

EP1000

Computer Controlled Cutting

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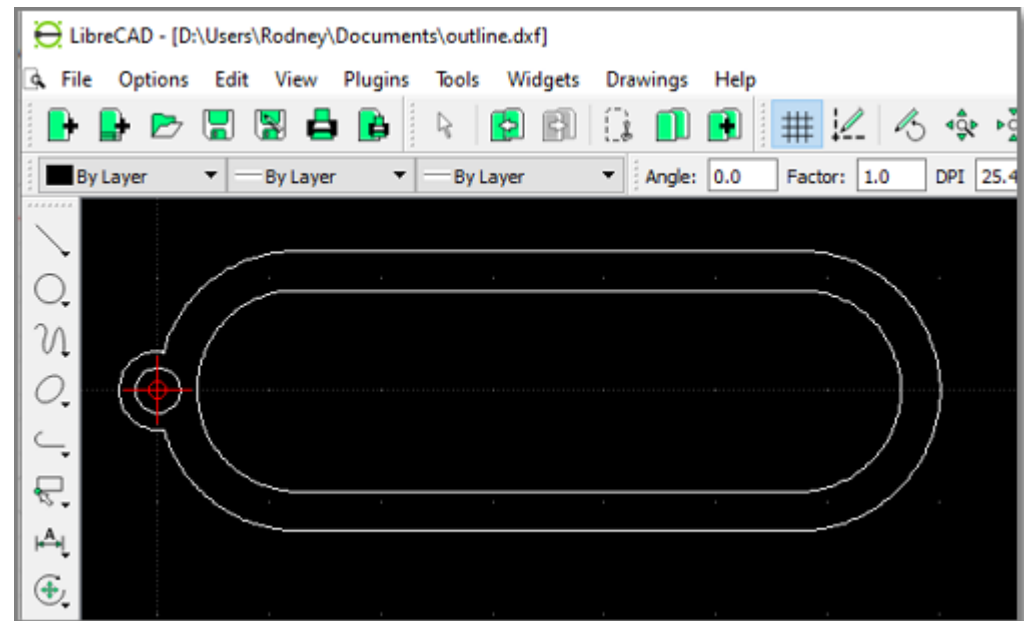
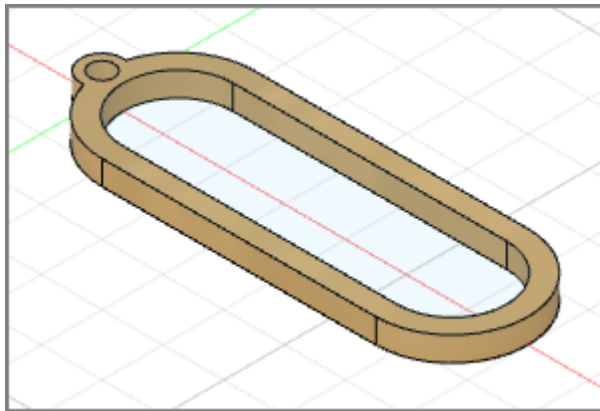
- Perform Cutting operations based on digital data.
- Also known as CNC (Computer Numerical Control)
- Data is provided from:
 - CADD operations
 - Digital 2D drawings
- Provides accurate and precise cutting operations
- Used in:
 - Laser cutting & engraving
 - Flatbed cutters & 2D routers
 - Milling machines

2D profile

- All cutting systems work on a 2D profile which provides an outline of the cut.
- Advantages:
 - The cut is precise with little wastage of material.
 - Allows positioning to prevent wastage.
 - Repeatability
- Vector File formats:
 - DXF (Data eXchange Format)
 - PDF (Portable Document Format)
 - SVG (Scalable Vector Graphics)

Vector Software

- 2D Vector drawing programs: Inkscape, AutoCAD
- CADD Software – Fusion 360



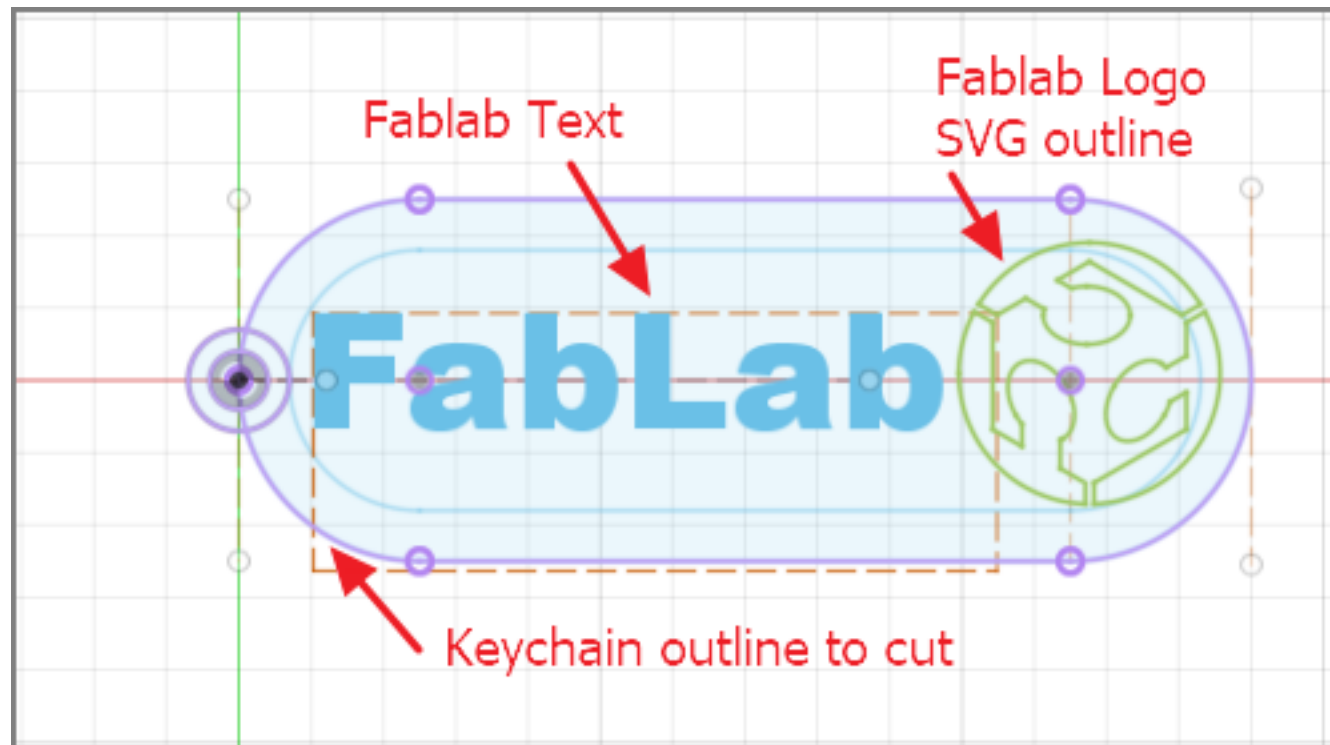
Don't forget Inkscape !

