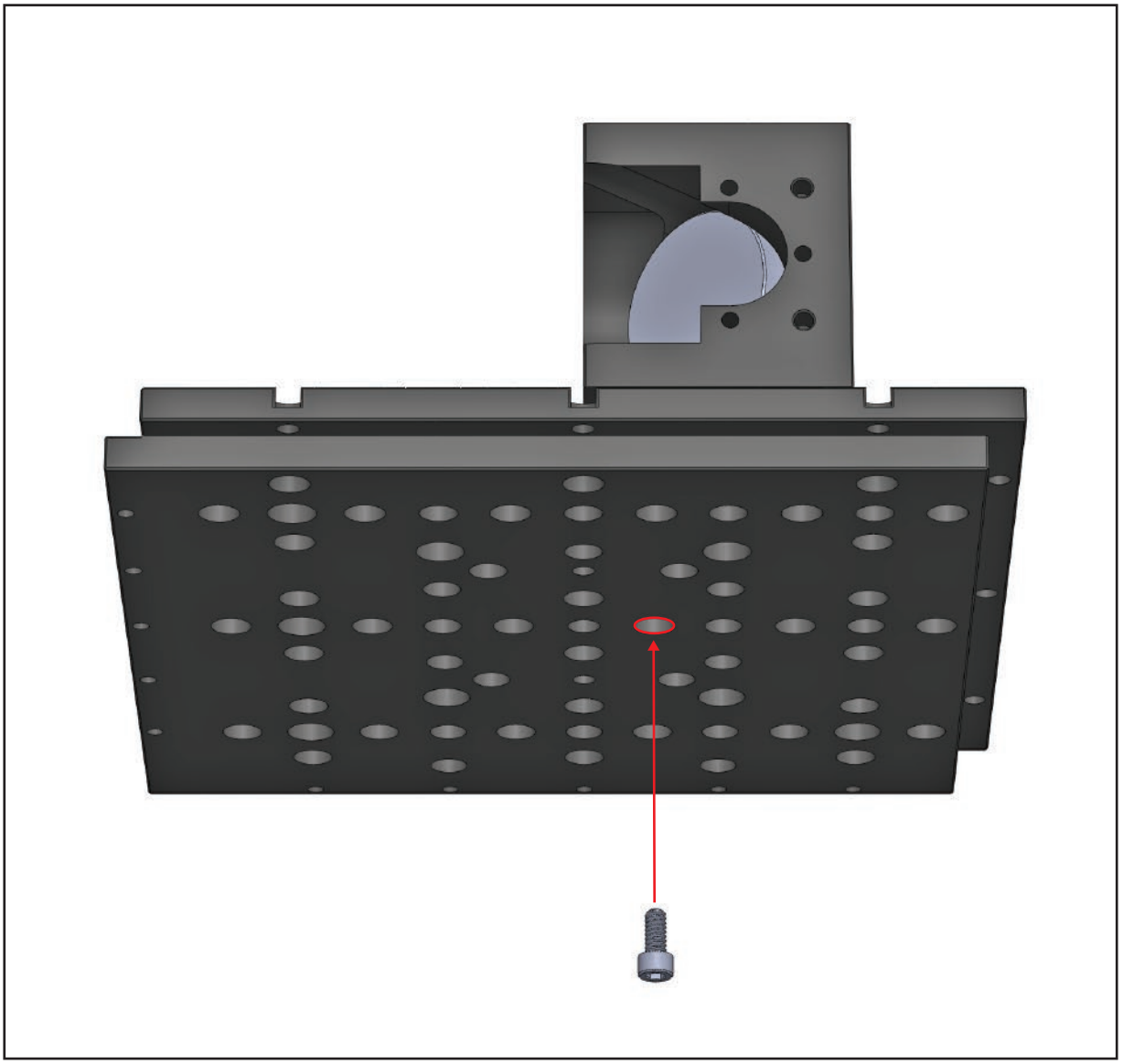

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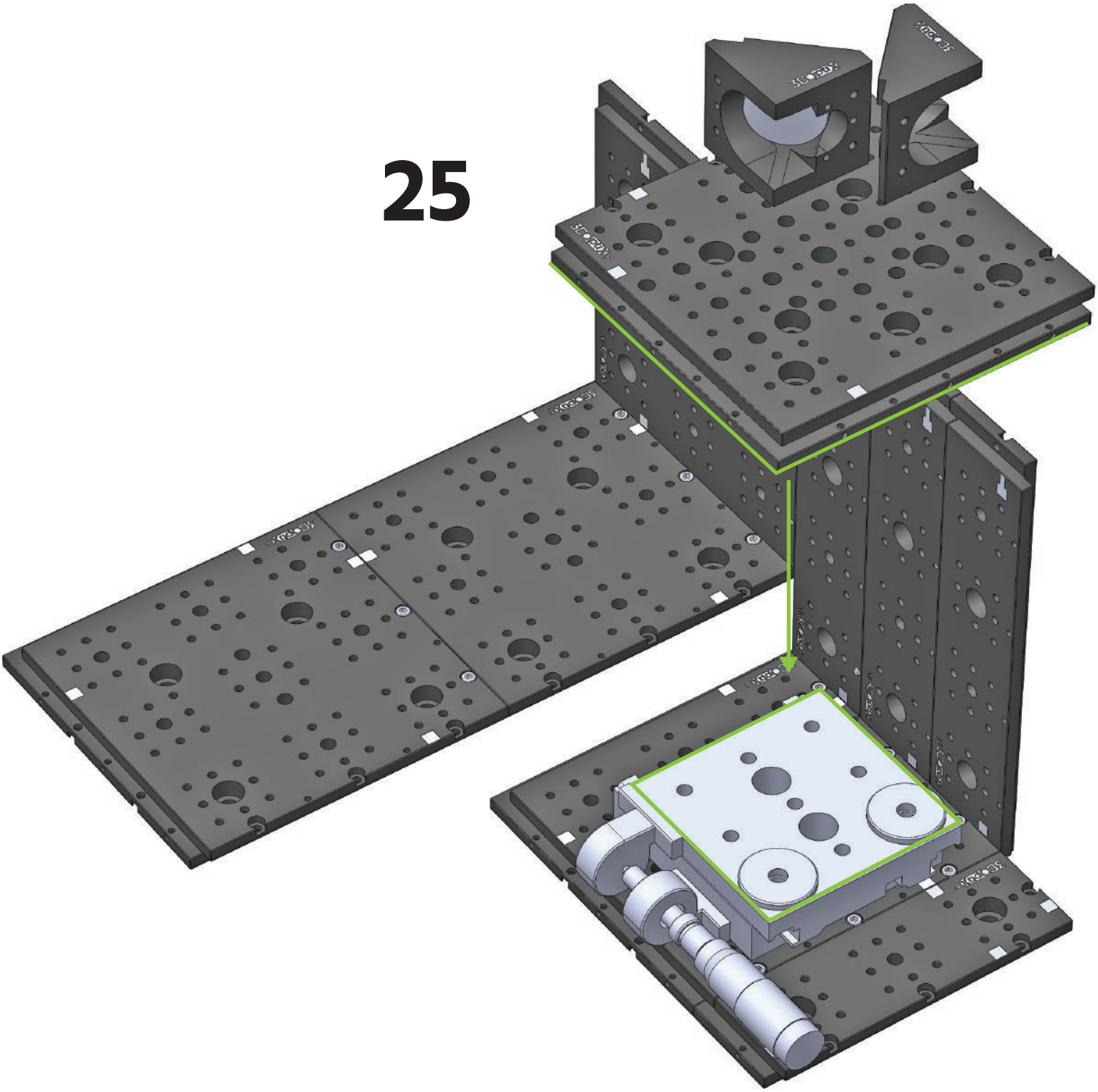
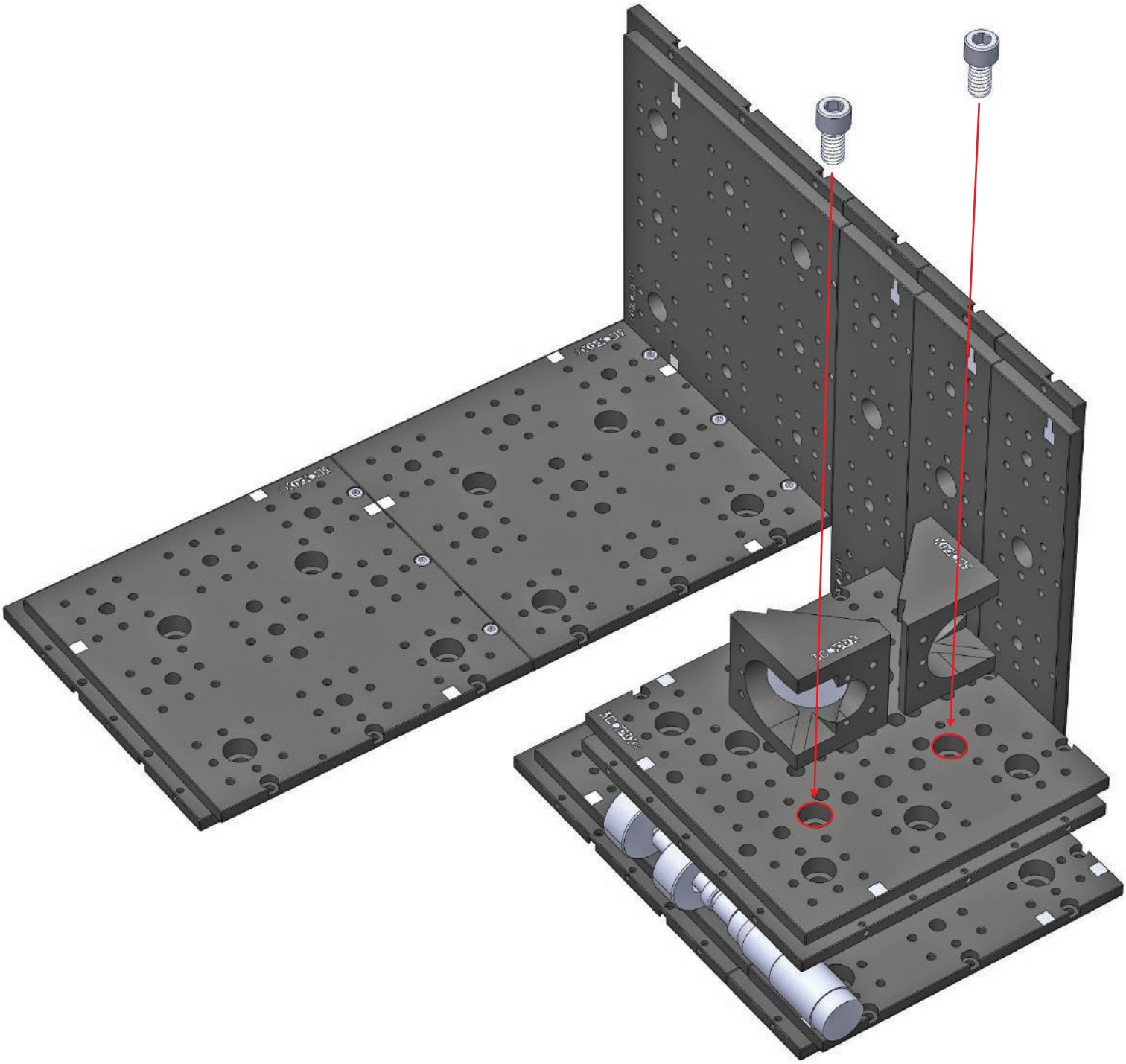


