

VM 250 Computational Lab Sessions

Lab #4

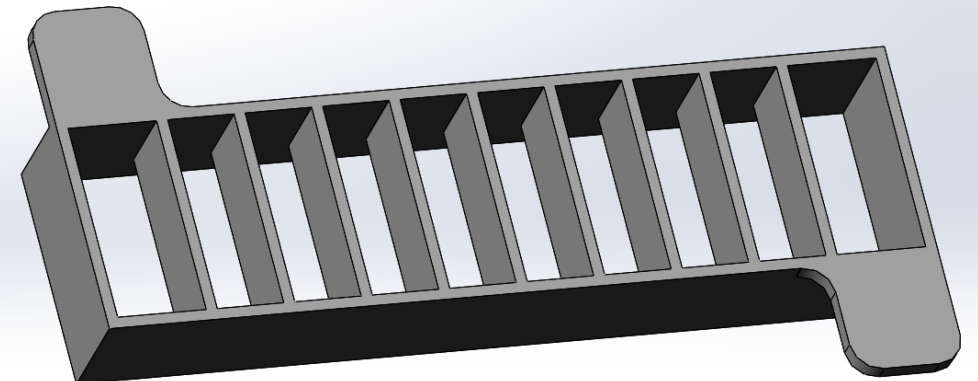
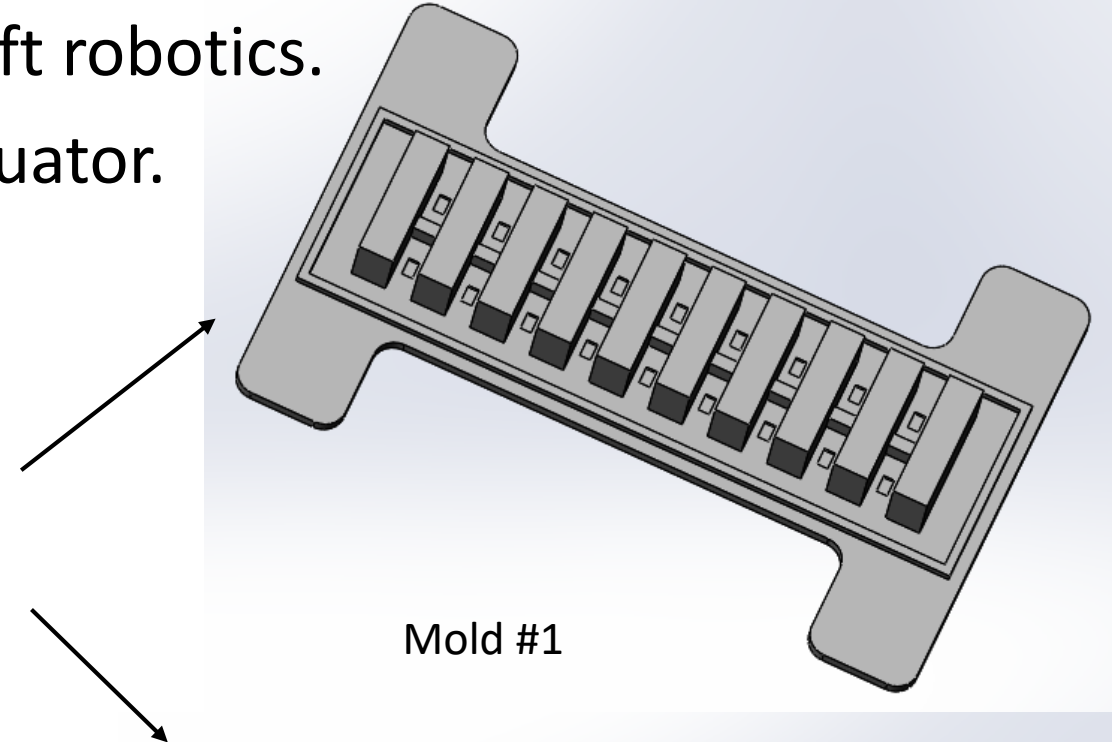
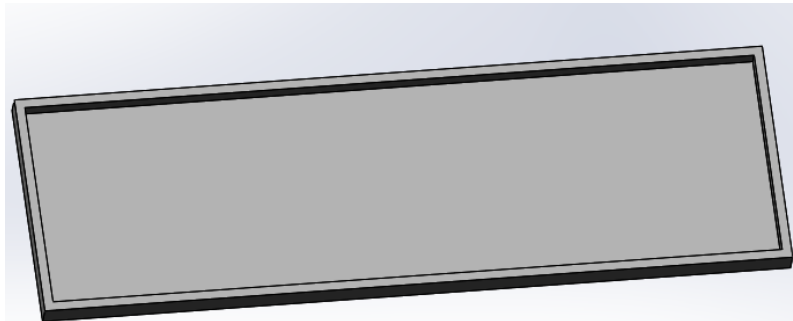
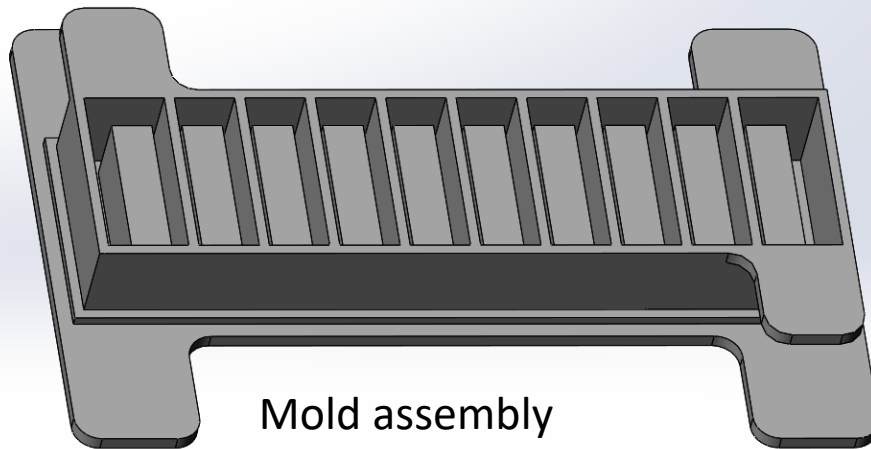
Mold Design for Soft Robotics

Prepared by TA Group



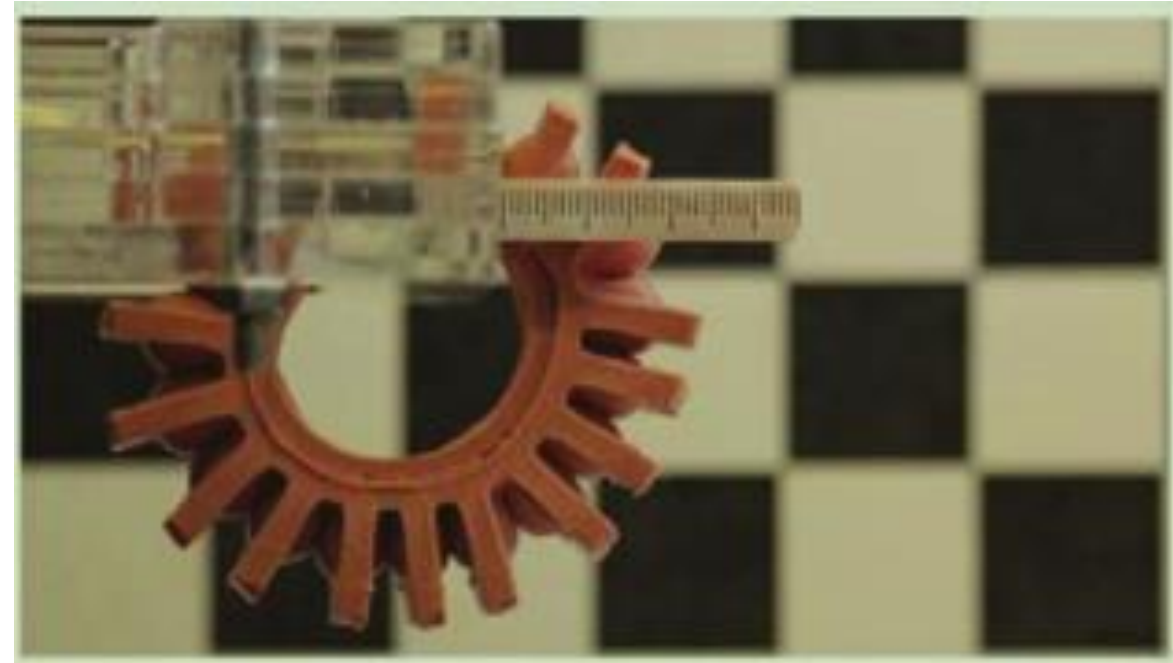
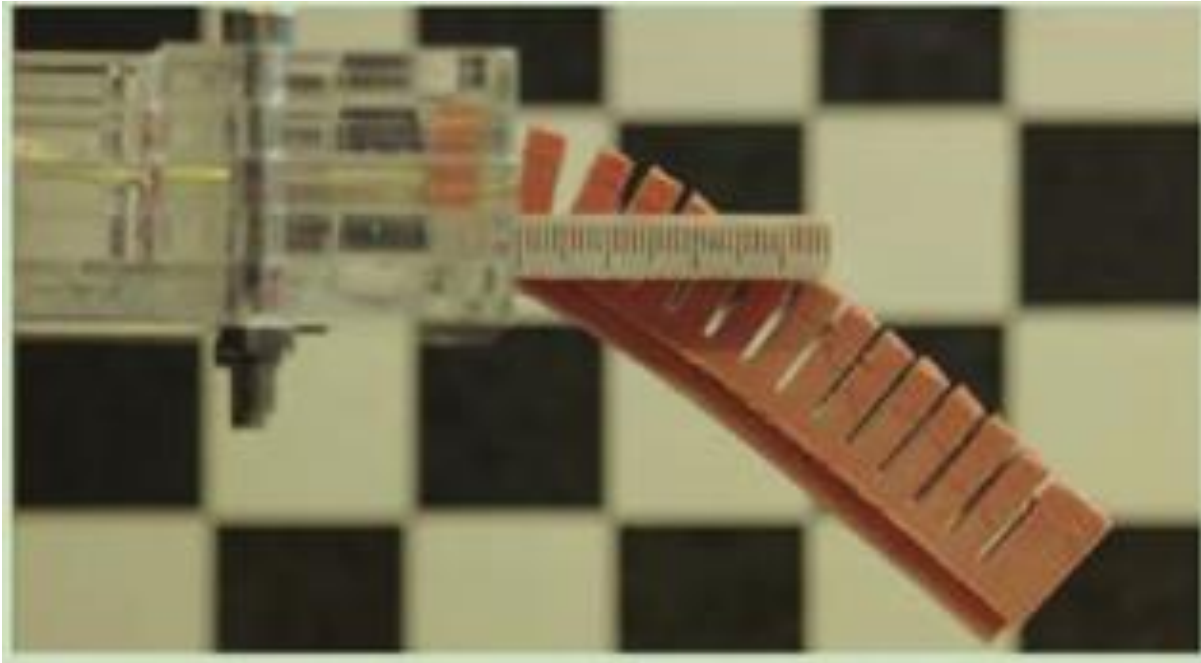
Goals