Software Tools

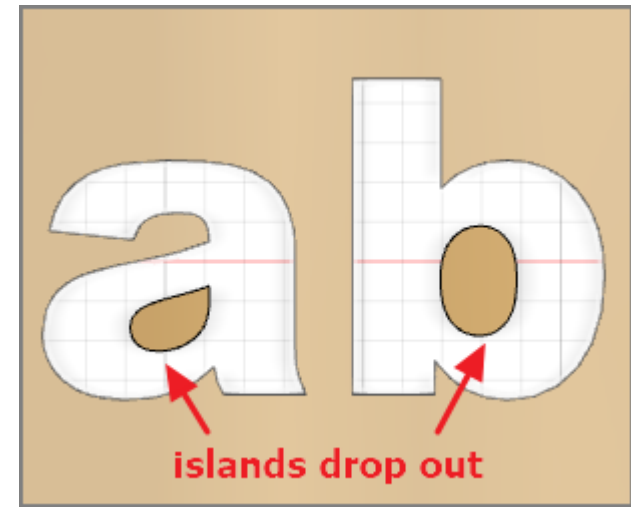
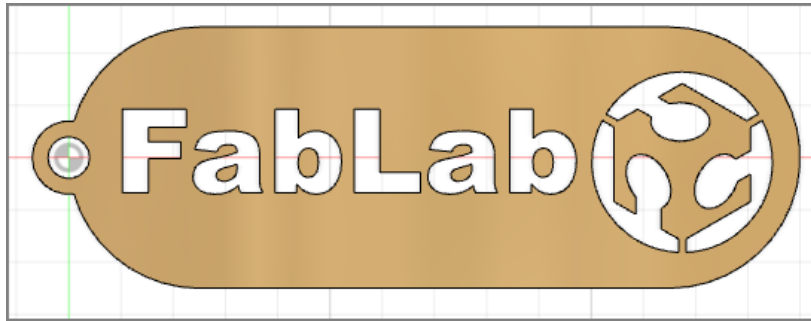
- Fusion 360
 - Full CAD/CAM software to obtain profiles
 - Lots of modelling tools to help
- Vector Drawing software
 - [Inkscape](#)
 - [LibreCAD](#) (for DXF files)
 - [CorelDraw](#) (licensed software)
- Output Vector formats
 - DXF (outdated, but still used, text editable)
 - PDF, EPS
 - SVG (may have different variants)
 - AI (Adobe Illustrator format)

Exercise 1: Keychain for cutting

- Let's make a keychain for the fablab with logo
- Size: 30mm x 70mm x Thickness (dependent on material)



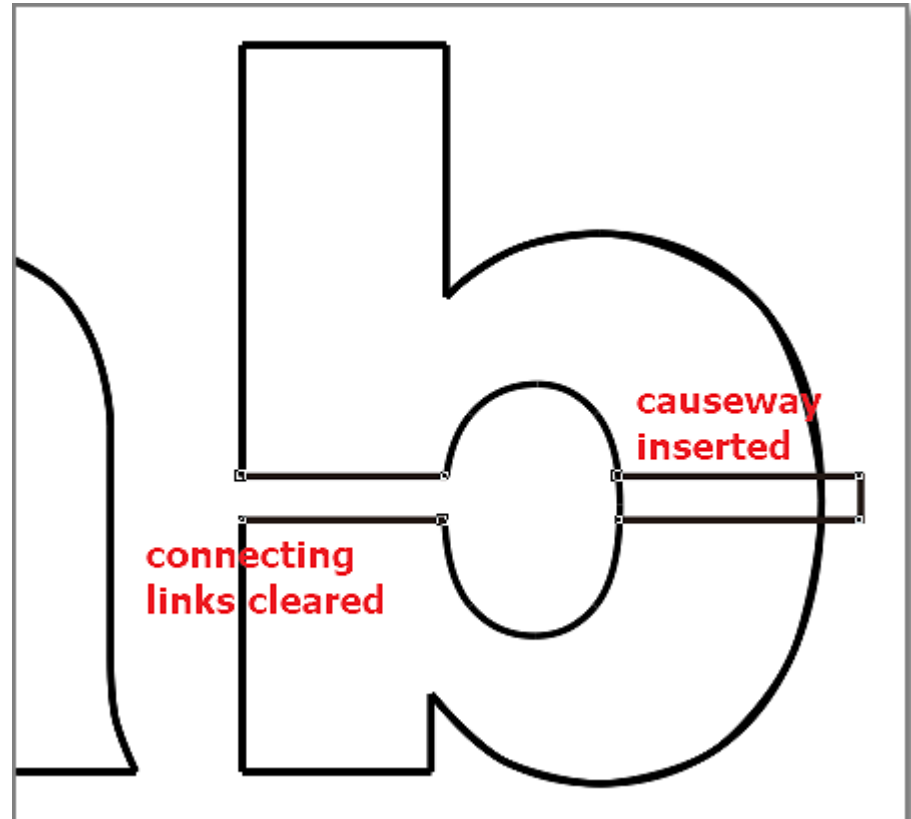
What happens when cut



- Islands may form, these drop out after cutting
- Need to edit the Vector file before cutting
- Placement of causeways to prevent drop-outs
- Post production (i.e. edit DXF exported file)