# 26 1/4"-20 Stainless Steel Cap Screw, 3/8" Long



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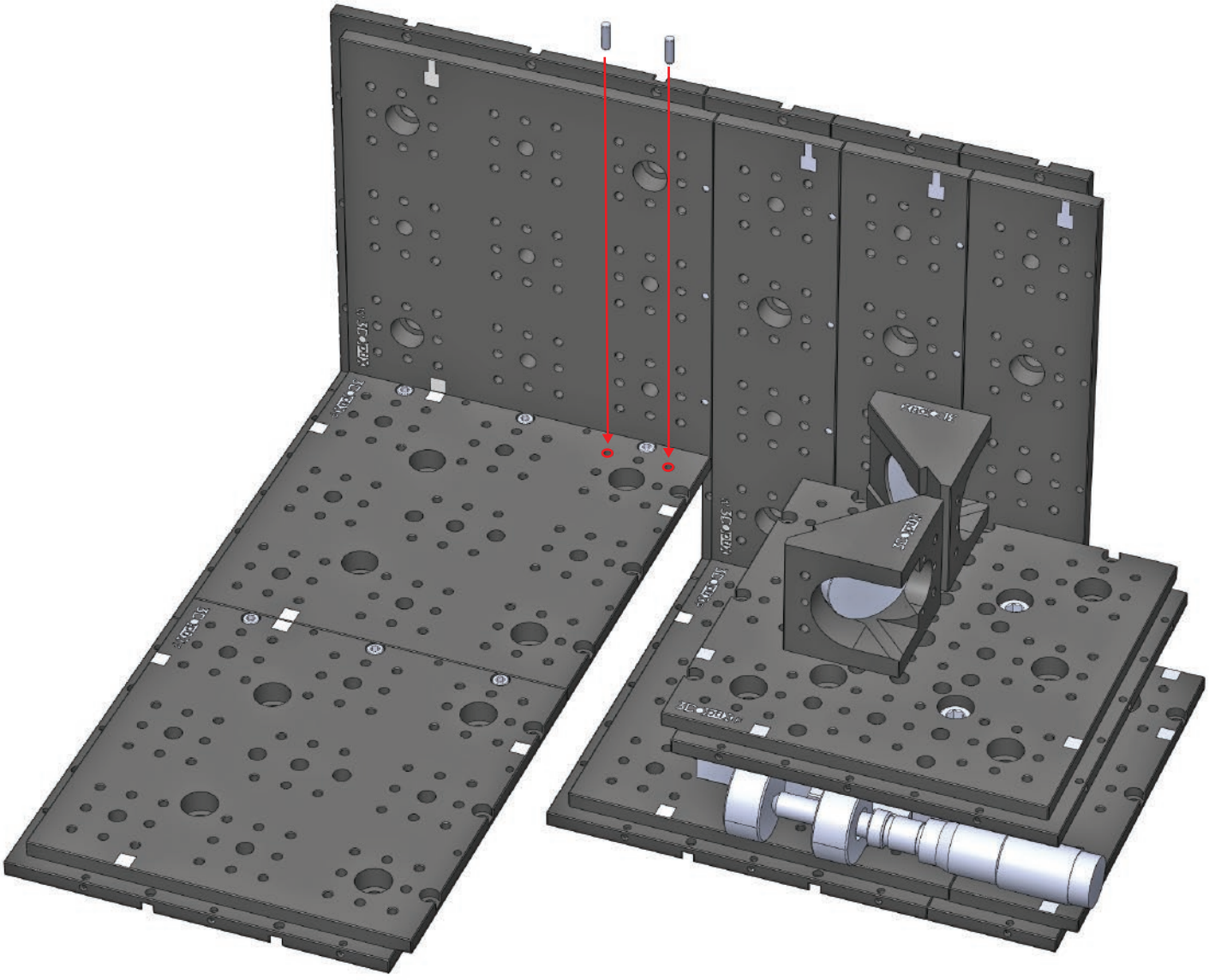
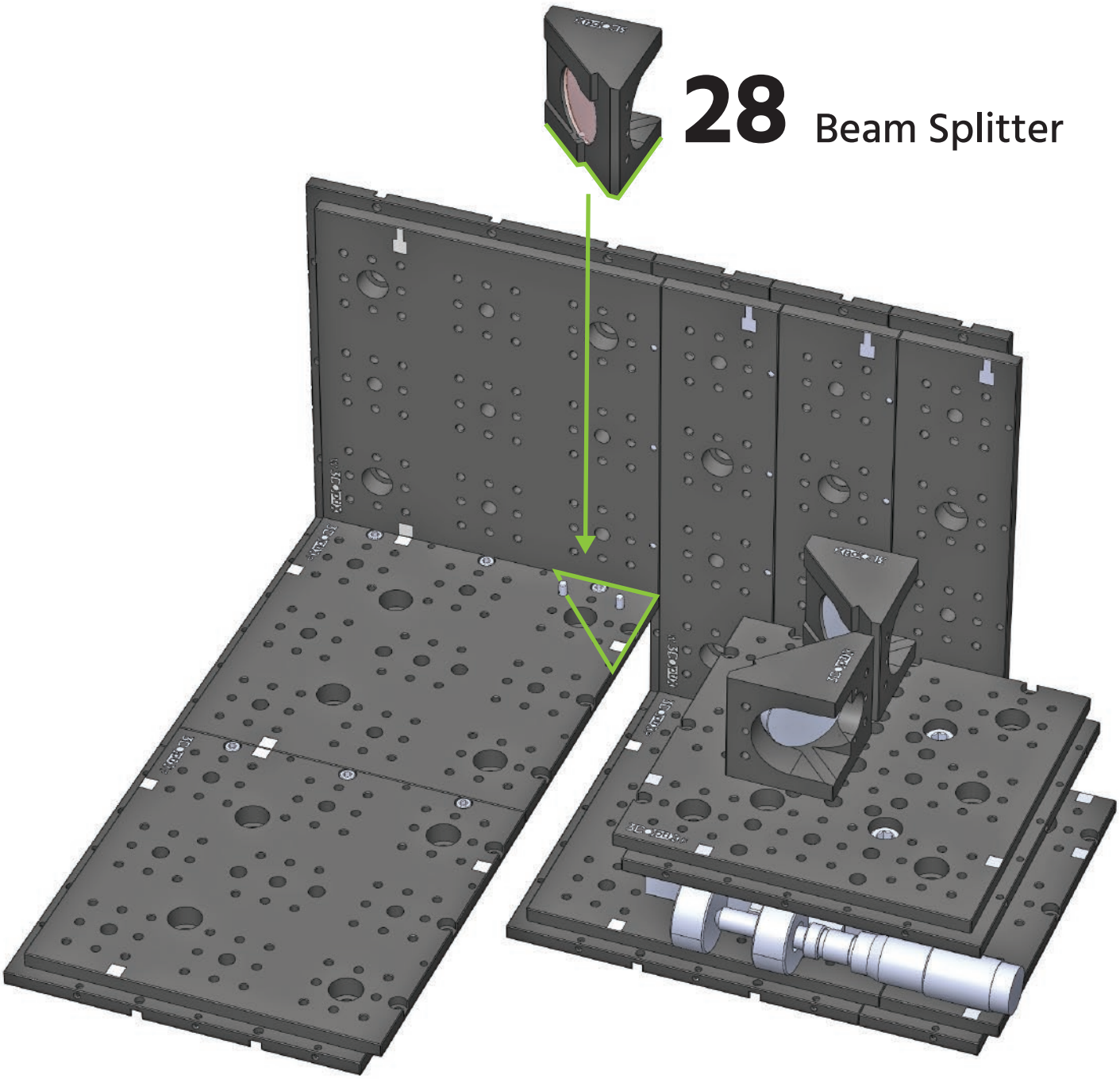
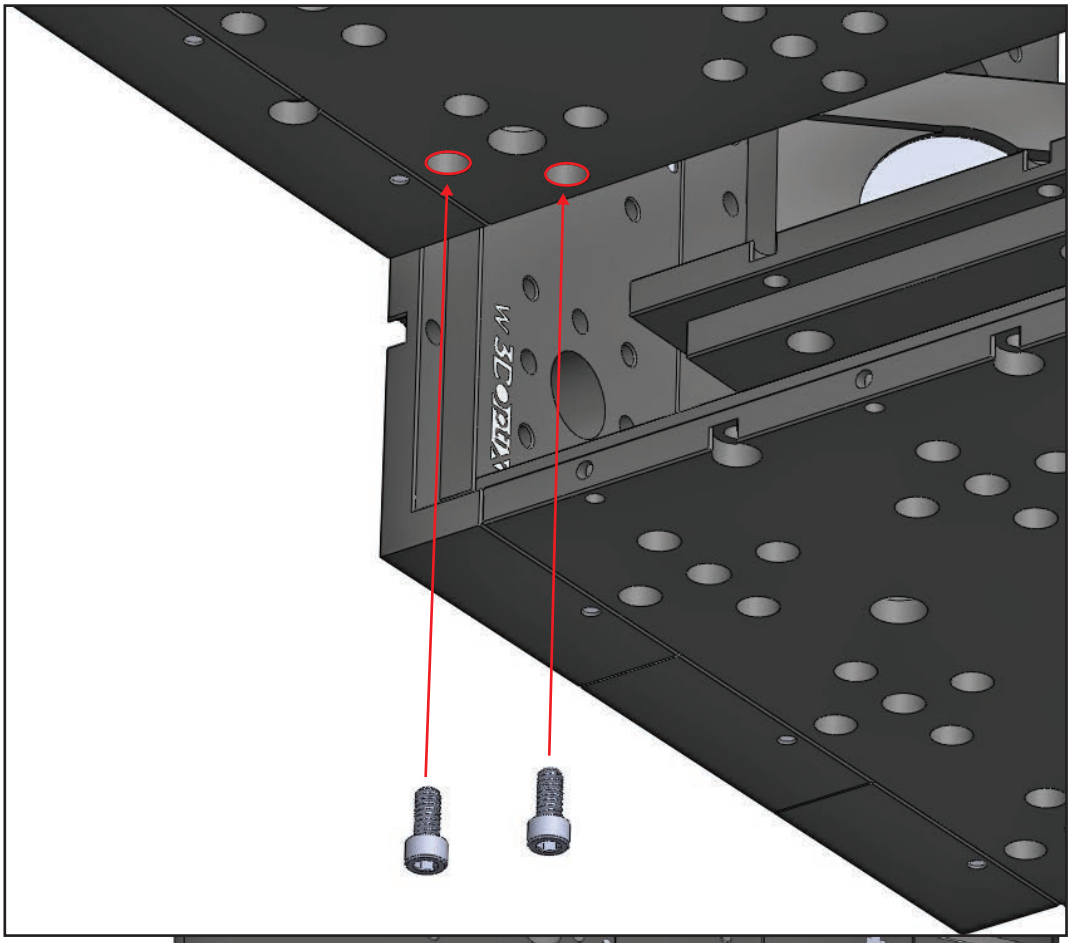


# 28 Beam Splitter





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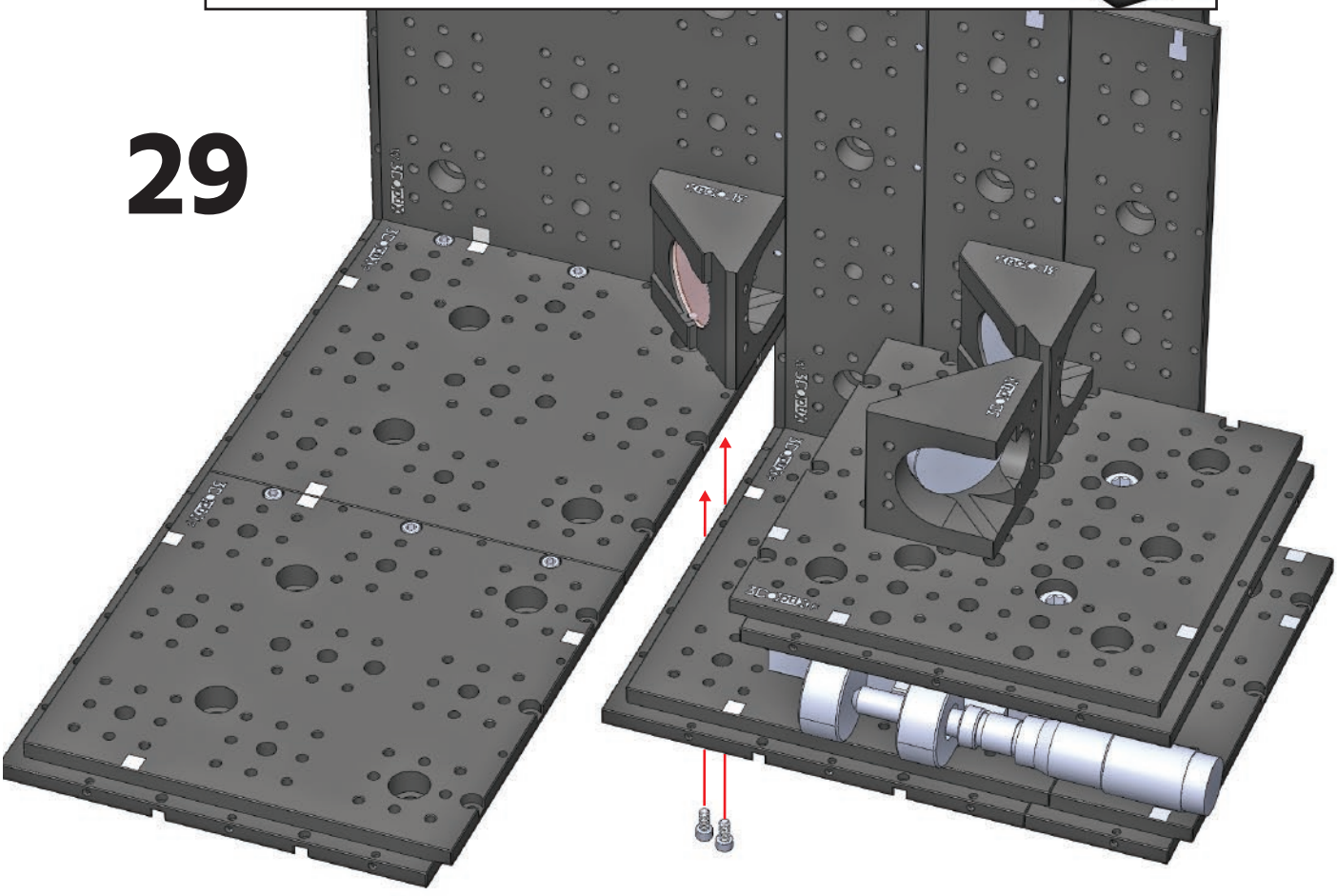