- Obtain fundamental concept on the soft robotics.
- Learn how to make molds for a soft actuator.



FPN (Fast Pneu-net) Actuator

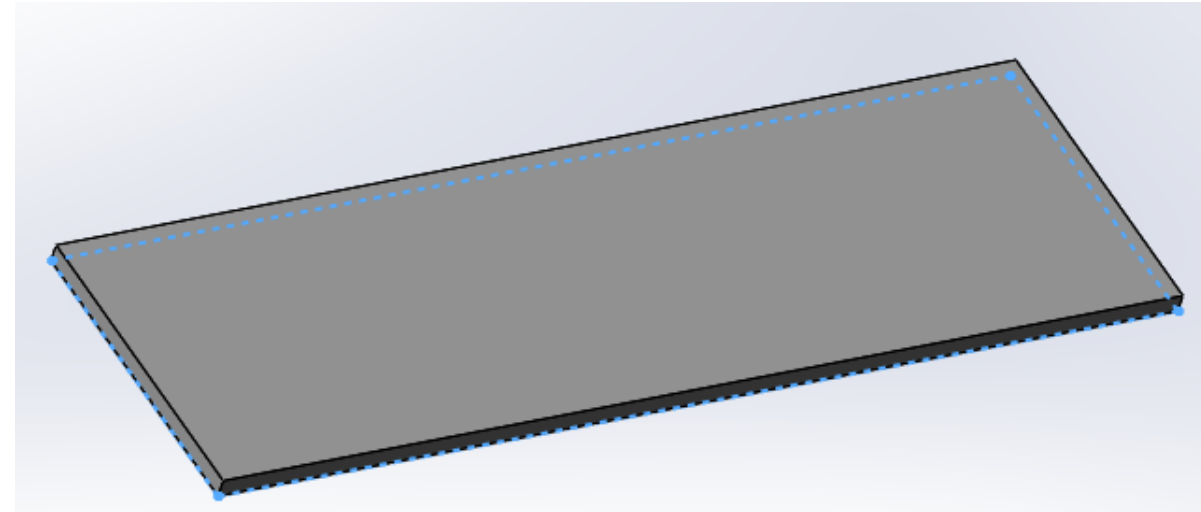
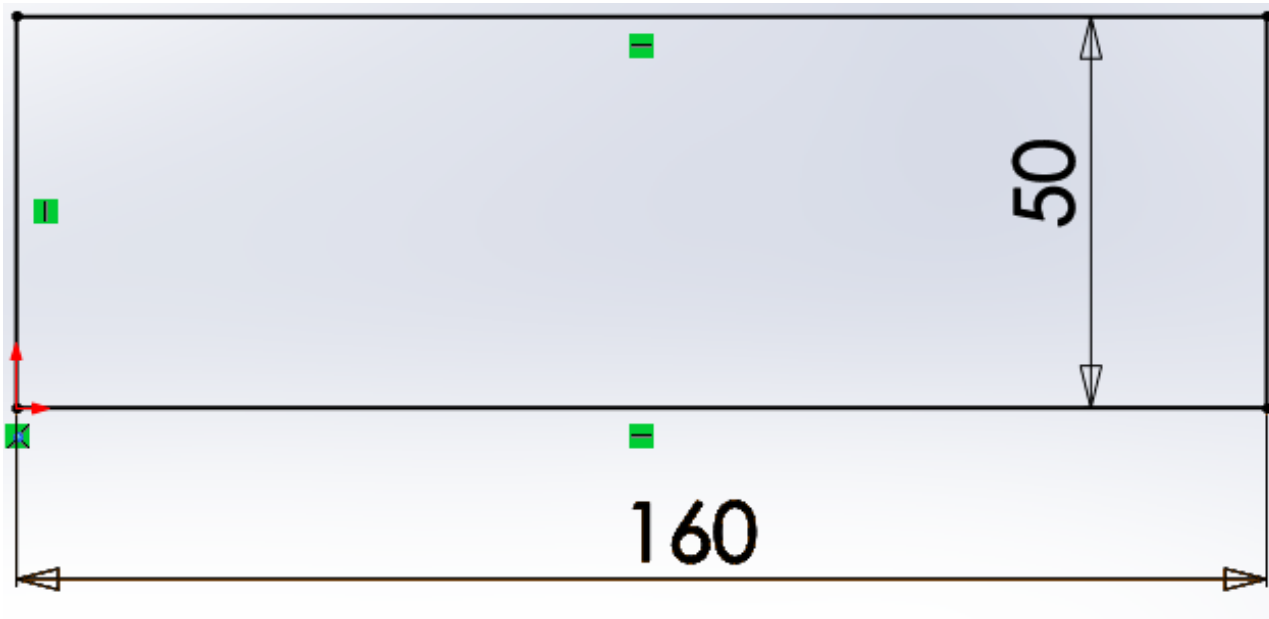
- It consists of several connected chambers. The chamber expands when it is pressurized, which makes the bottom layer bend to the other side.