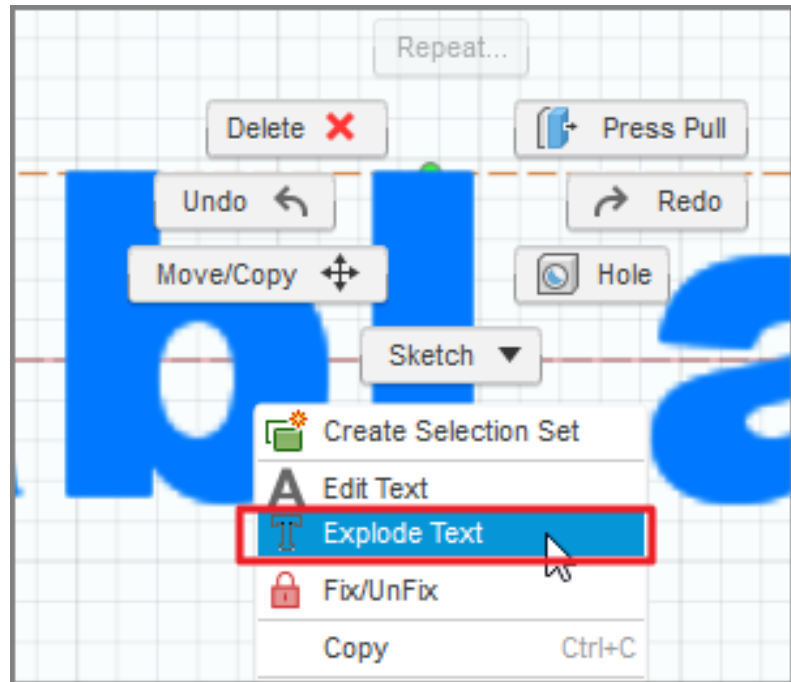
Post Production Editing

- Use a Vector Drawing program to create the causeways
- May need knowledge of vector drawing program
- Suggest CorelDraw

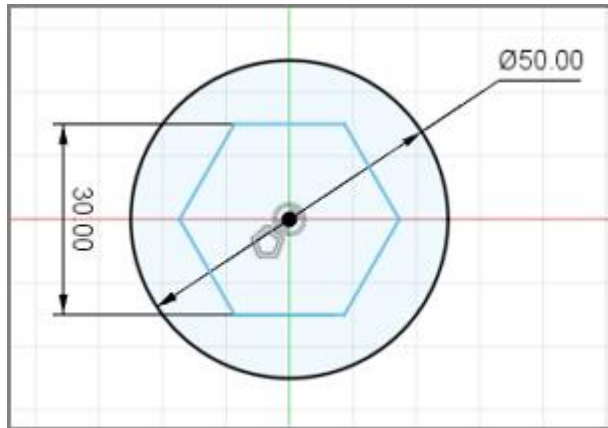


Fusion 360 Explode Text

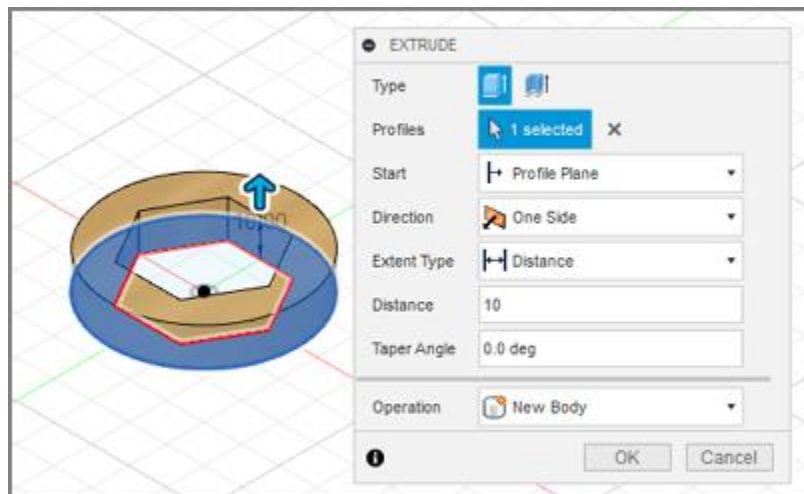
- Use the Explode Text function to **separate** each letter in the word.
- Add causeways in Fusion 360 before extrusion for cut surface