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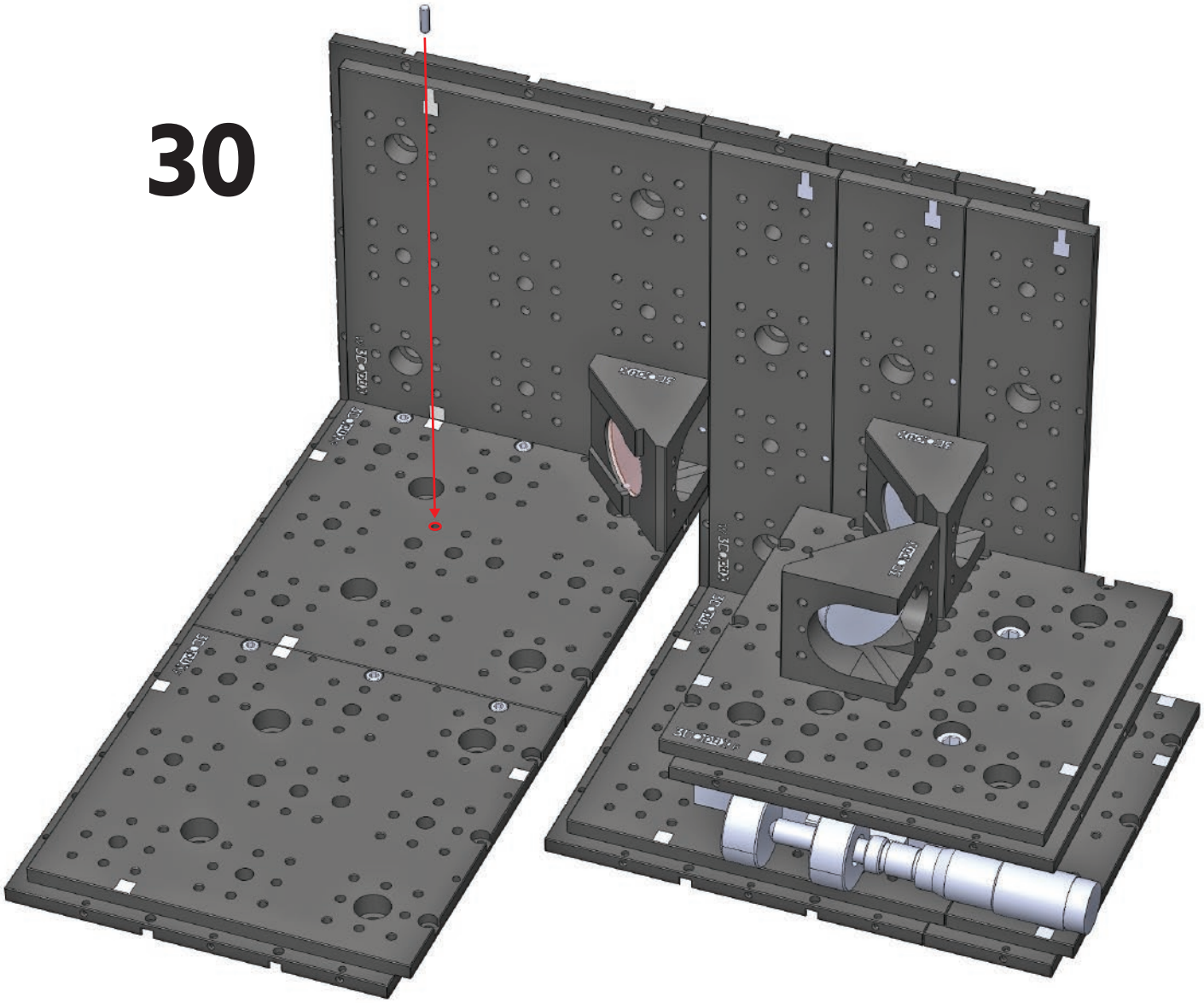
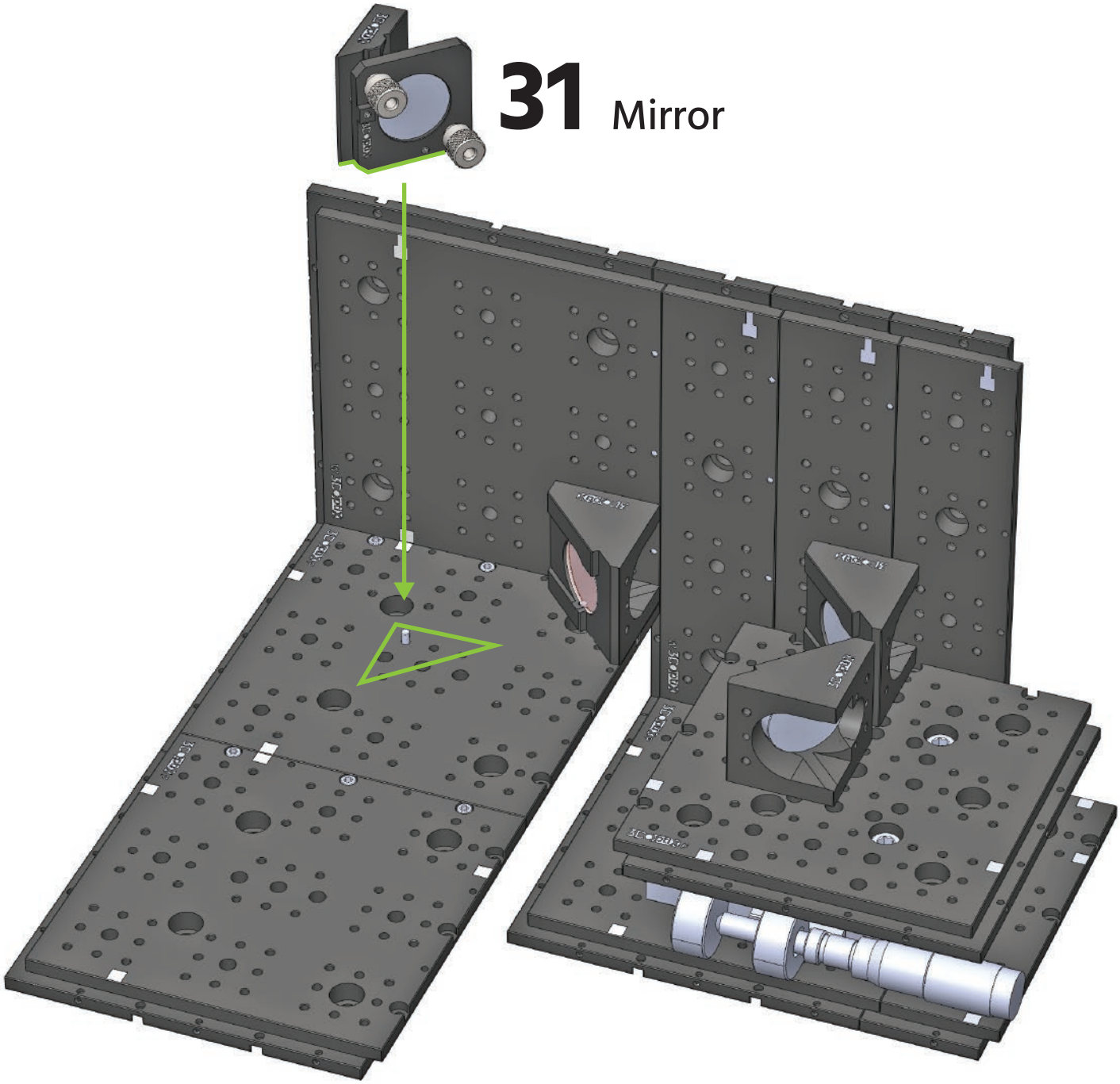
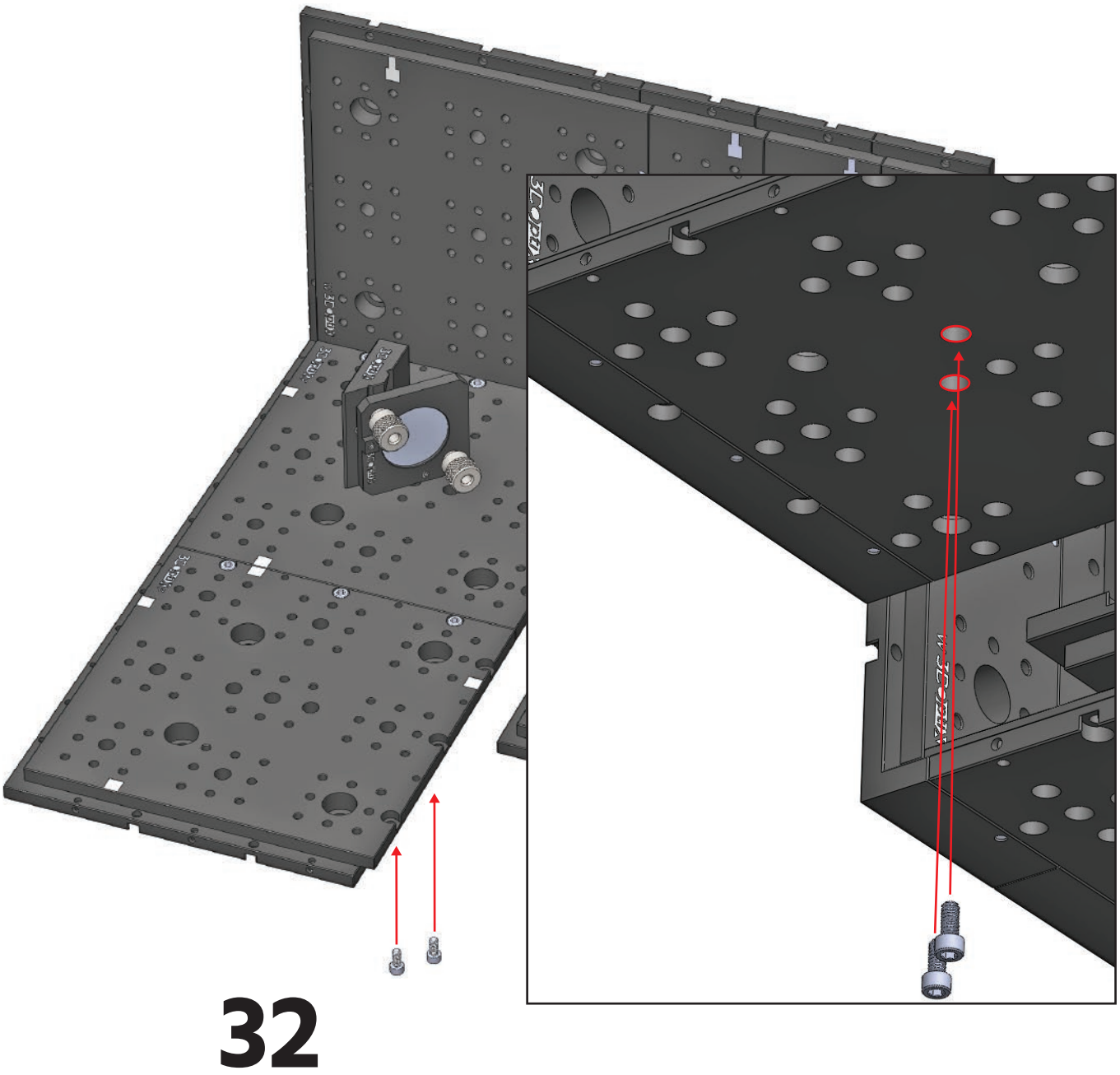
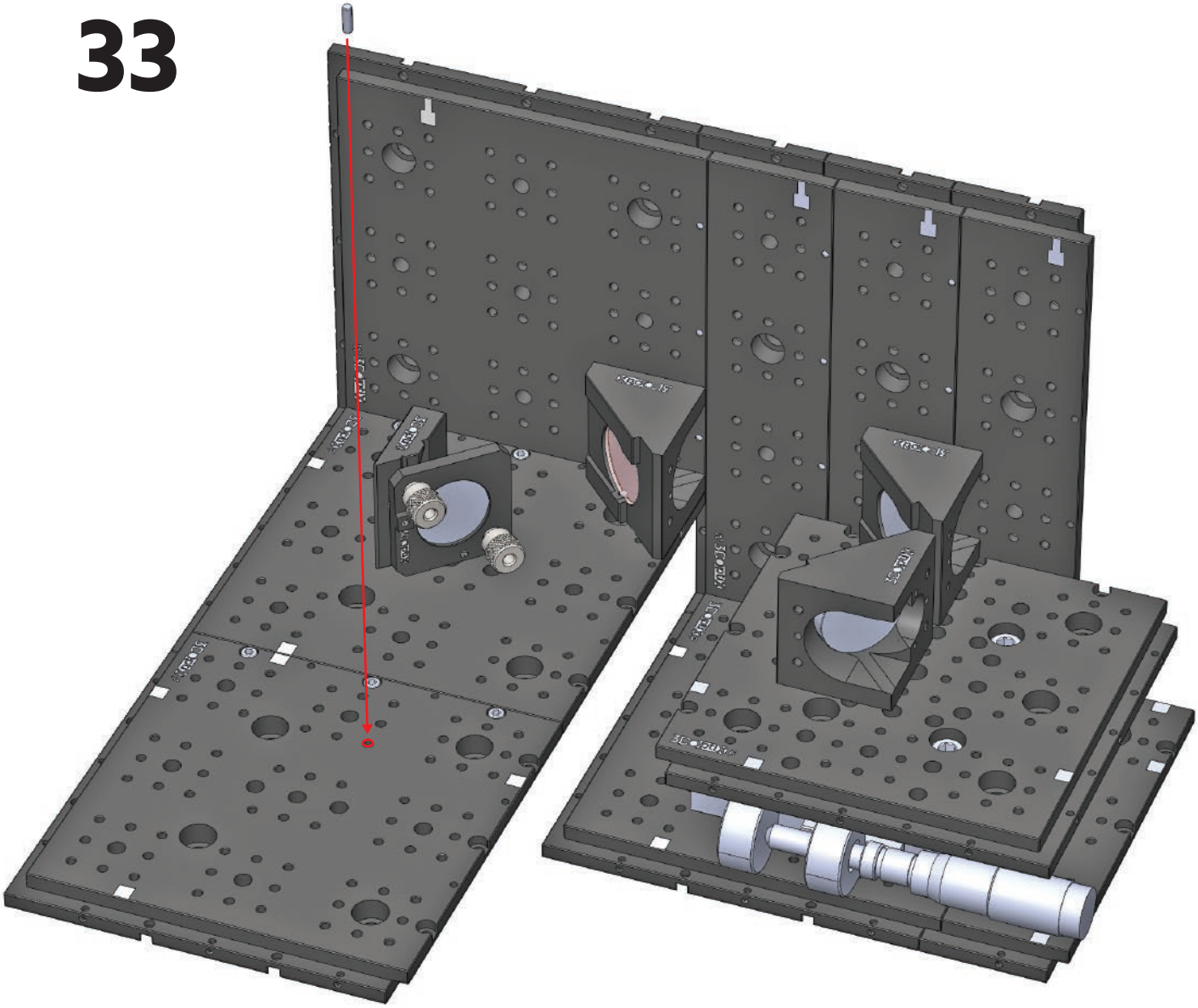