3D Sketch

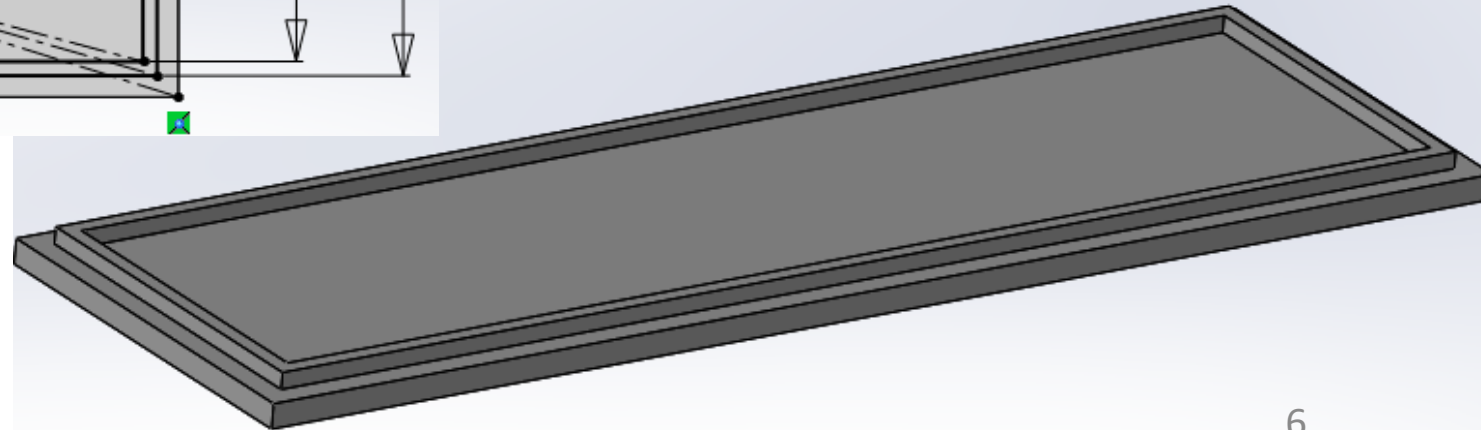
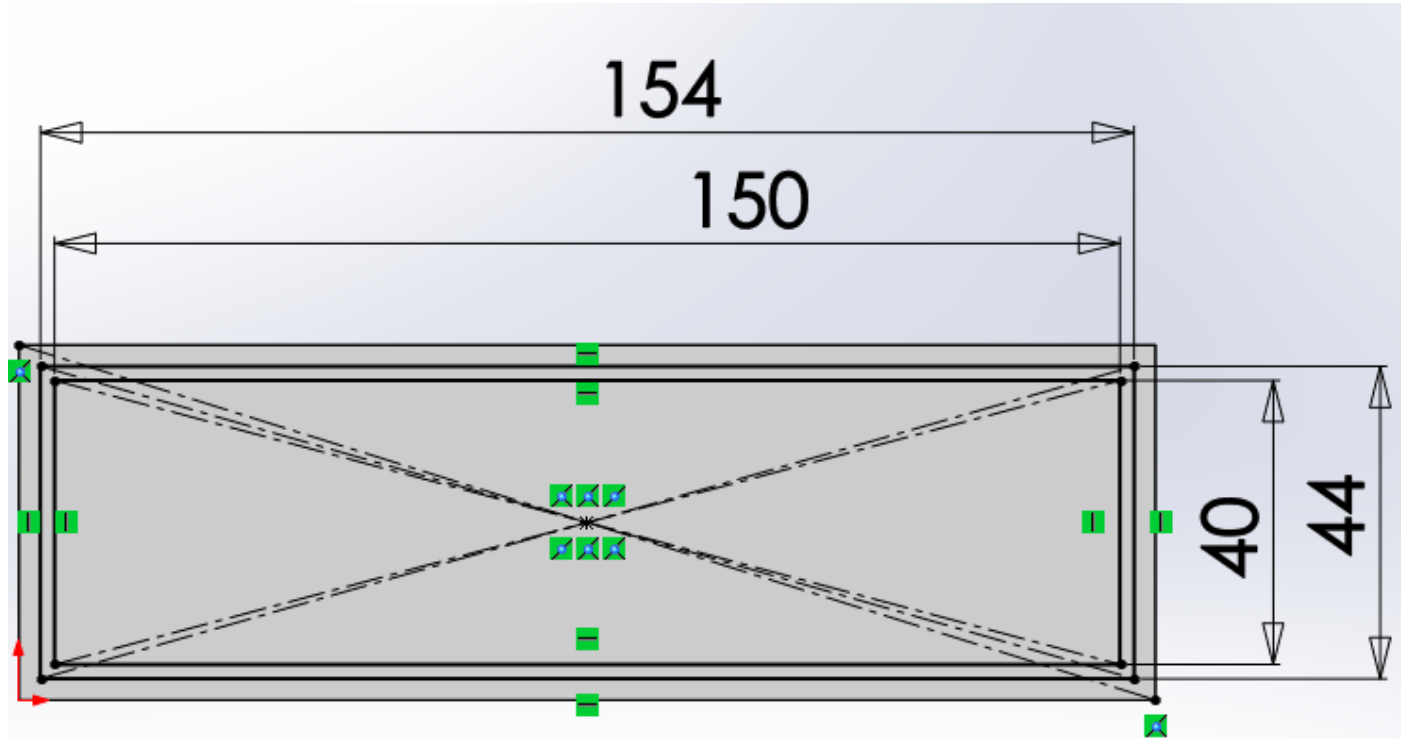
Mold #1 for an FPN Actuator

- Create a new file in SolidWorks
- Draw a rectangular plane first. The height for extrusion is 3.



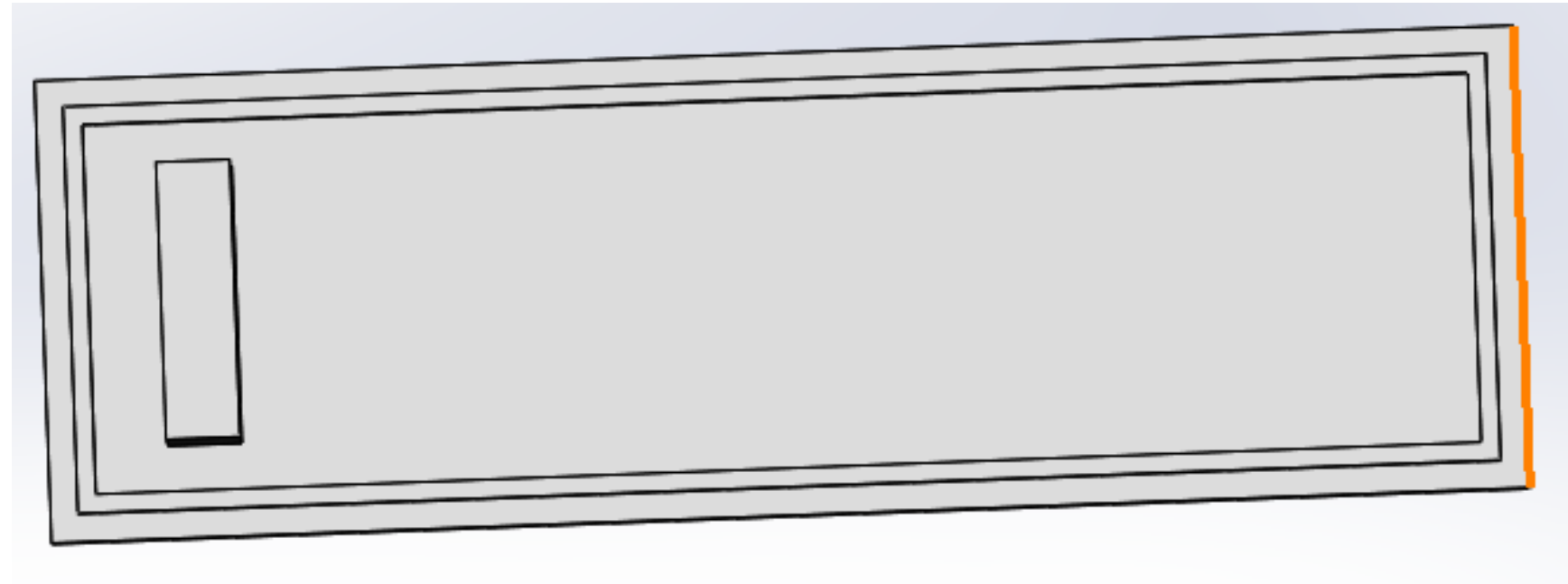
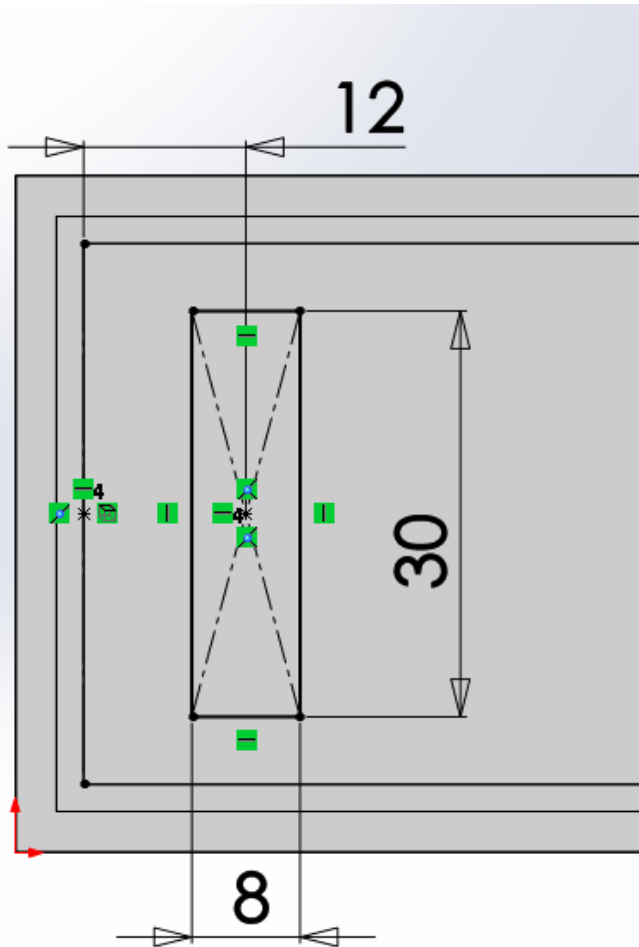
Mold #1 for an FPN Actuator

- Draw a rectangular box on the top plane of the block. The height is 2.