Fusion 360: Export Cut Profile -1

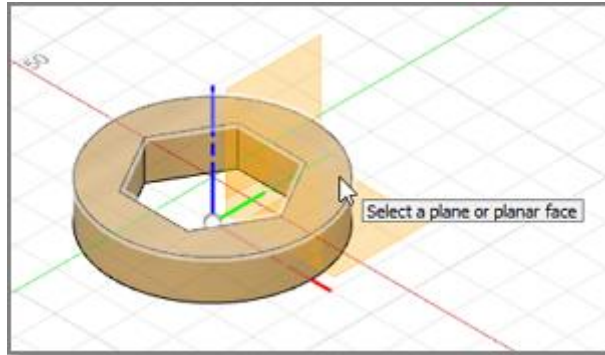


- Create your design

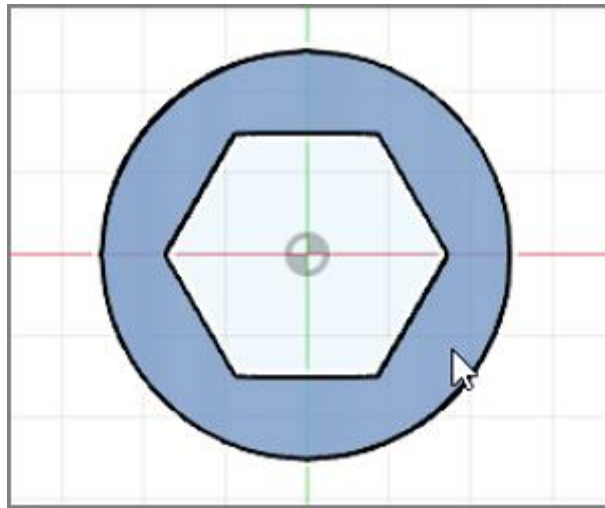


- Extrude surfaces to create object

Fusion 360: Export Cut Profile -2

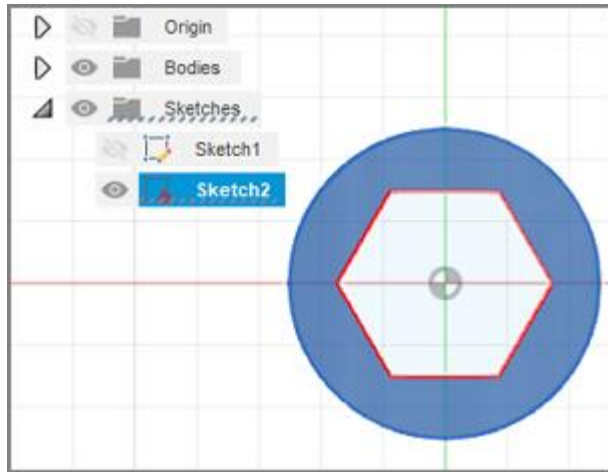


- New sketch on object profile to cut

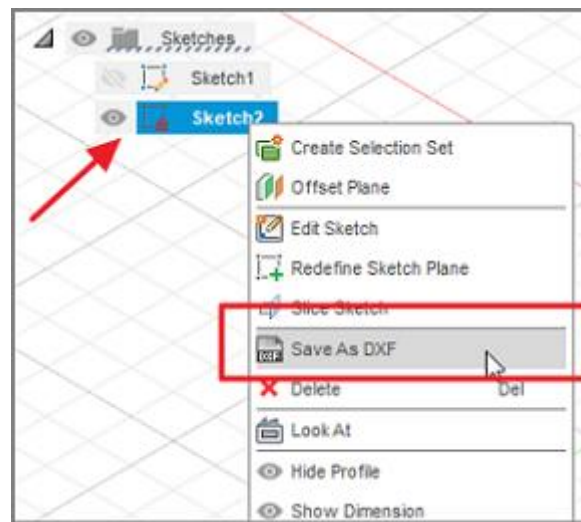


- Click again on profile to verify/select

Fusion 360: Export Cut Profile -3



- New sketch created
- Should rename to avoid confusion (design_dxf)



- R-Click on sketch name
- Save As DXF

DXF format

```

washer.dxf
262  AcDbEntity
263  8
264  0
265  100
266  AcDbPolyline
267  90
268  6
269  70
270  1
271  43
272  0.0
273  10
274  -8.6602540378443997
275  20
276  -14.999999999999991
277  10
278  8.6602540378443802
279  20
280  -15.000000000000007
281  10
282  17.320508075688771
283  20
284  -4.4408920985006262e-15
285  10
286  8.6602540378443944
287  20
288  14.999999999999993
289  10
290  -8.6602540378443802
291  20
292  15.000000000000011
293  10
294  -17.320508075688778
295  20
296  1.9984014443252818e-14
297  0
298  CIRCLE
299  5
300  101
301  100
302  AcDbEntity
303  8

```

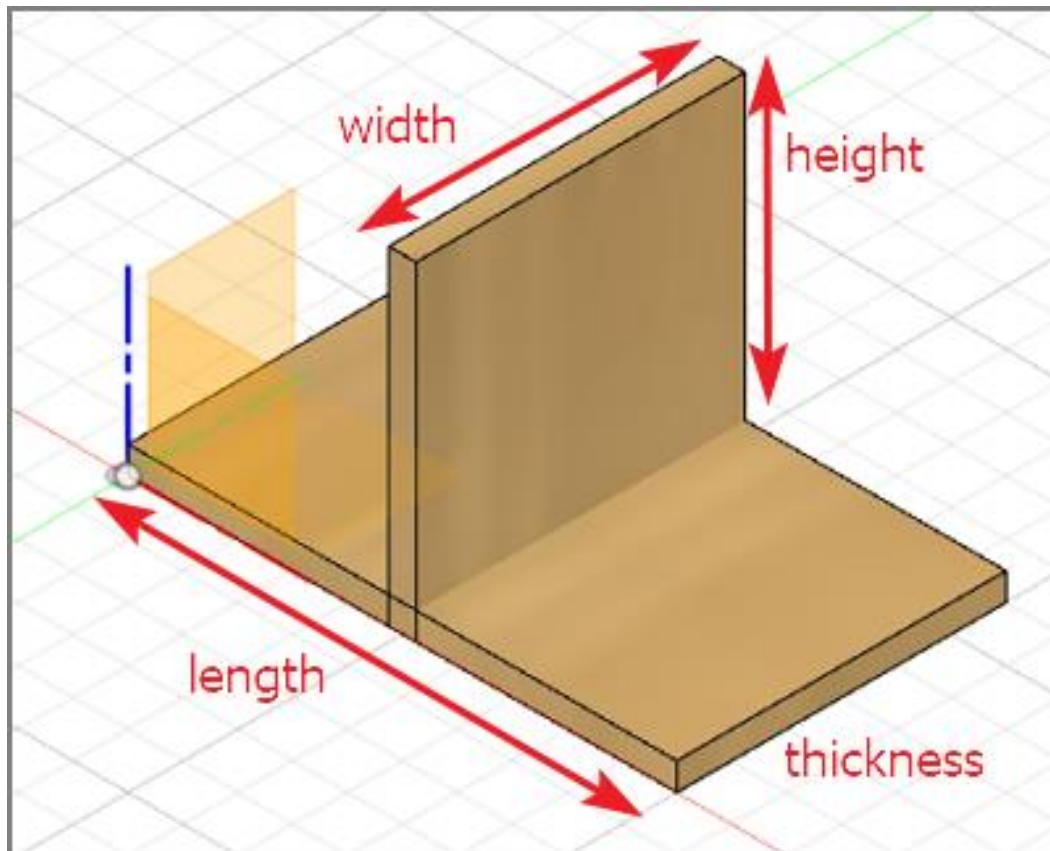
- A simple text format that defines the coordinates of the profile.
- Can come in different versions
- Backward compatible only

Fusion 360: Modelling

- Modelling allows us to simulate the actual object using CADD
- We can use CADD tools to help us in the design
- Most common tools are:
 - Combine
 - Joints
 - Cross-sectional views
 - Clearances

Let's make a joint

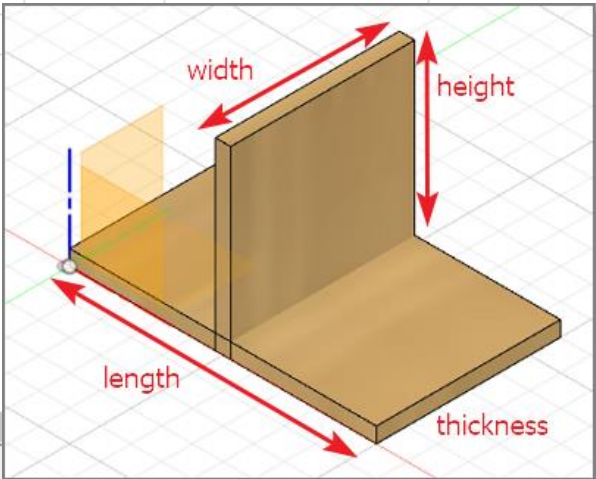
- We will use the CADD features to assist us
- We would like to join 2 pieces of wood