31 Mirror



# 32

# 33



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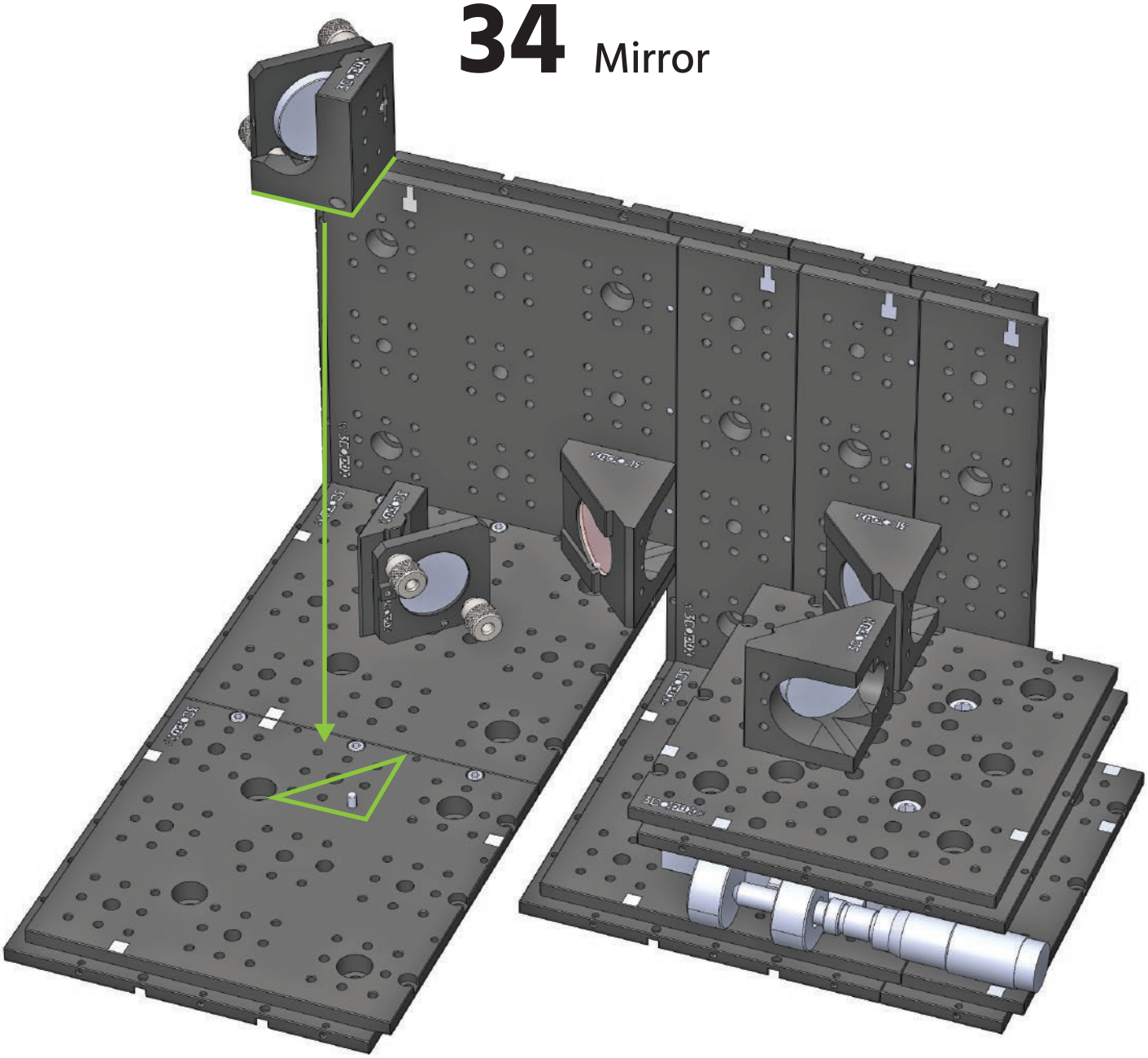

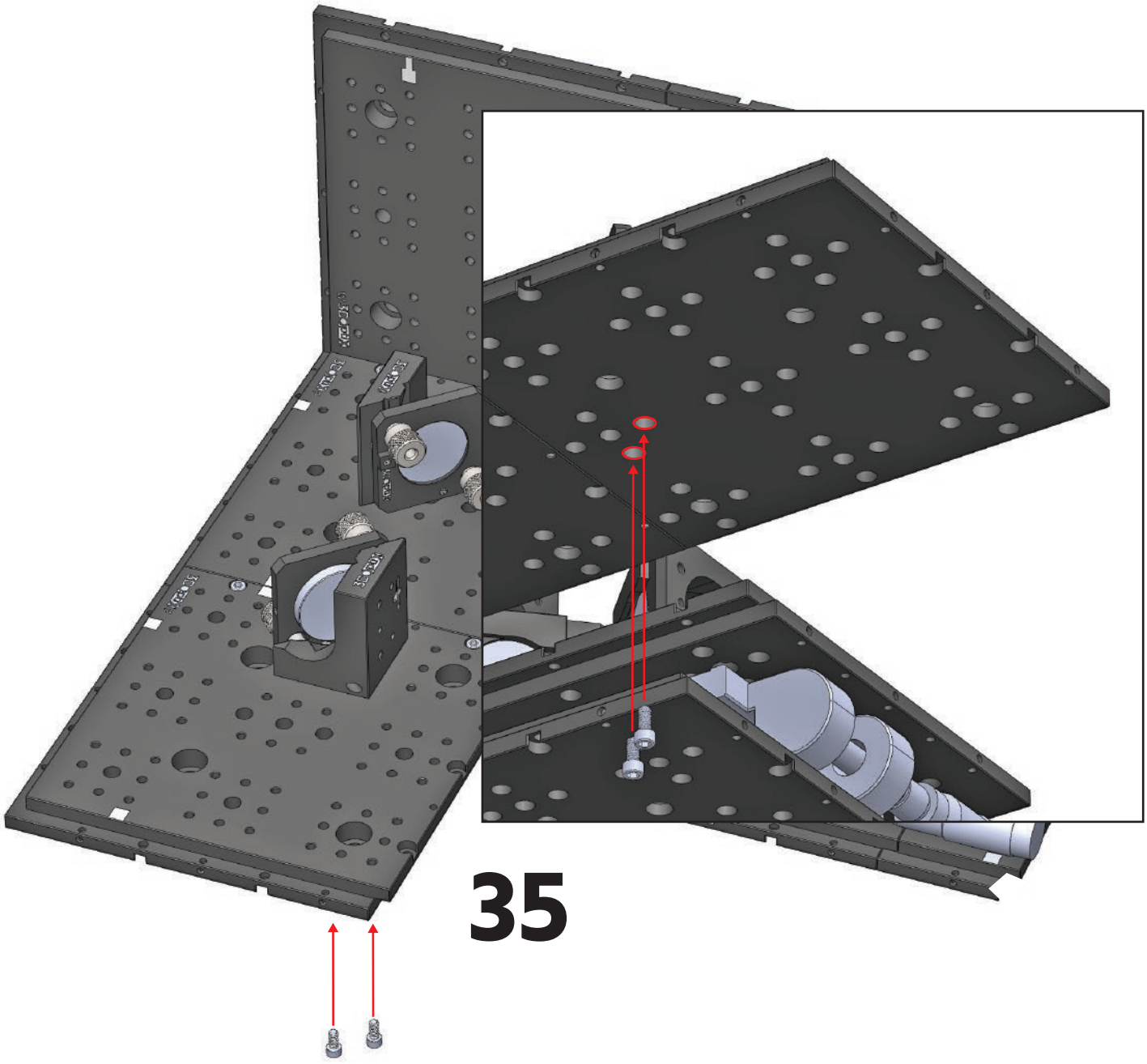
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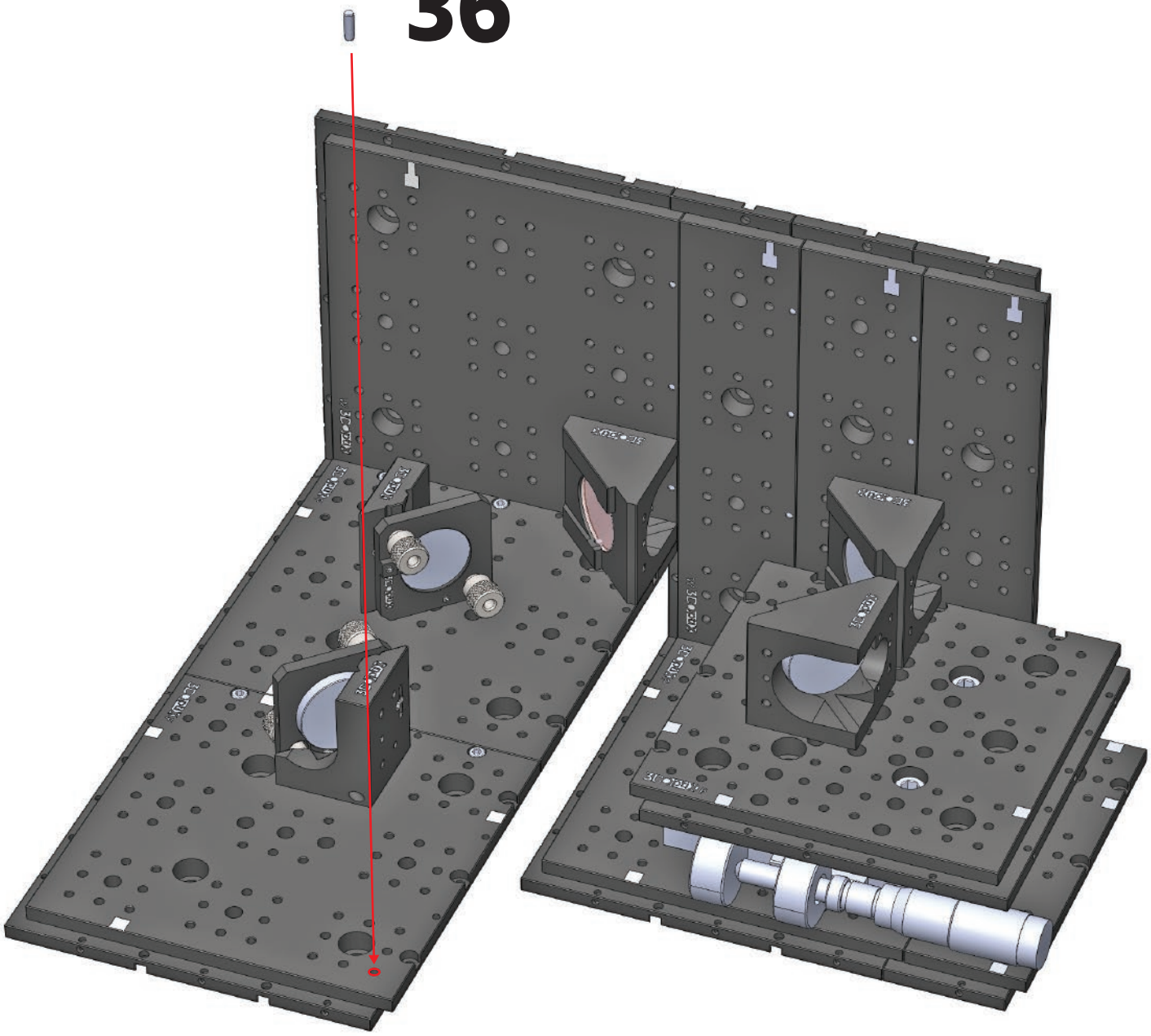