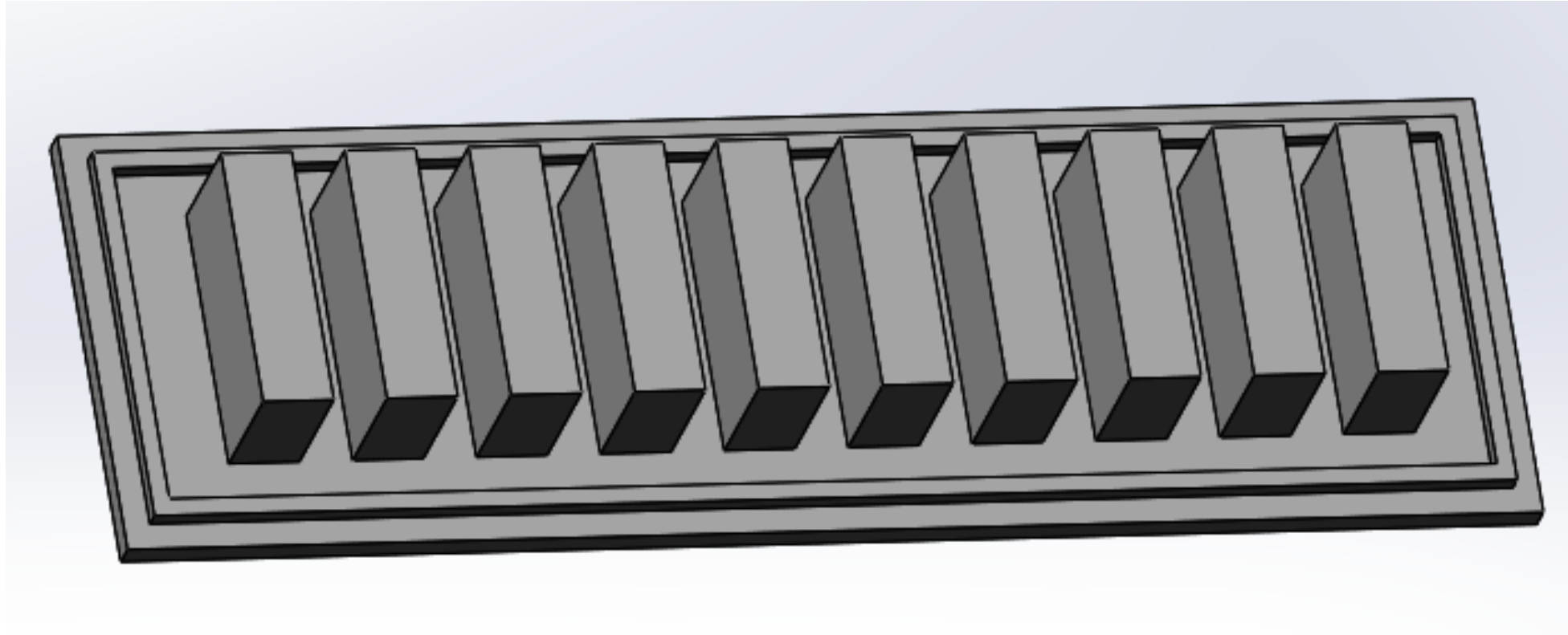
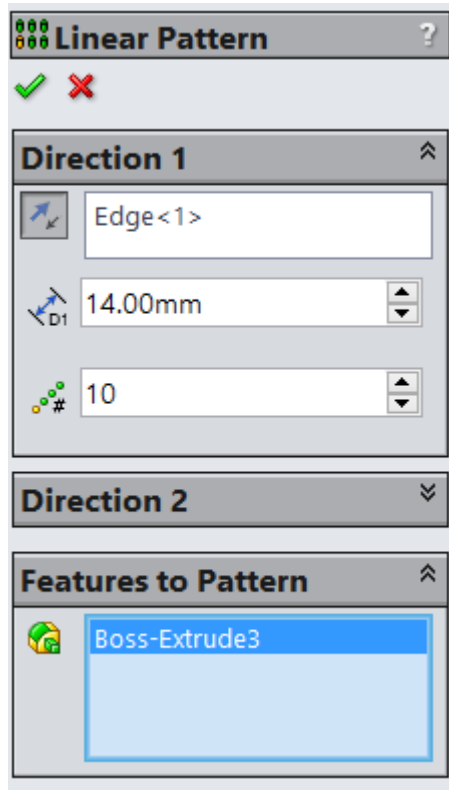
Mold #1 for an FPN Actuator

- Create the first grid as shown.



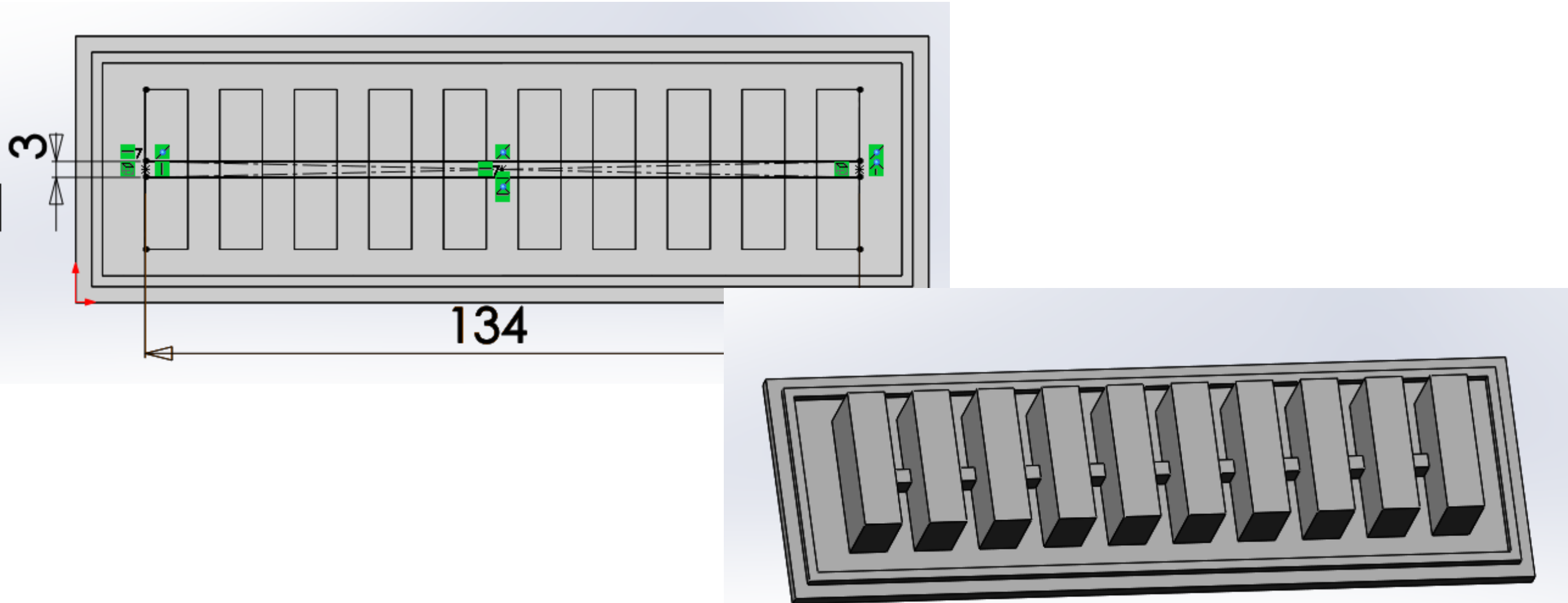
Mold #1 for an FPN Actuator

- Use “Linear Pattern Feature” function to create the other grids.



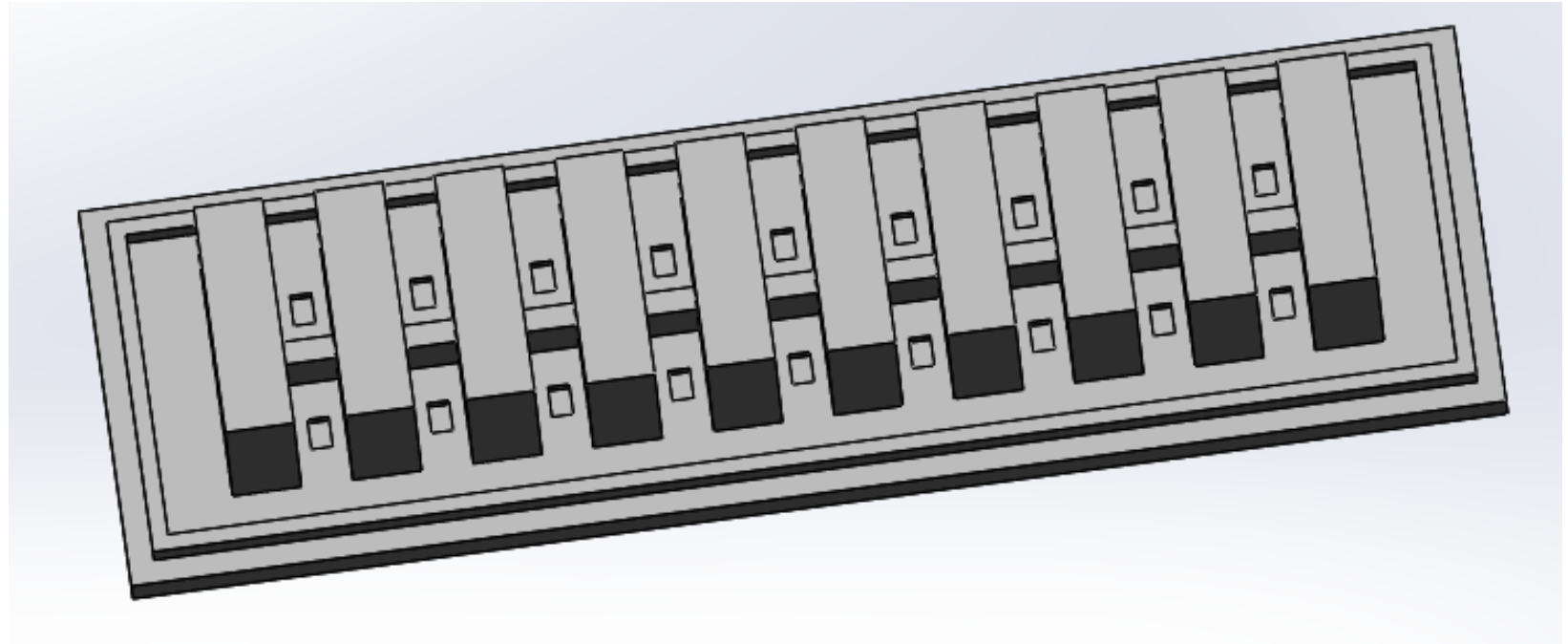
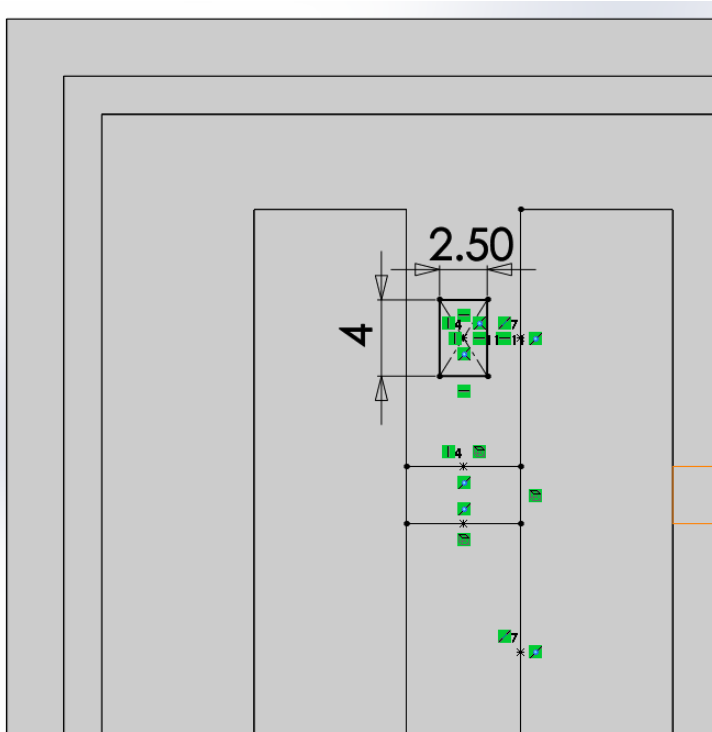
Mold #1 for an FPN Actuator