Drawing Parameters

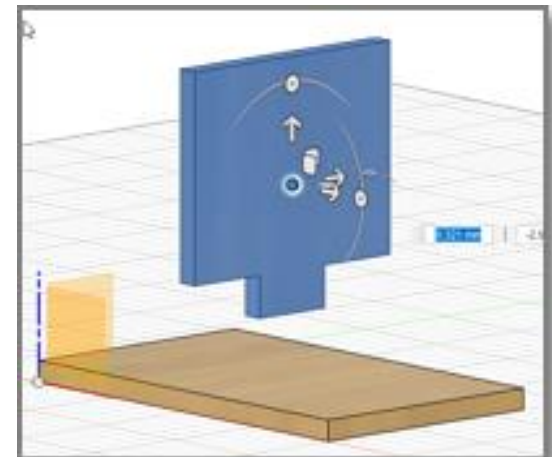
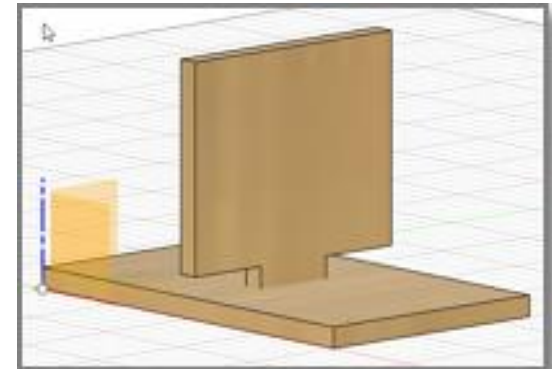
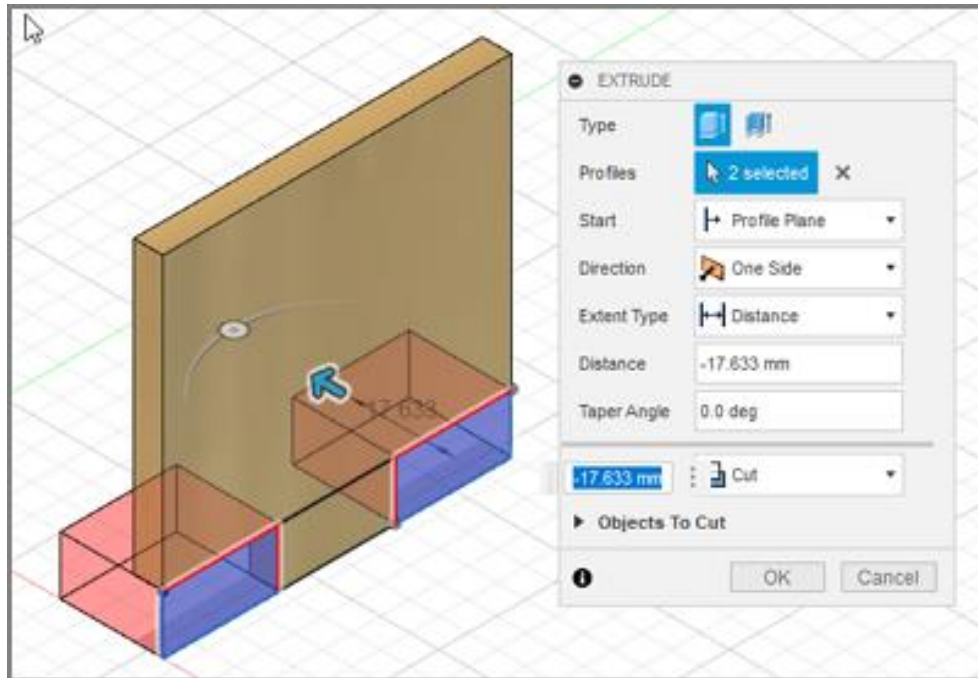
Parameters

Parameter	Name	Unit	Expression	Value	Comments
Favorites					
▼	User Parameters +				
☆	User Param...	length	100 mm	100.00	
☆	User Param...	width	60 mm	60.00	
☆	User Param...	height	60 mm	60.00	
☆	User Param...	thickness	5 mm	5.00	
▼	Model Parameters				
>	base				
>	vertical				



OK

Draw the 2 components

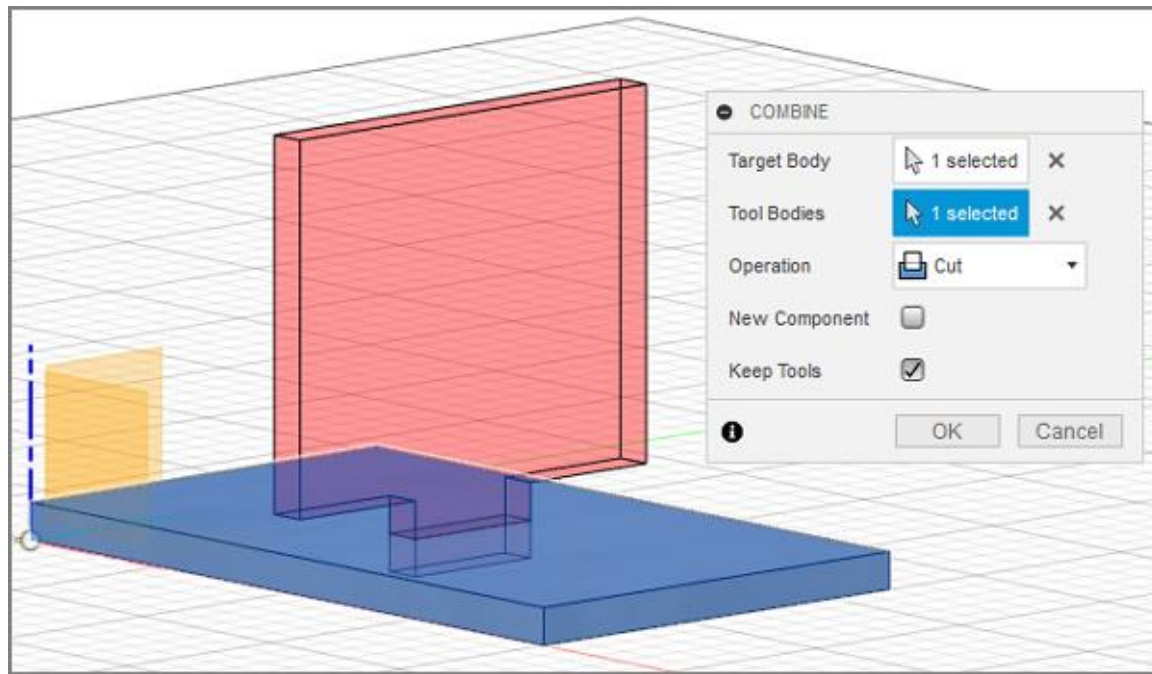


We would like a “tight” fit, since we are going to CCC the wood.