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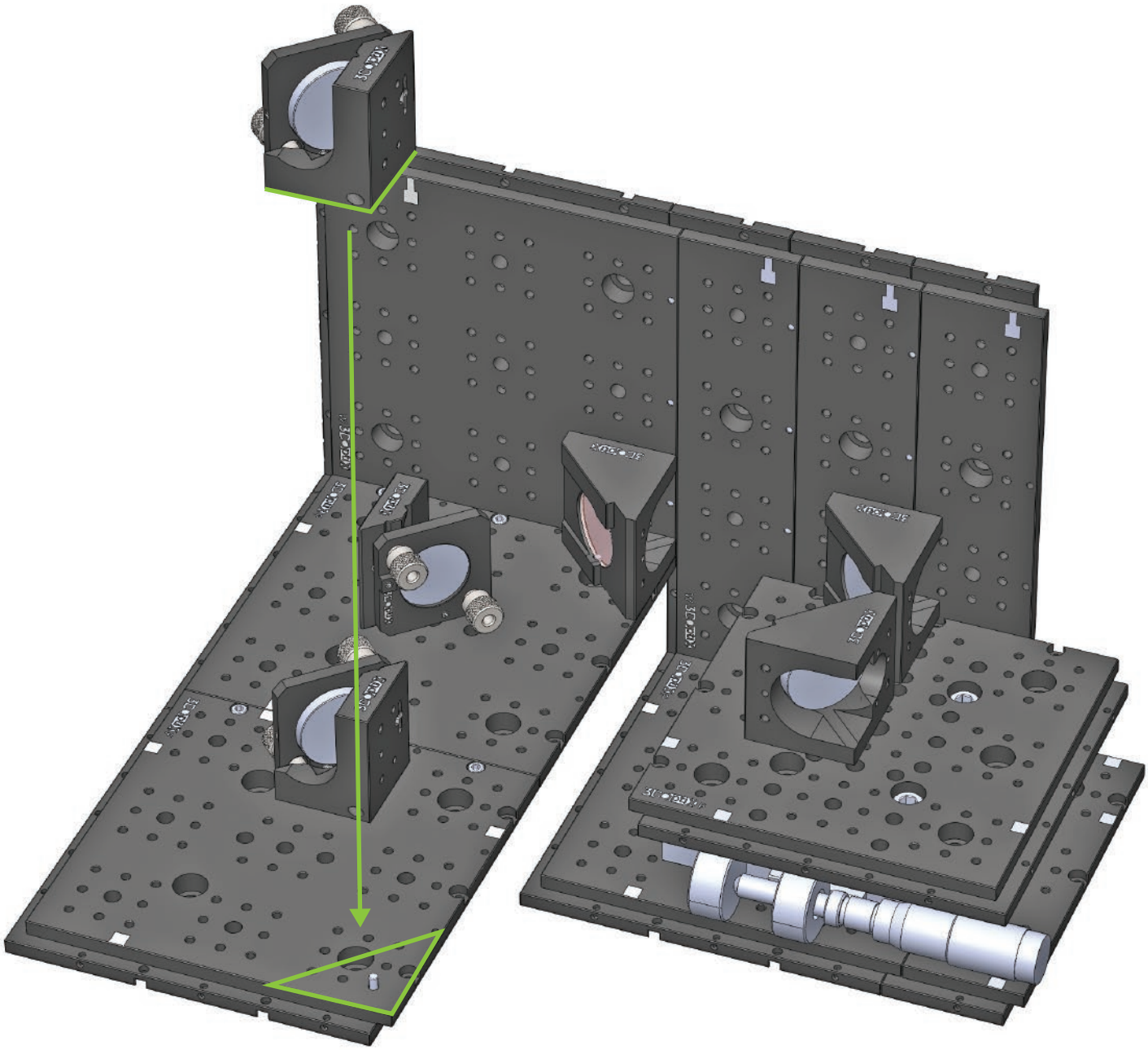