- Connect the grids. The height is 5.



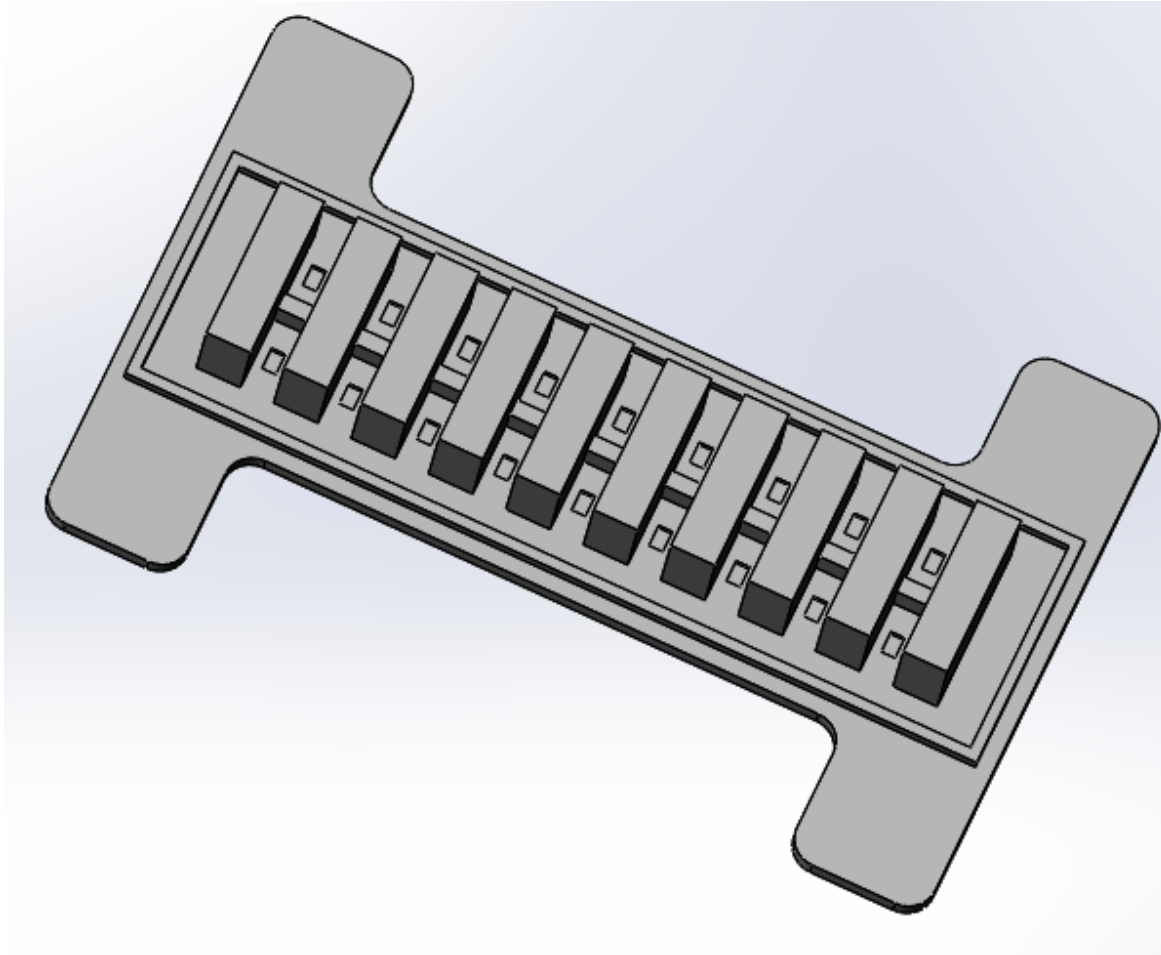
Mold #1 for an FPN Actuator

- Make two small holes on the bottom.
- Use “**Pattern Feature**” to create a series of holes.



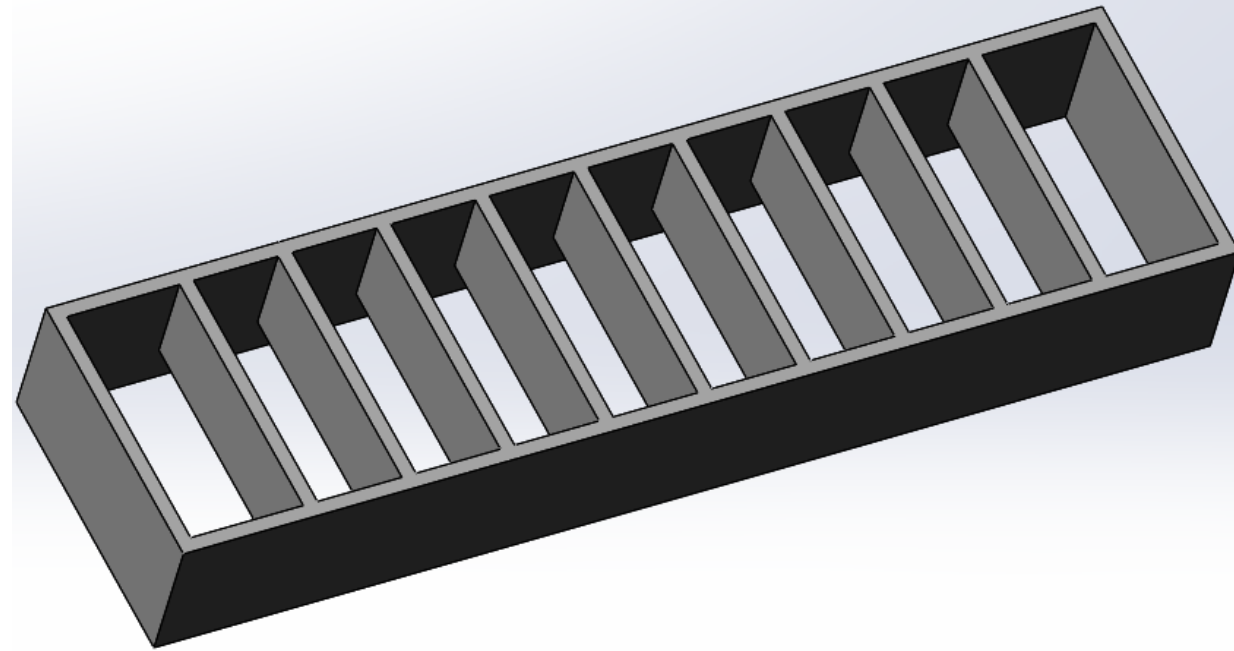
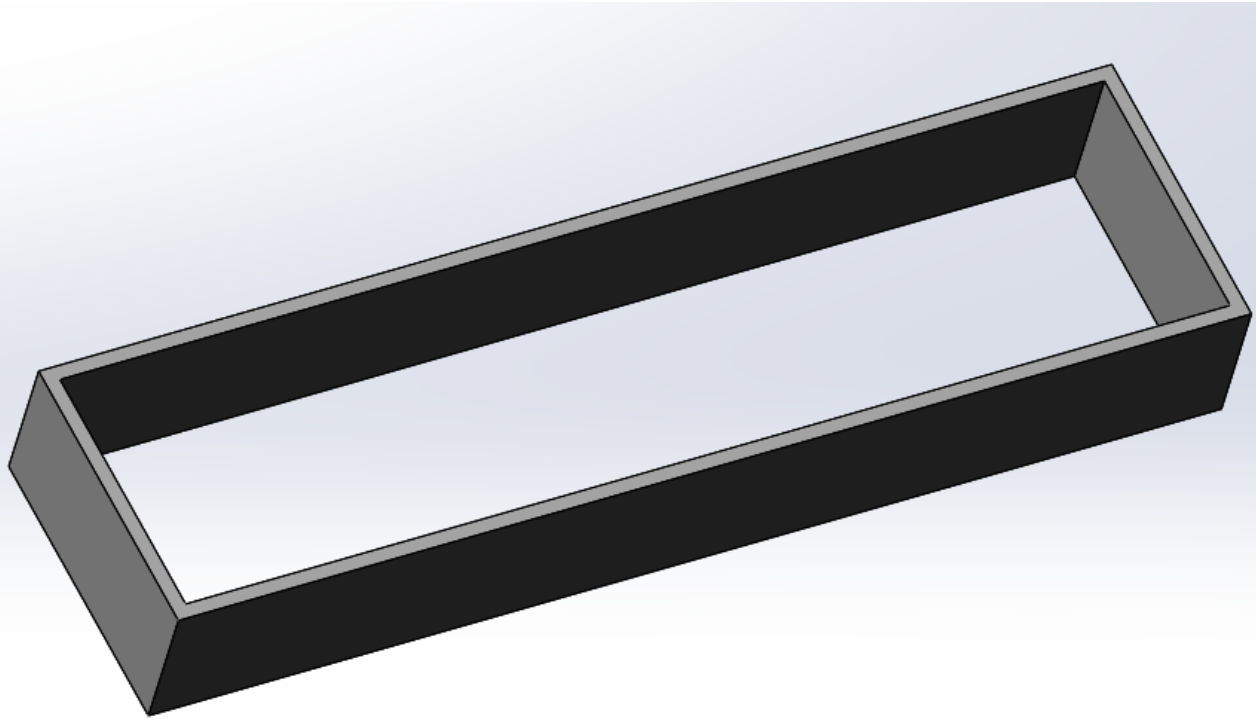
Mold #1 for an FPN Actuator