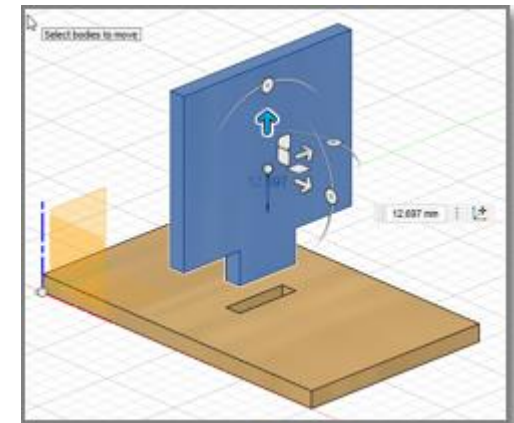
The cuts will be very precise.

(The joint is exaggerated to show the effect)

Use CADD to effect the joint



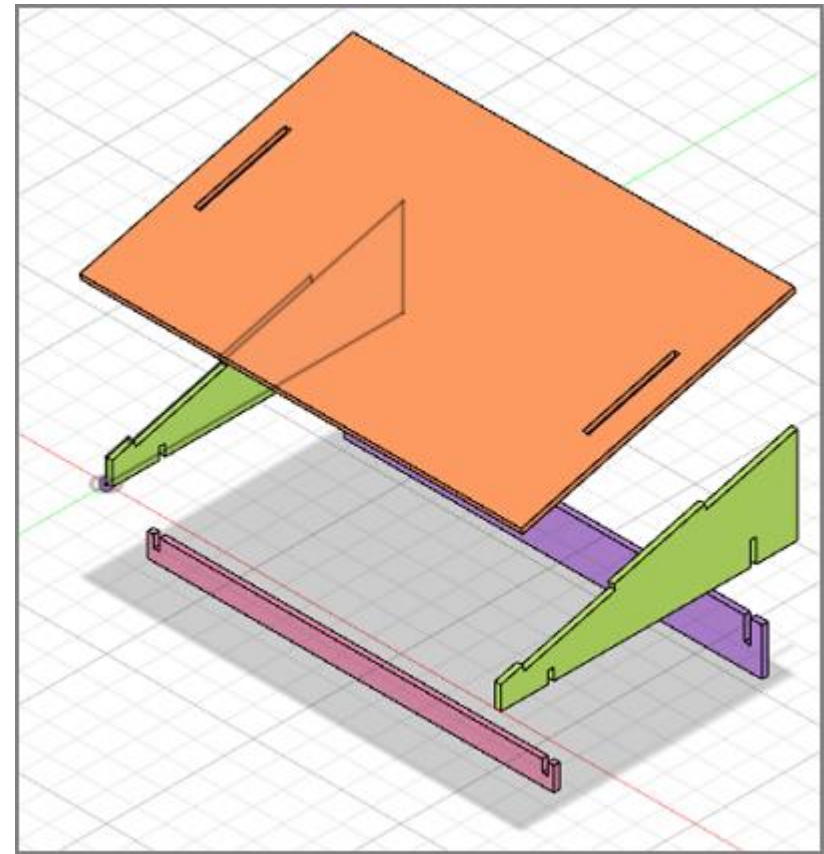
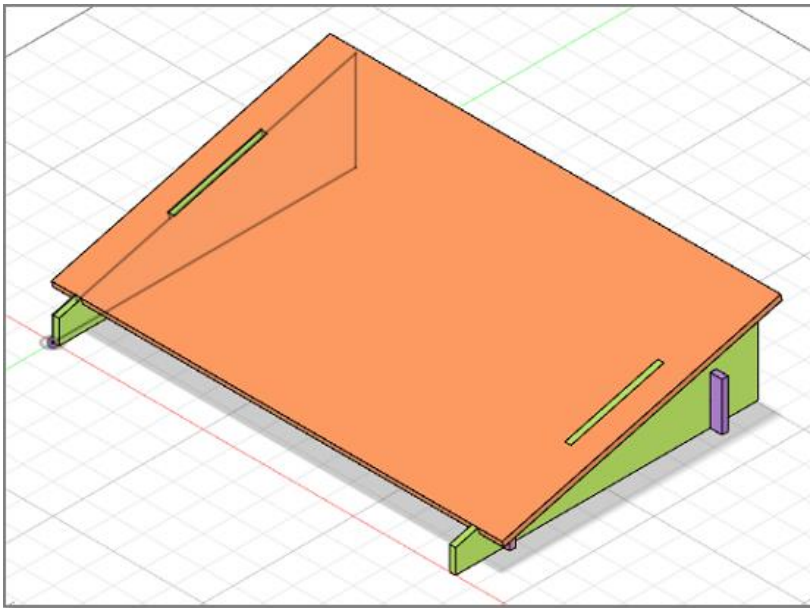
Blue = Target Body
Red = Tool Body
Operation = Cut
Keep tools



- Modify > **Combine**
- Creates the joint and necessary cuts without further drawing

Laptop Stand

- Let's quickly design a laptop stand that can be lasercut.