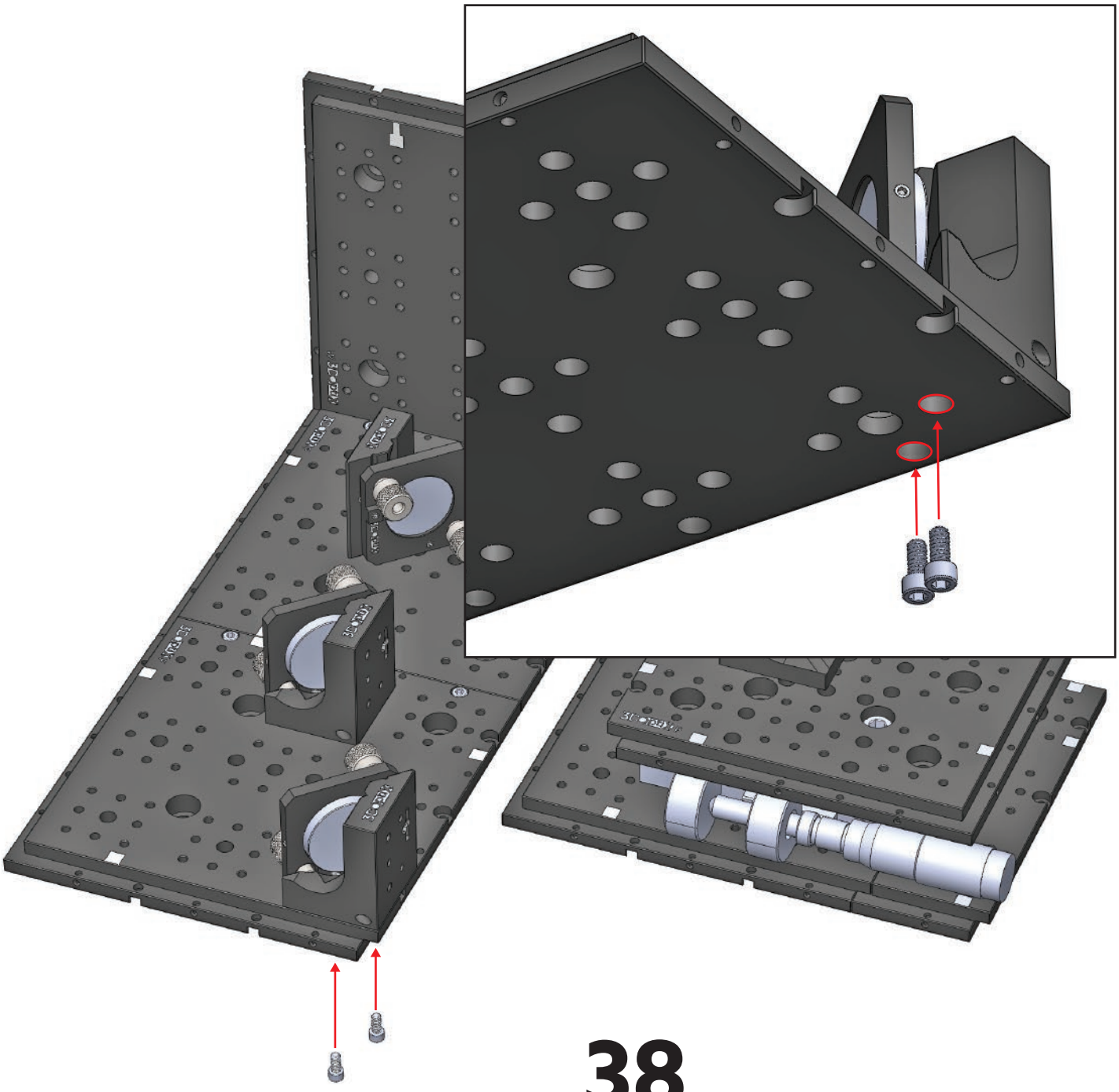

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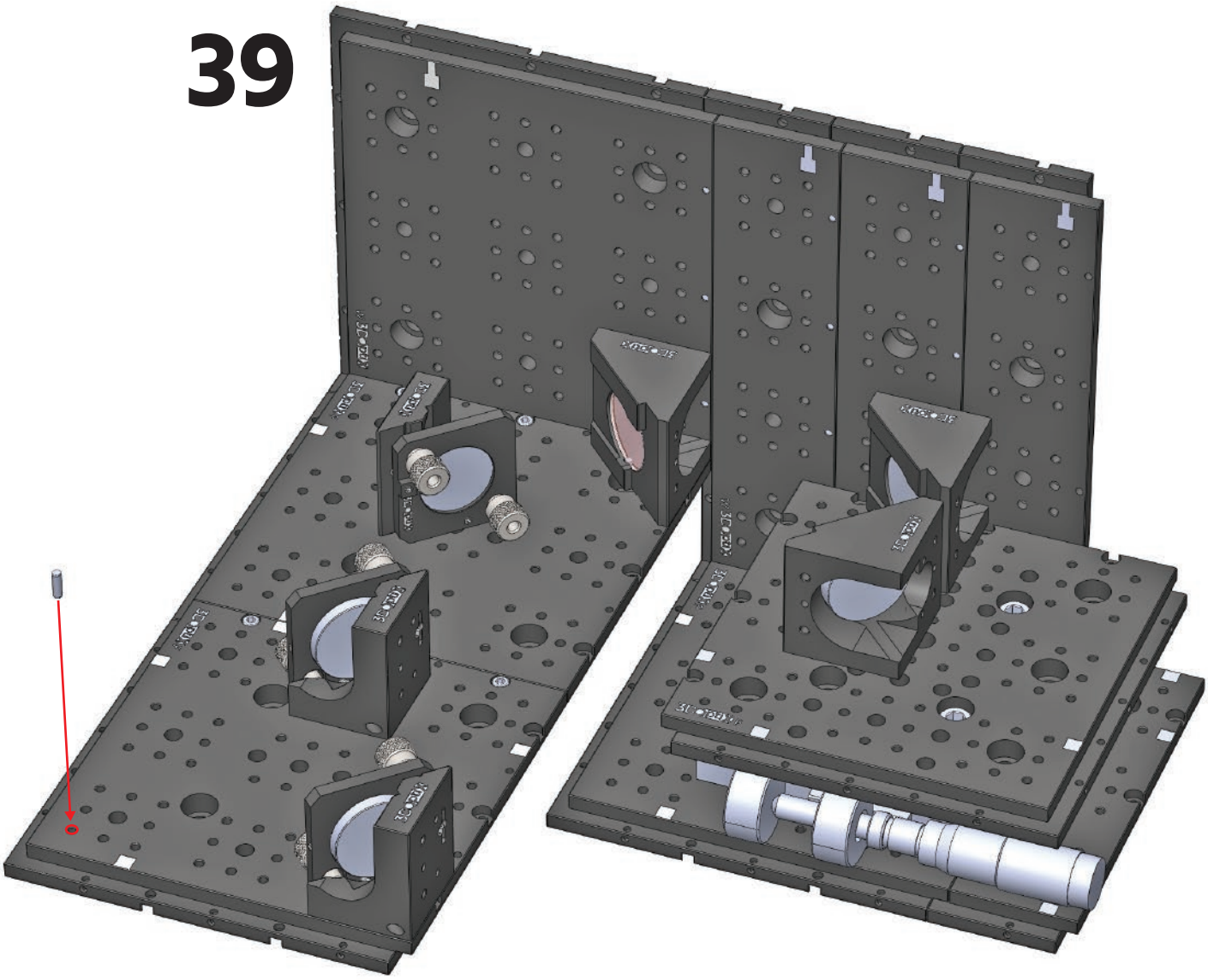
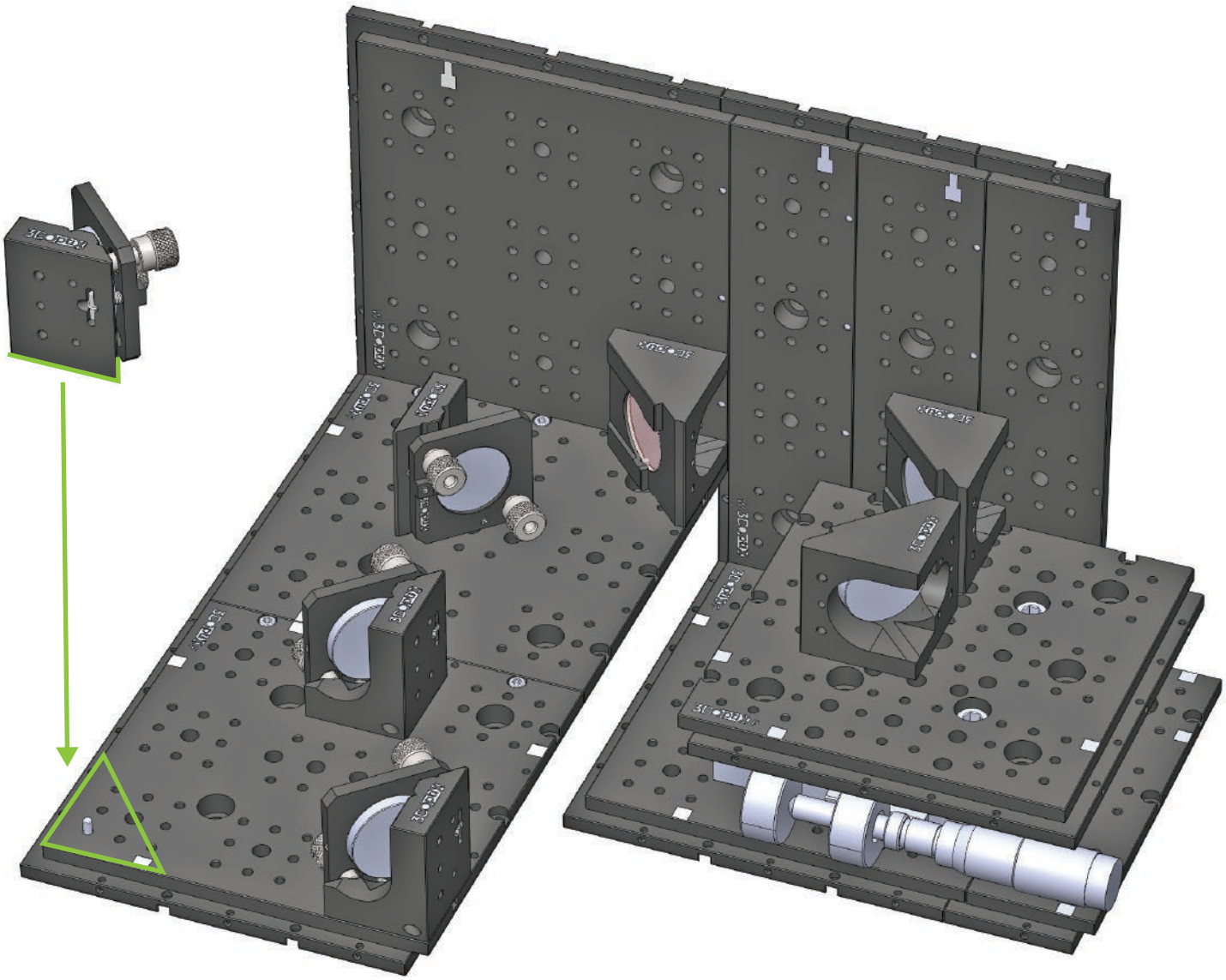
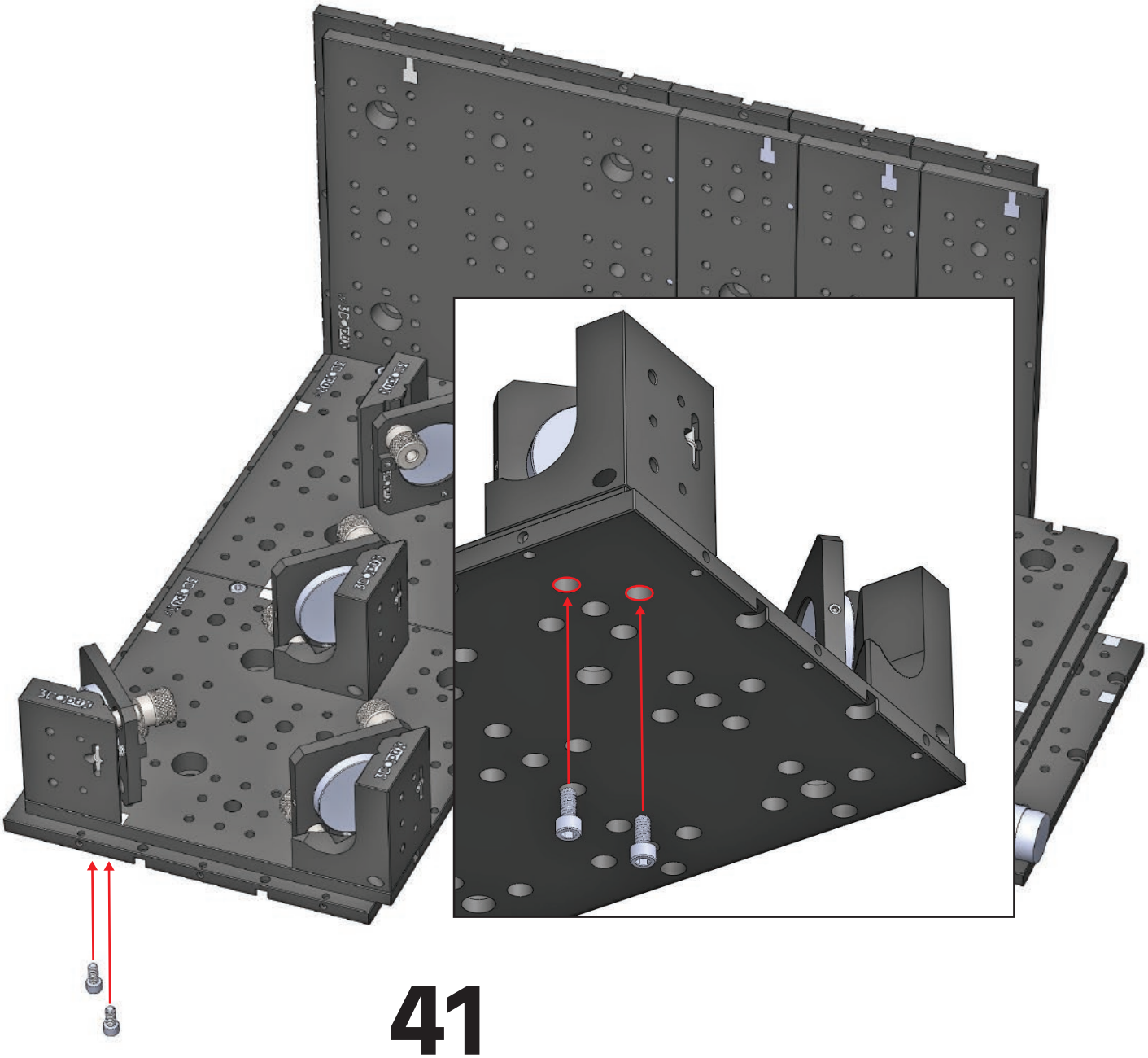
# 39