- You may also need to add the handle parts which will convenient when you manufacture this actuator.



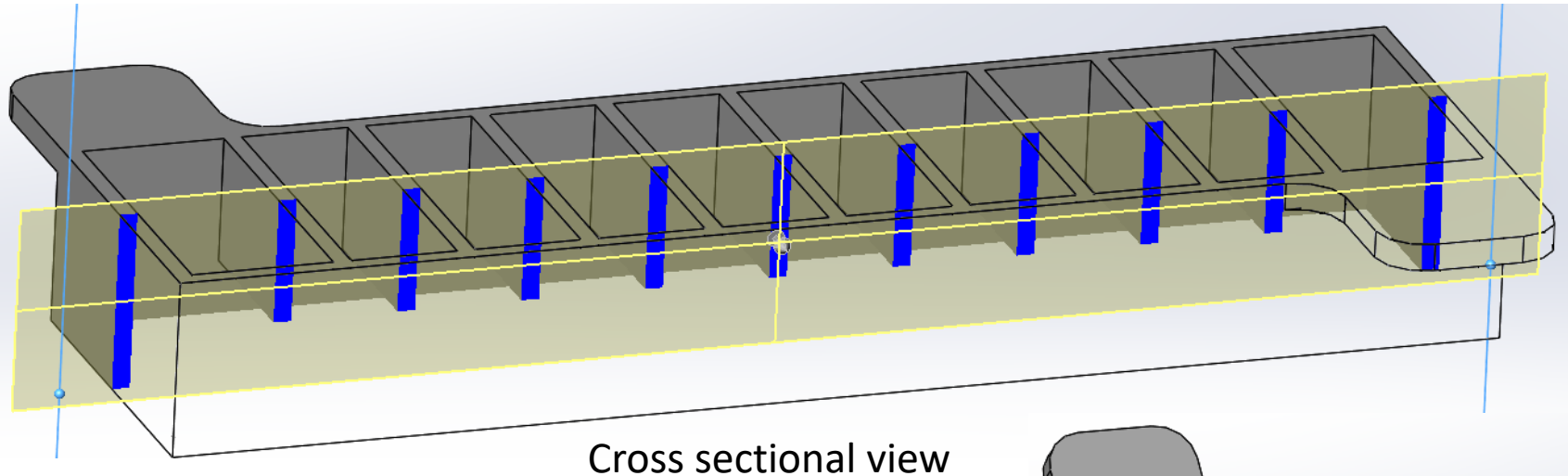
Mold #2 for an FPN Actuator

- Make a rectangular shell first.

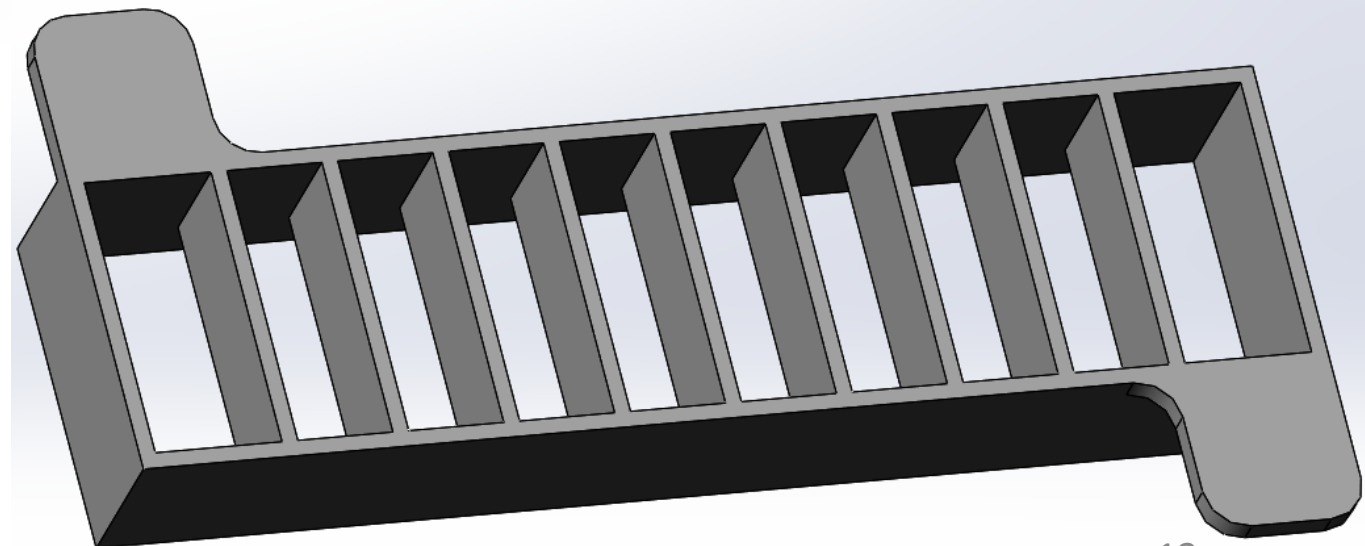


Mold #2 for an FPN Actuator

- Add two handle parts.