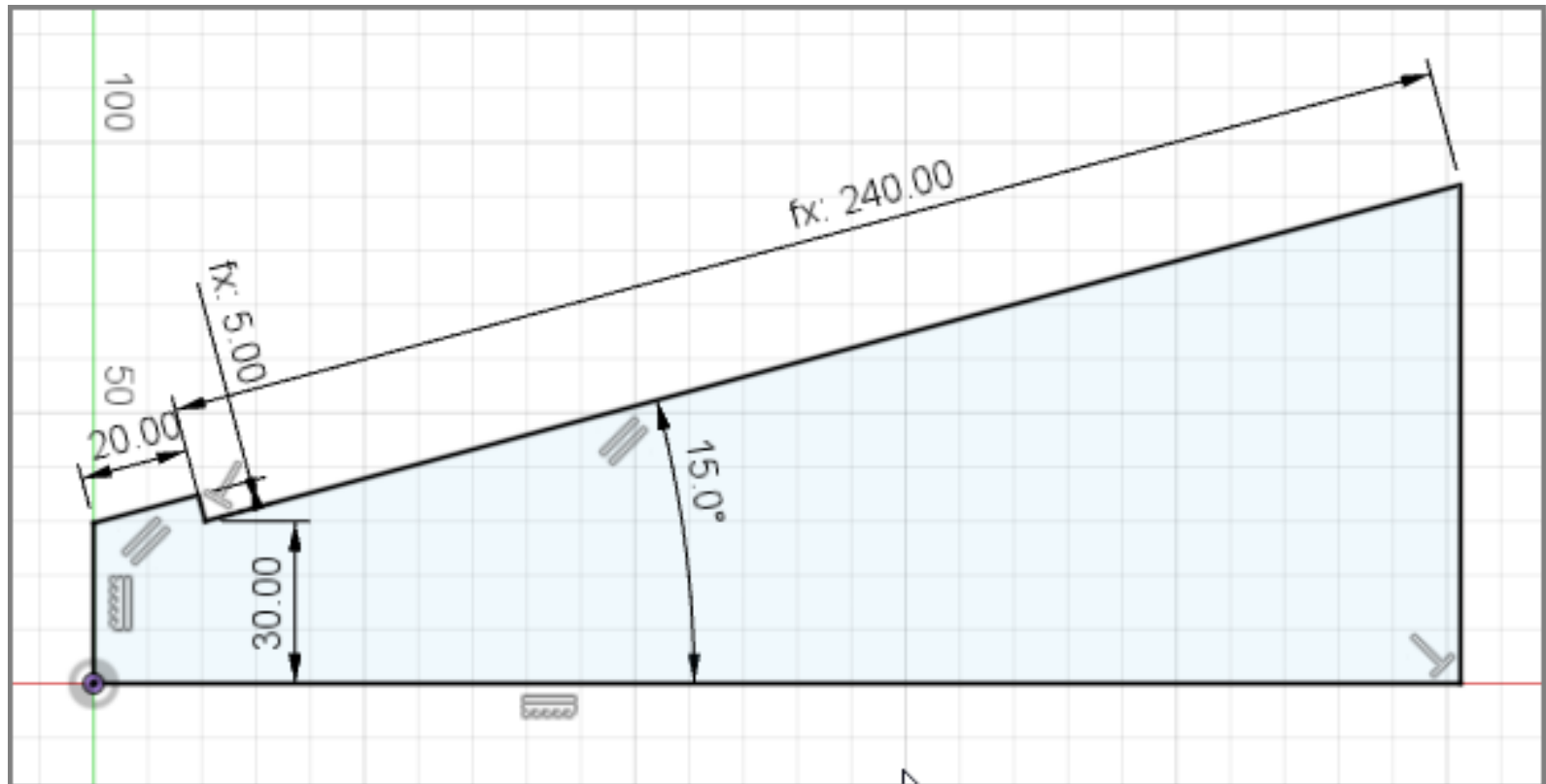


4 components

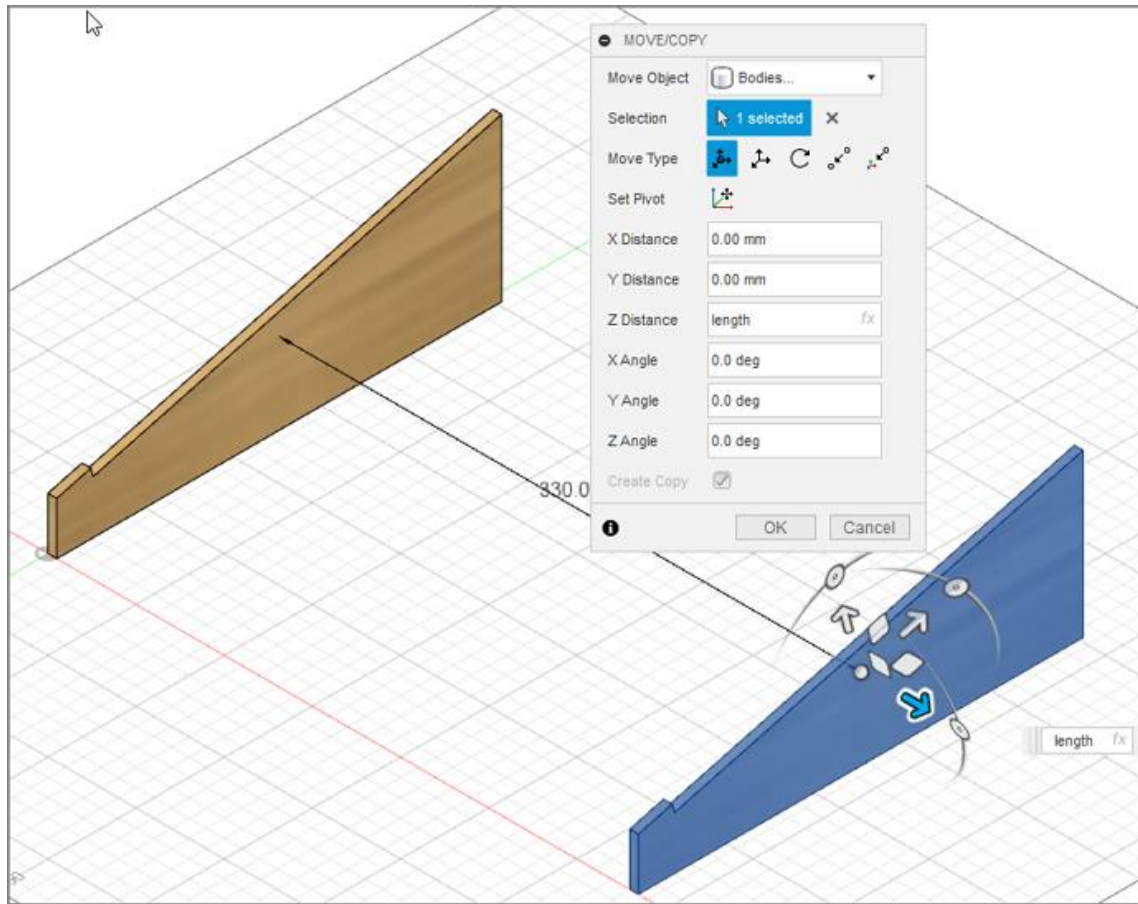
- legs (x2)
- top
- front support
- rear support