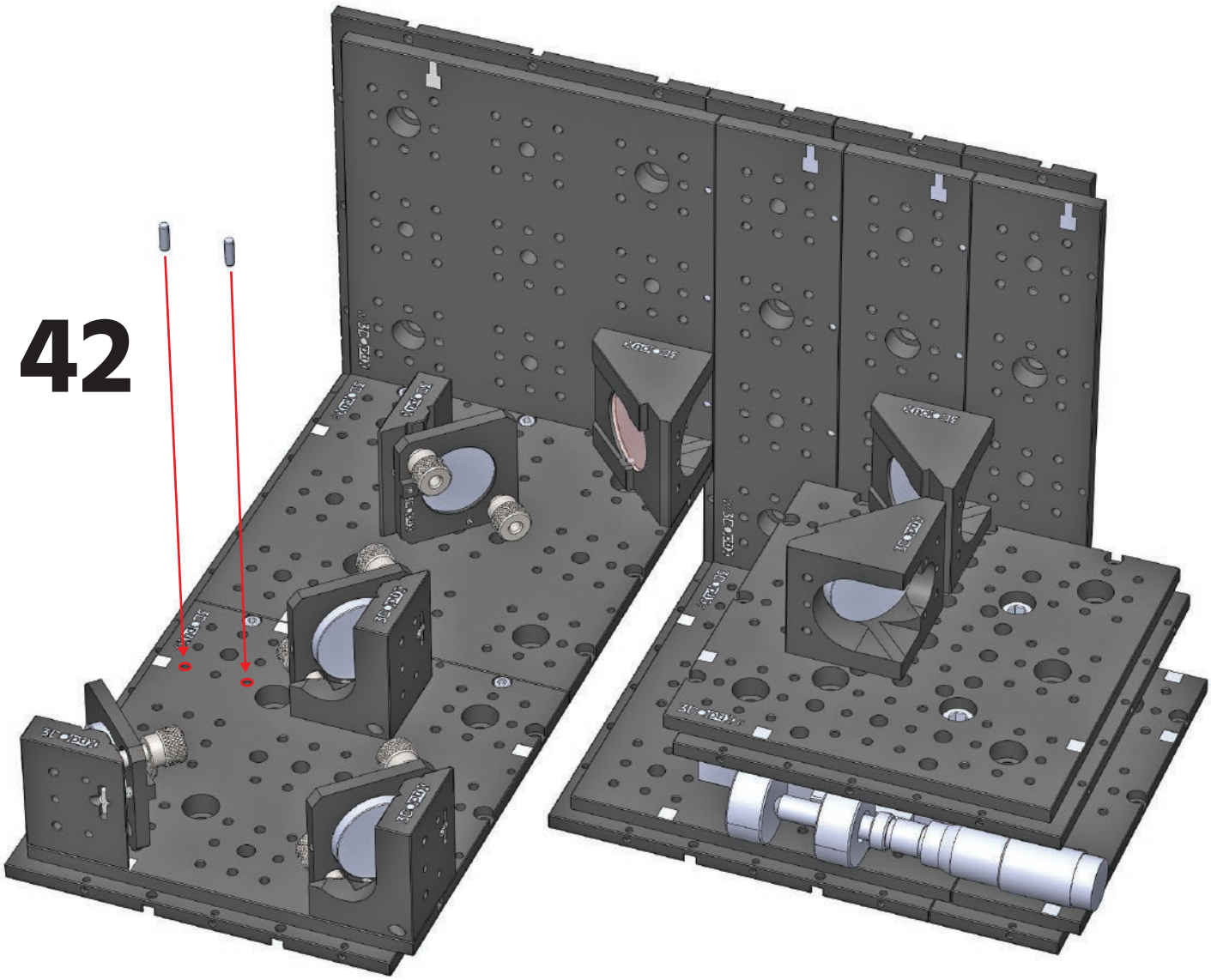
# 40 Mirror



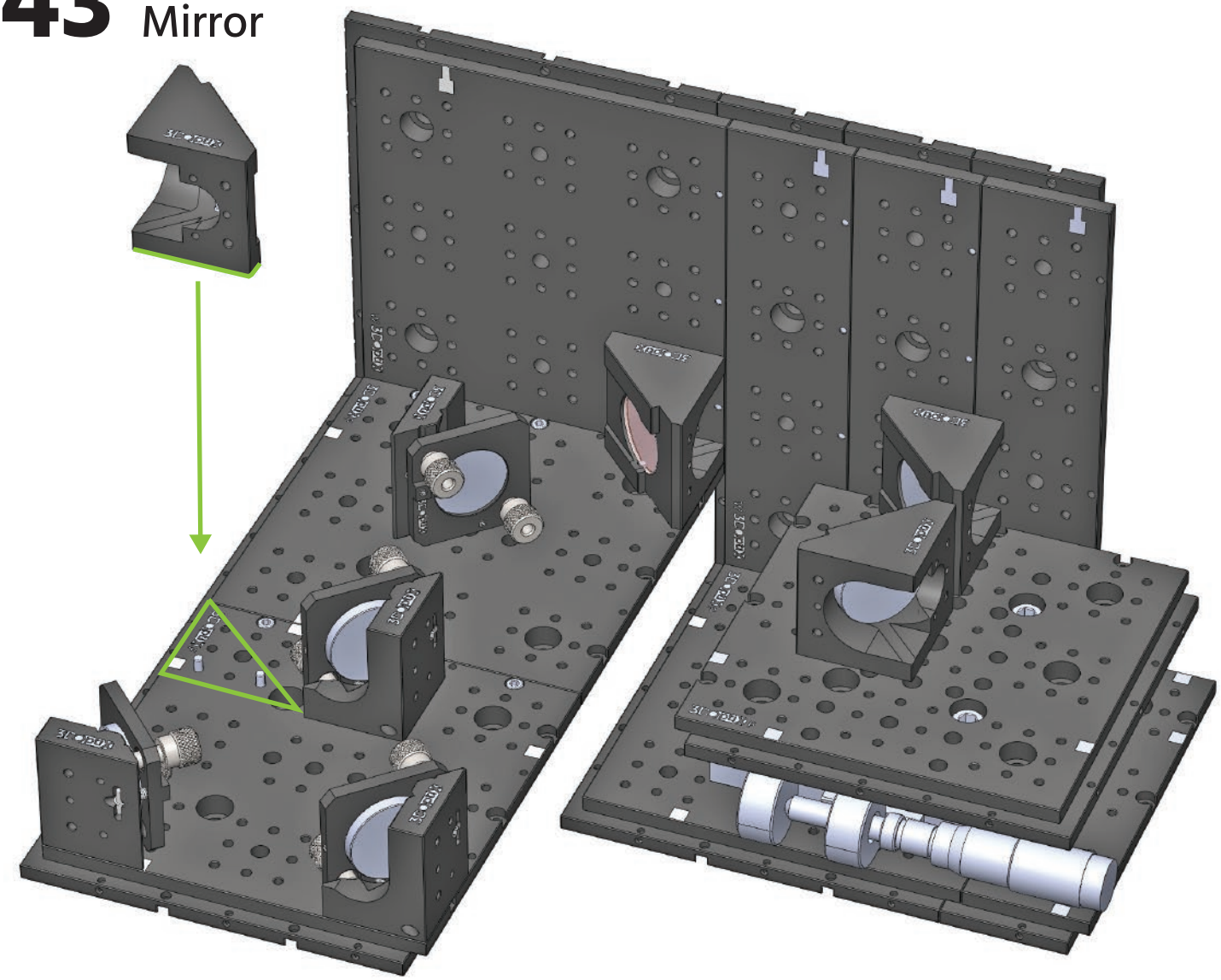


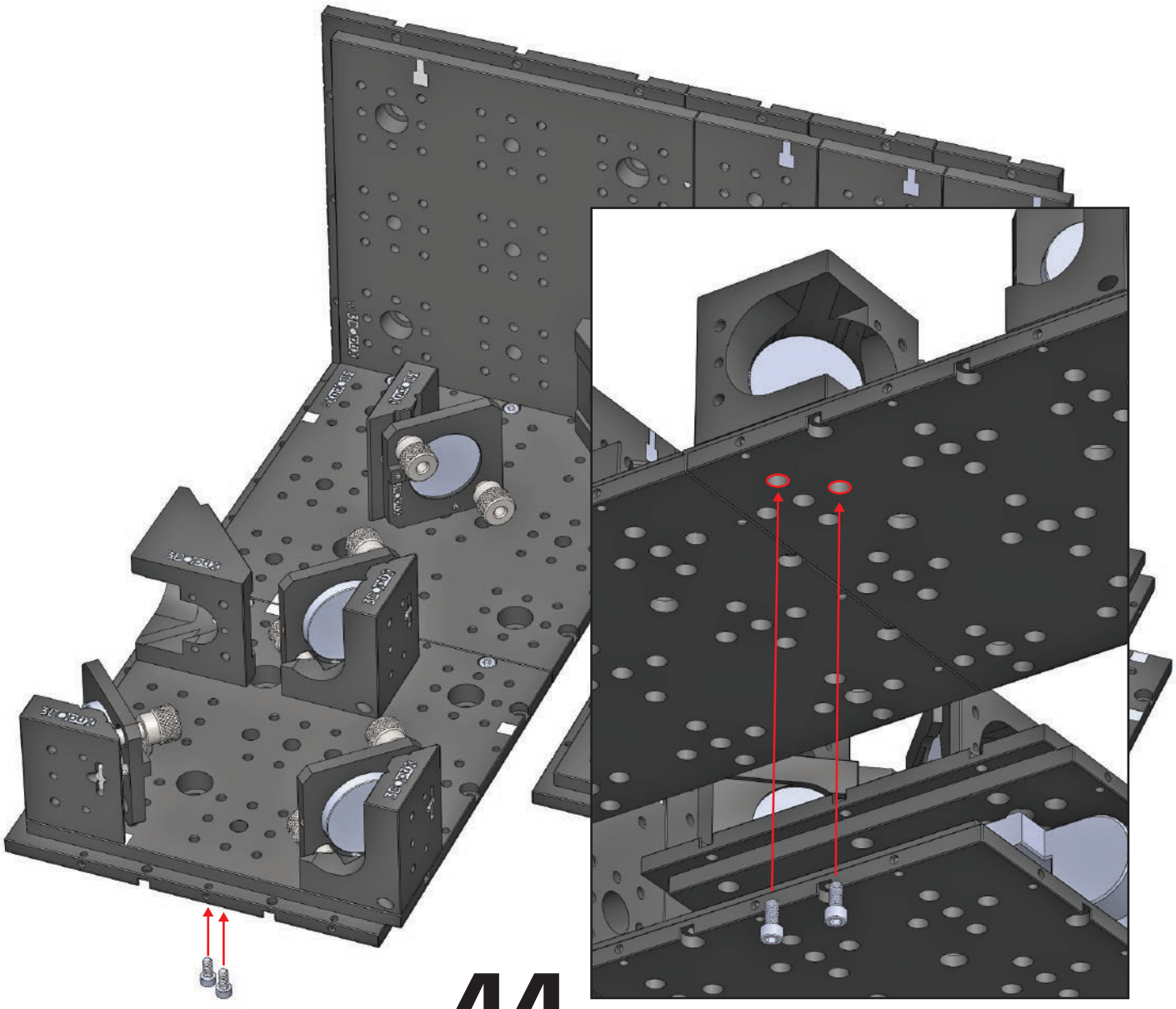
# 41

# 42



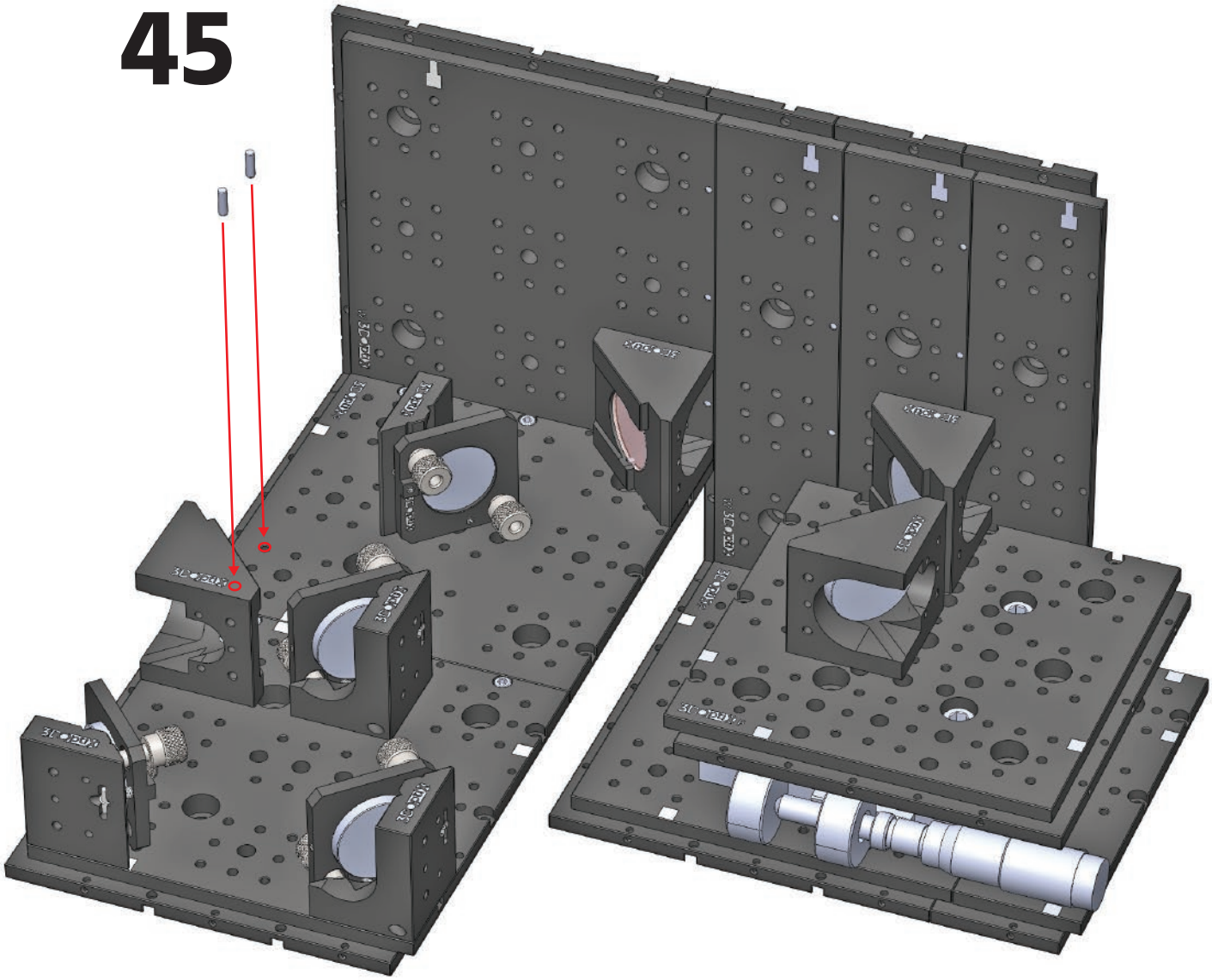