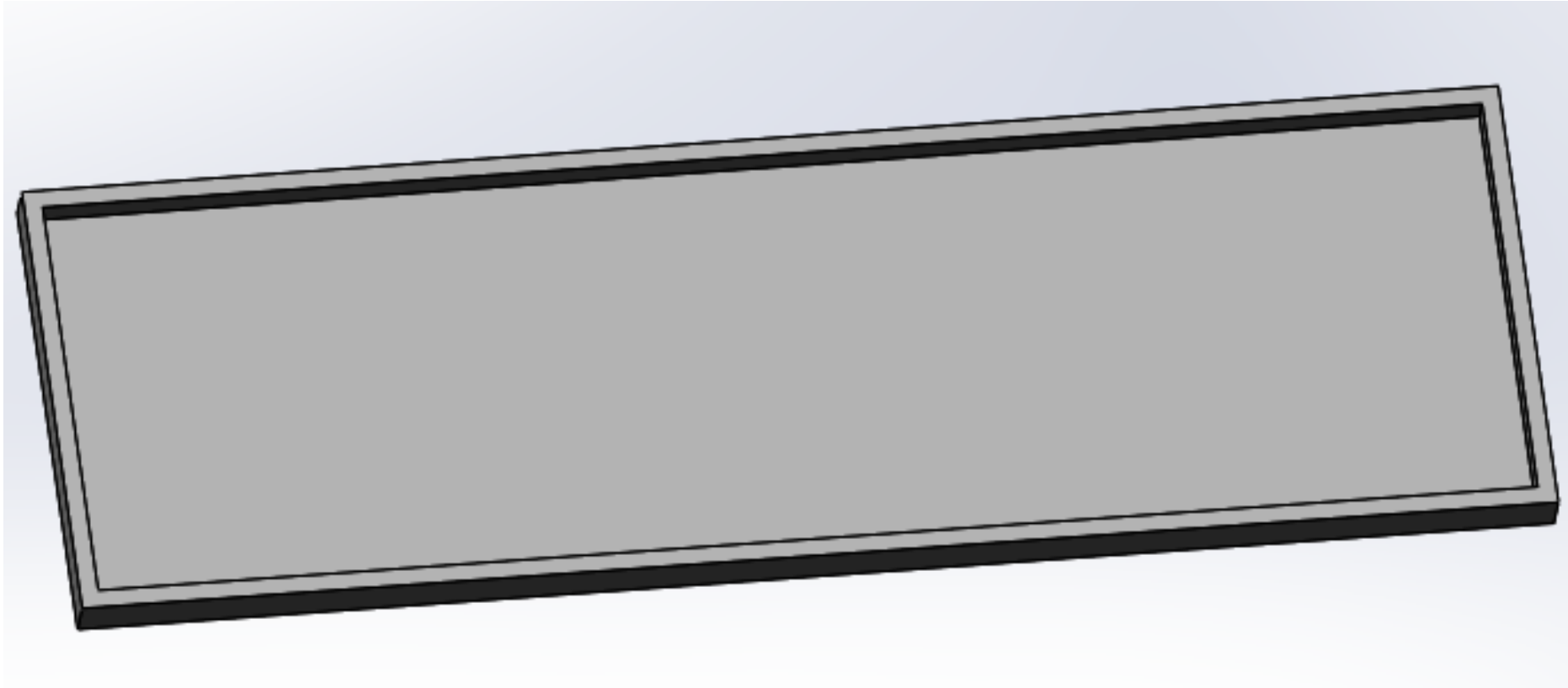


Cross sectional view

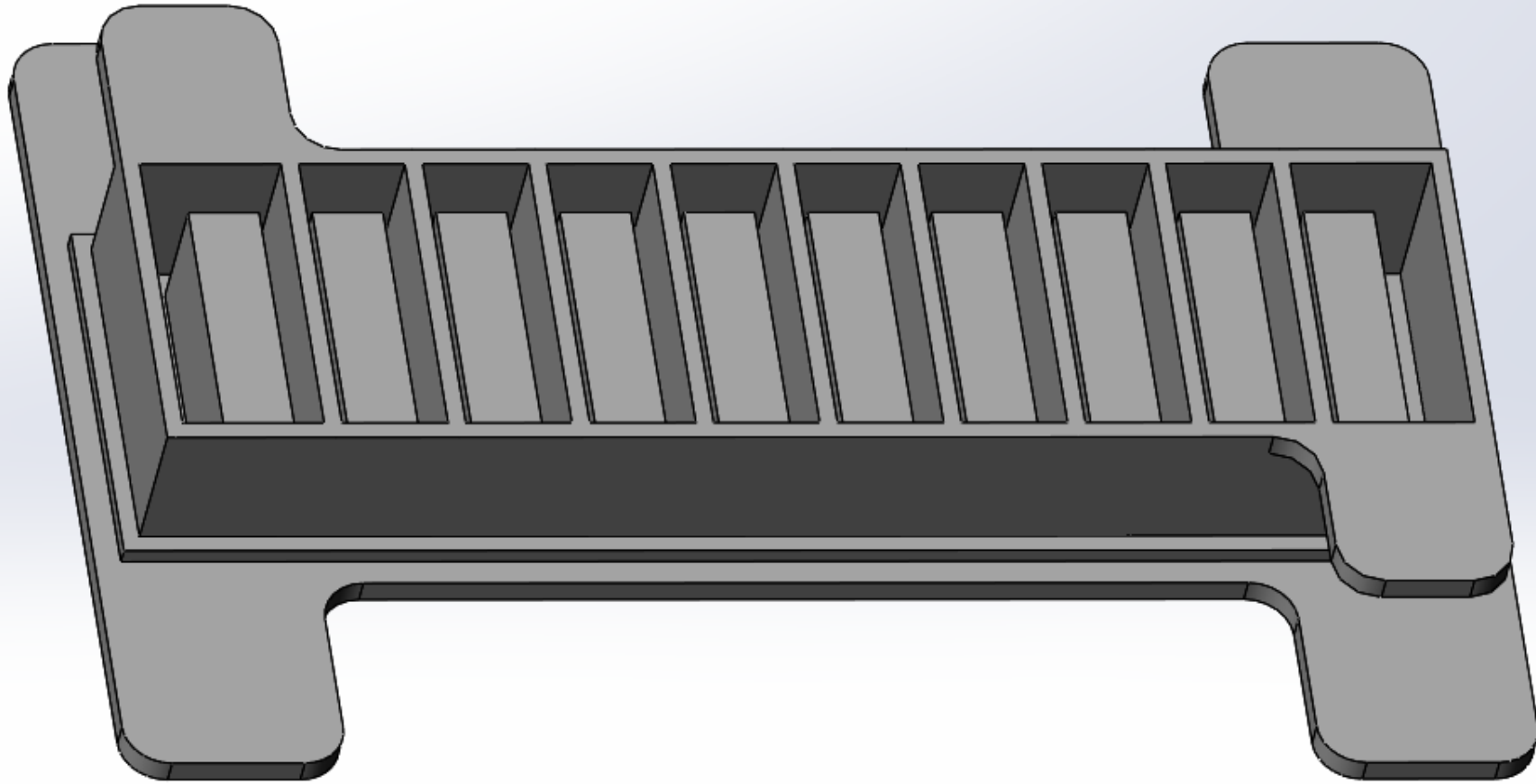


Bottom layer for an FPN Actuator

- You need another rectangular groove to make the bottom layer (Using a shell feature).

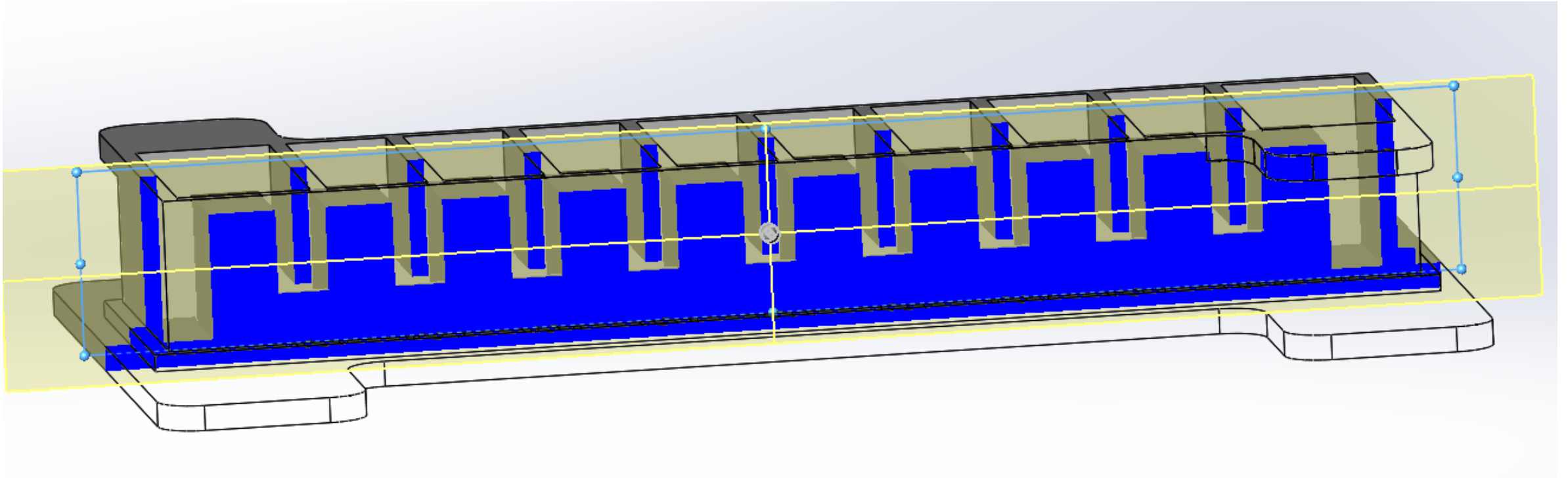


Create assembly



Create assembly

- The section view of the assembly is like this.



Fabrication

Manufacturing procedure

- Print the molds with an FDM-based 3D printer.