# 43 Mirror



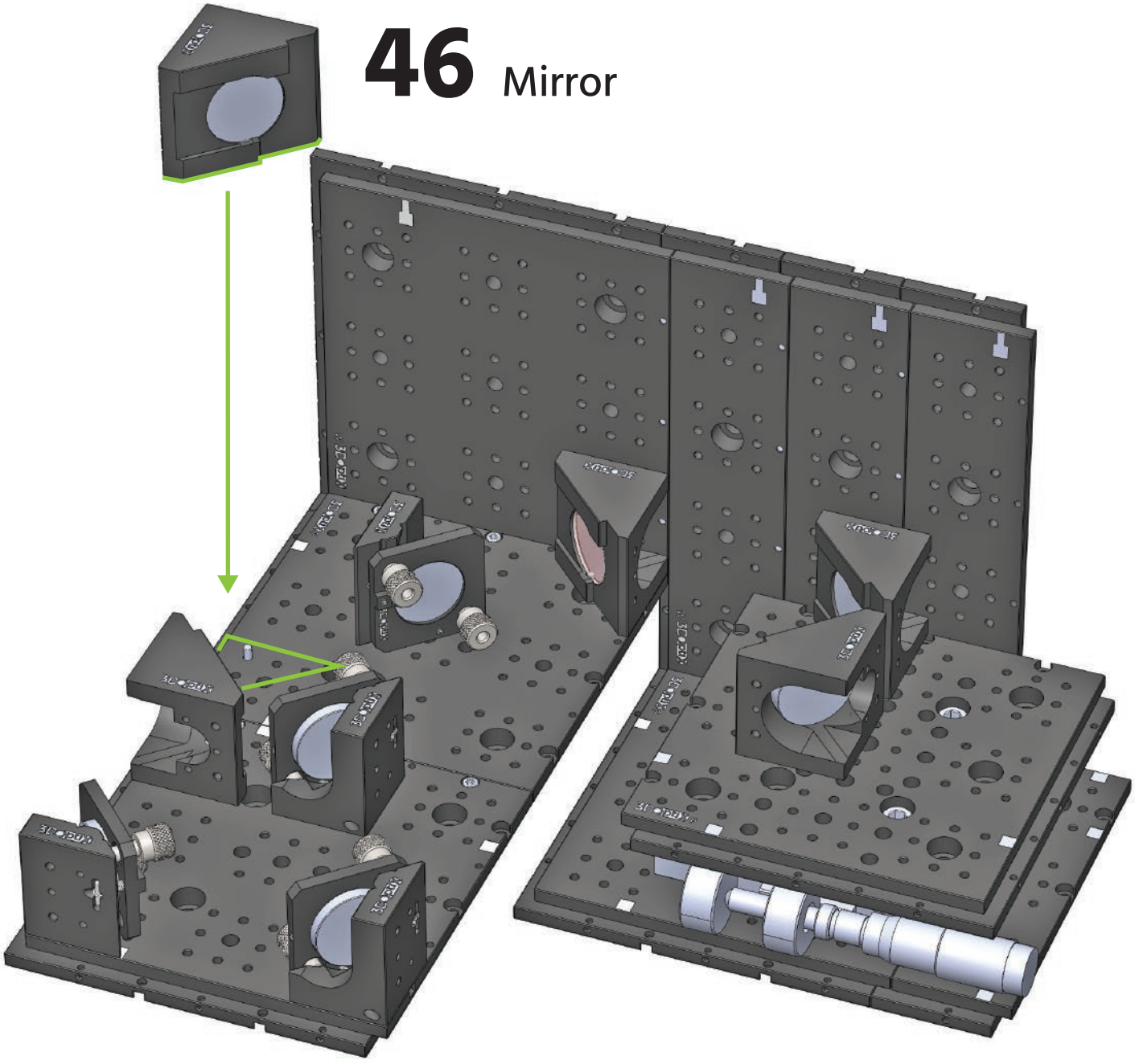


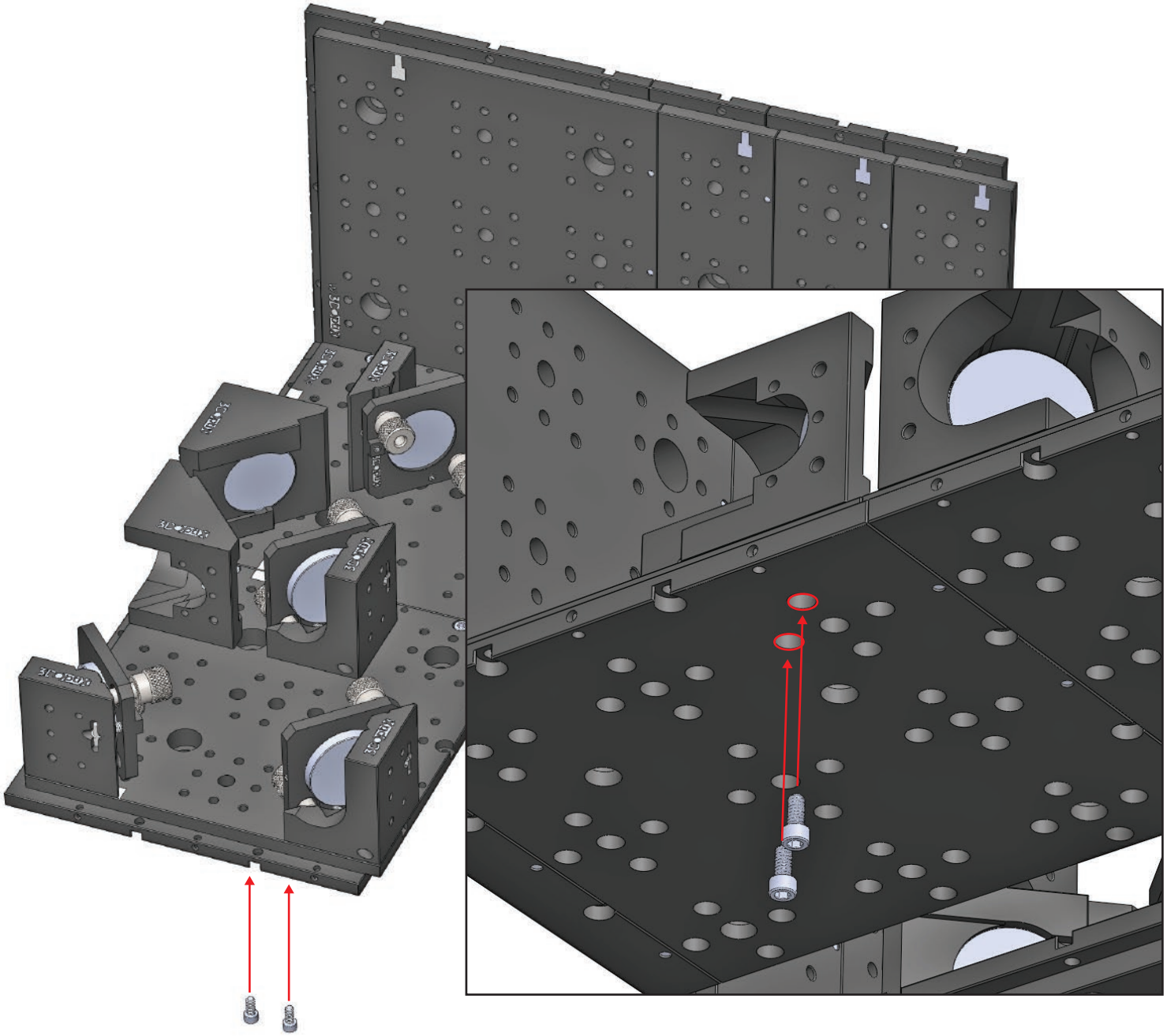
# 44

# 45

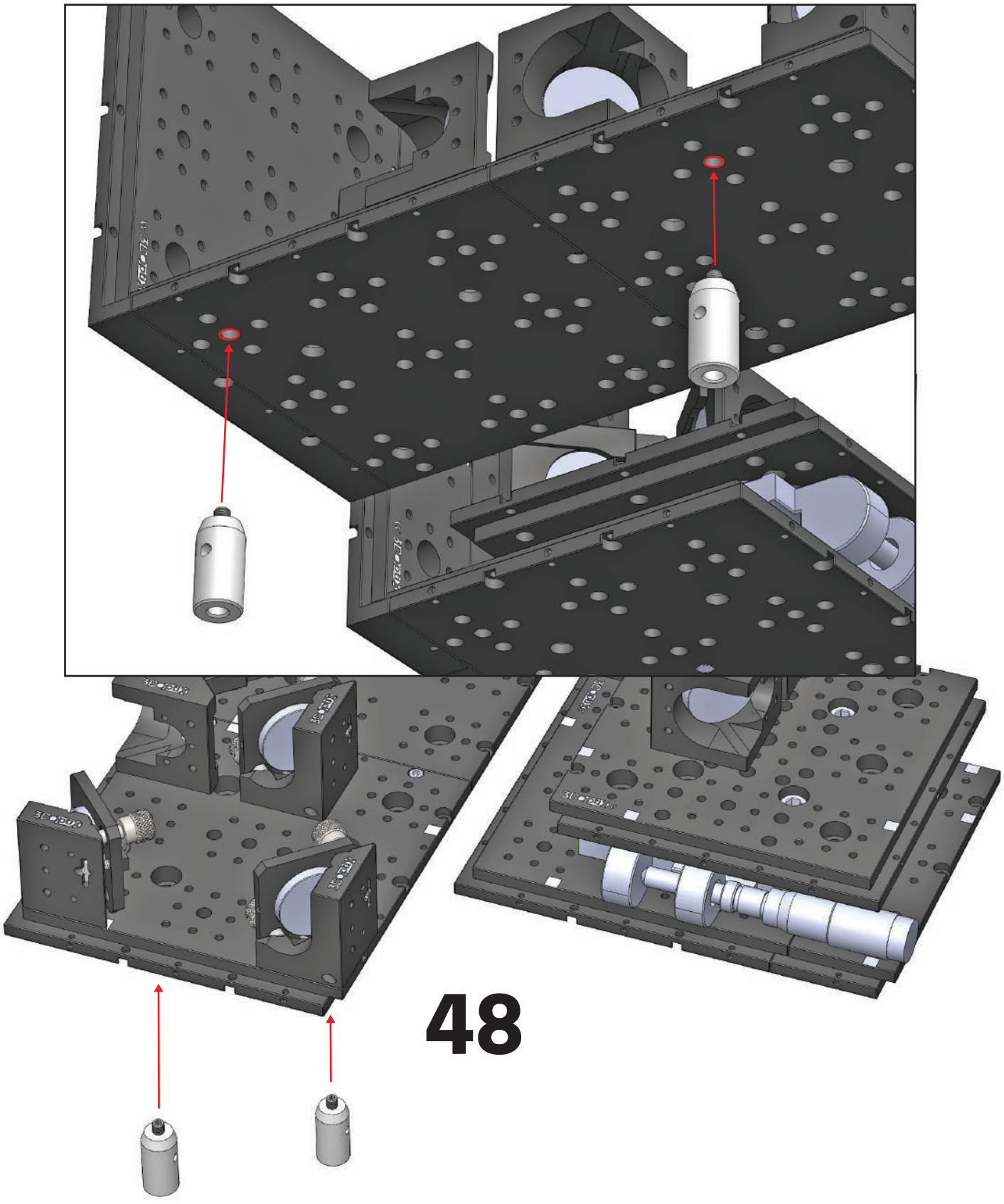


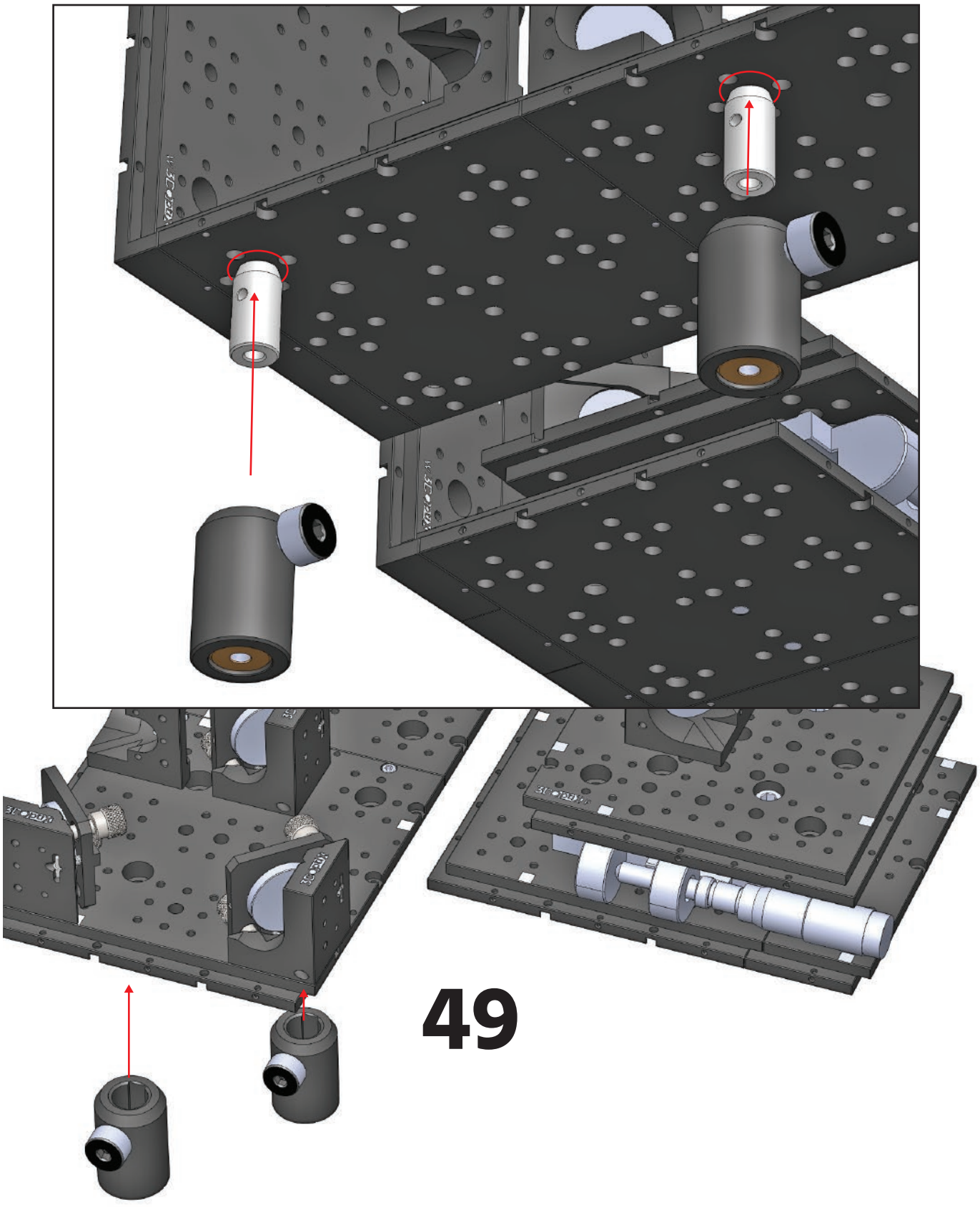
# 46 Mirror





# 47


48



# 49