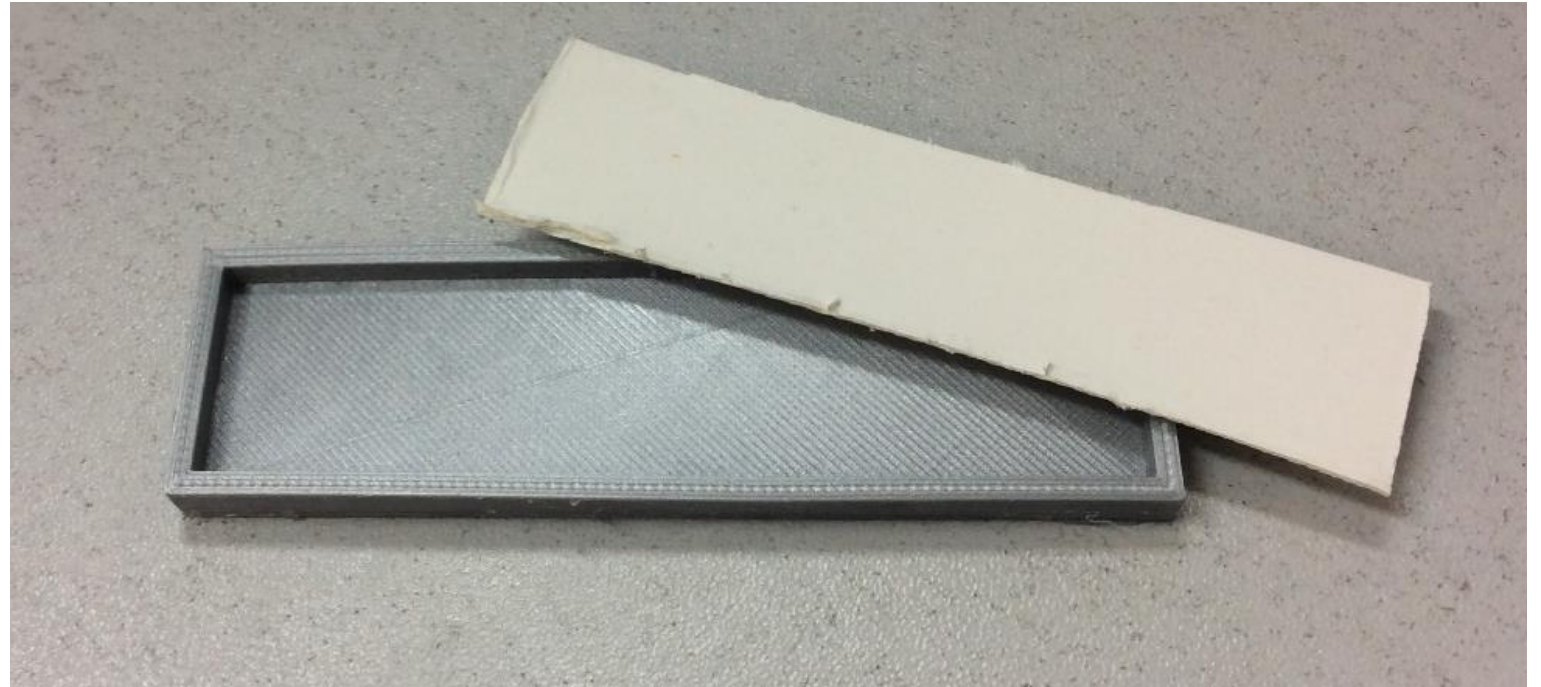
Manufacturing procedure

- Combine the molds and fill the empty space with a soft material (liquid).
- Wait until the soft material is fully solidified (for about four hours).



Manufacturing procedure

- Make the bottom layer while you are waiting for the main body to be solidified.
- Pour the semi-liquid elastomer resin into the rectangular groove. Put a paper layer on it when the material is almost solidified, and fill in the groove with the semi-liquid elastomer resin.



Manufacturing procedure

- Take the main body and the bottom layer out of the molds after they are solidified.
- Glue the two parts with the elastomer.



Manufacturing procedure

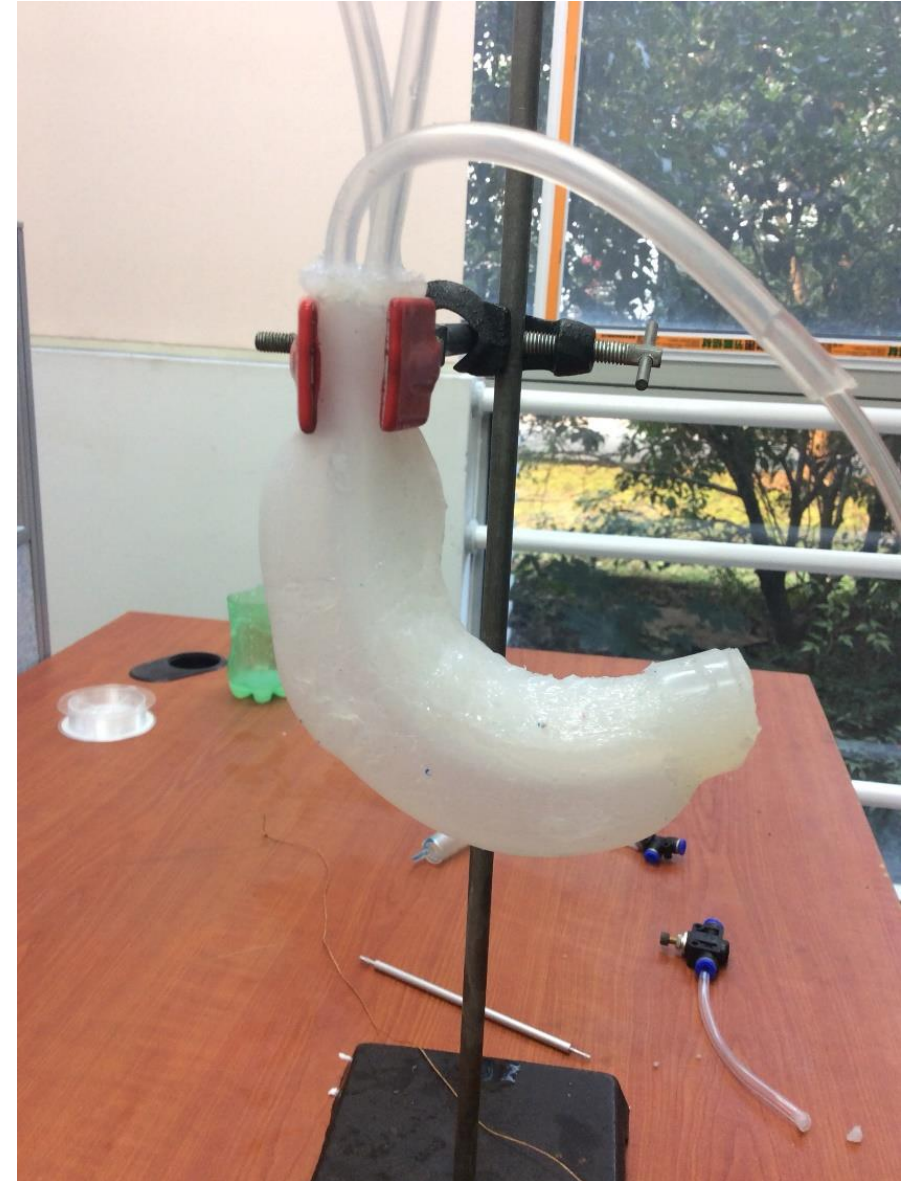
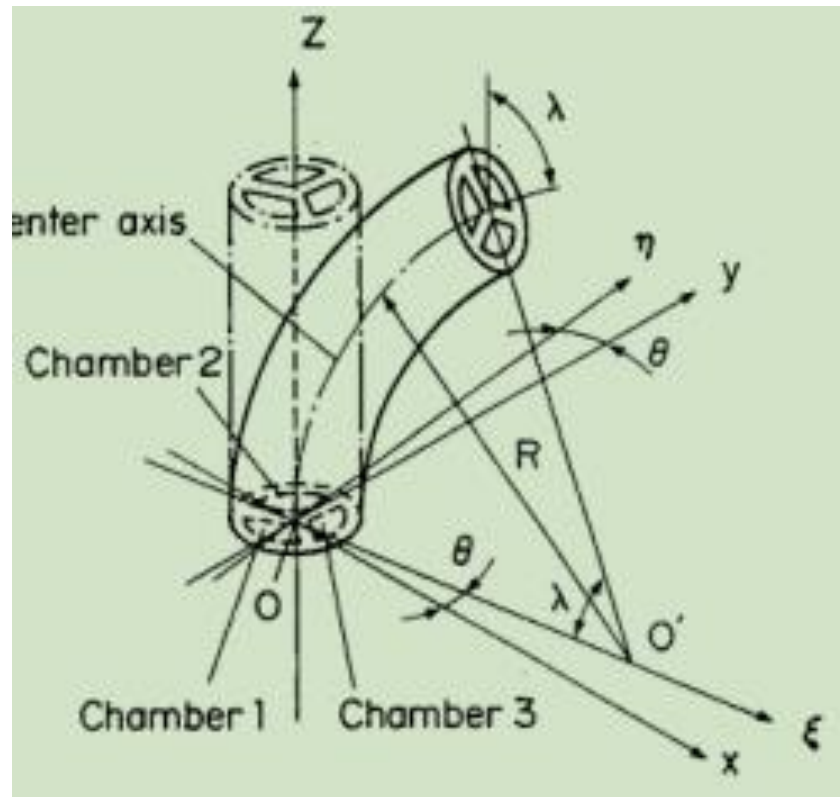
- Remove unnecessary parts and insert an air tube.



Other grippers

Other actuators

- Multi-channel flexible actuator
- 3D motion controlled by different pressure.



Manufacturing procedure

- Half-cylinder shape with fiber reinforcement.
- It can achieve bending, extending and twisting.