Legs

- Set your own parameters



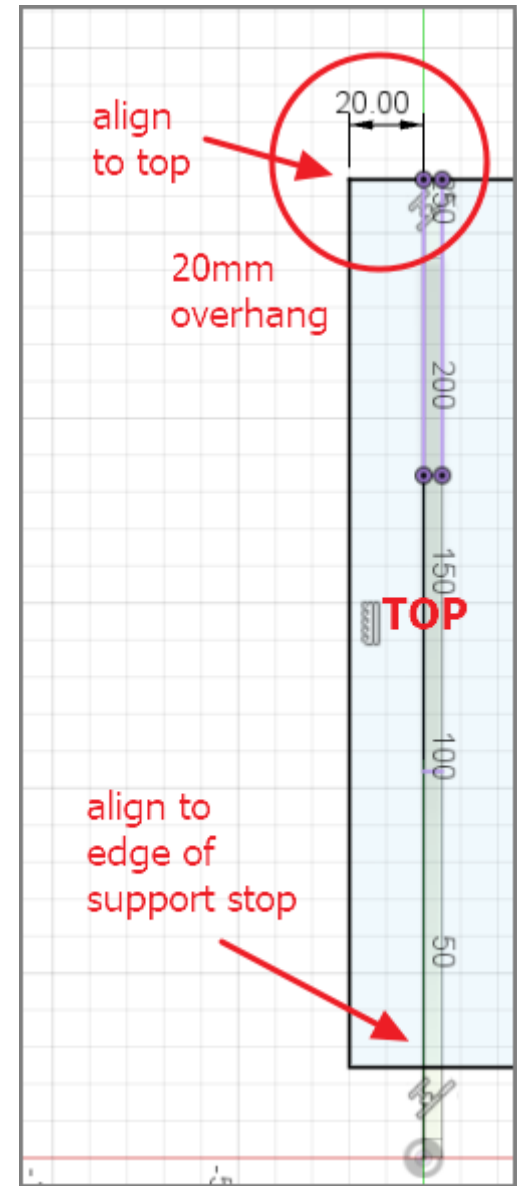
Create the body and a copy of the leg



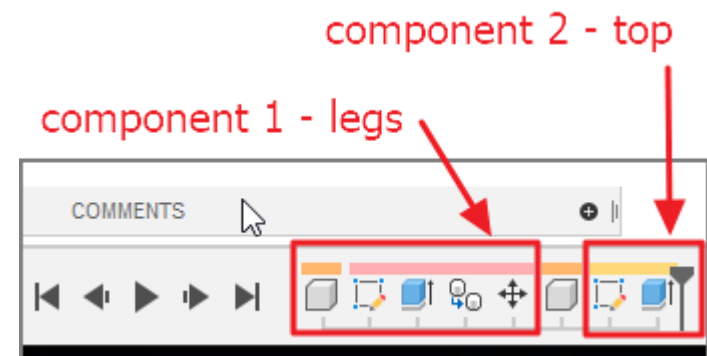
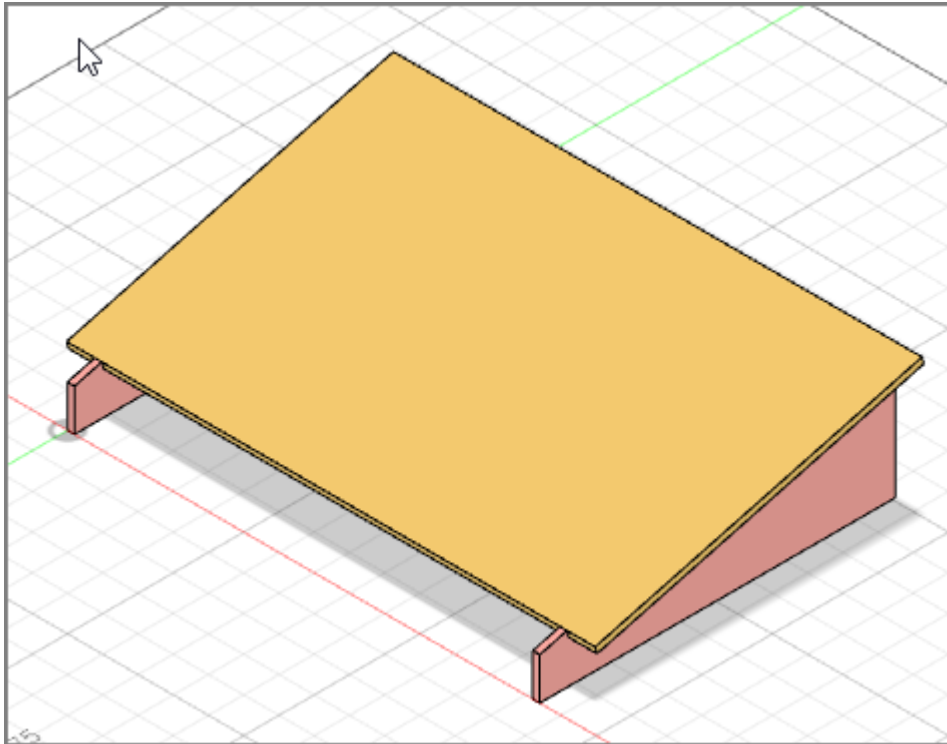
- Extrude the profile using **thickness**
- Move/Copy the body
- Length of laptop

Add Component - Top

- Create component **Top**
- **Enable the component!**
- Create new sketch, select slope surface
- Top should line up with the top edge of the legs
- Bottom should line up with the slip support stop
- Sides extend 20mm on each side
- Extrude the top



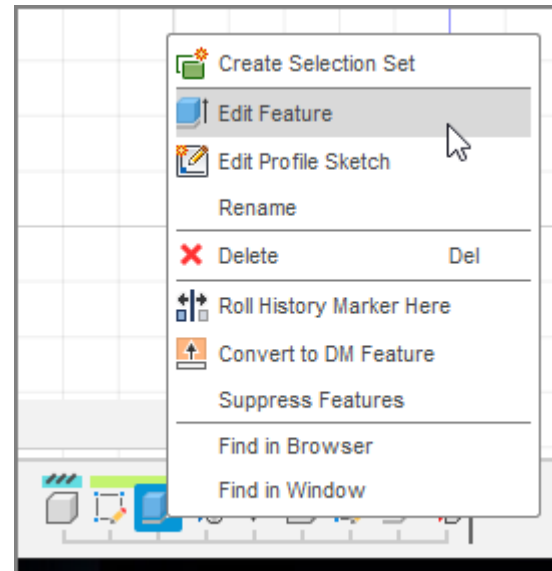
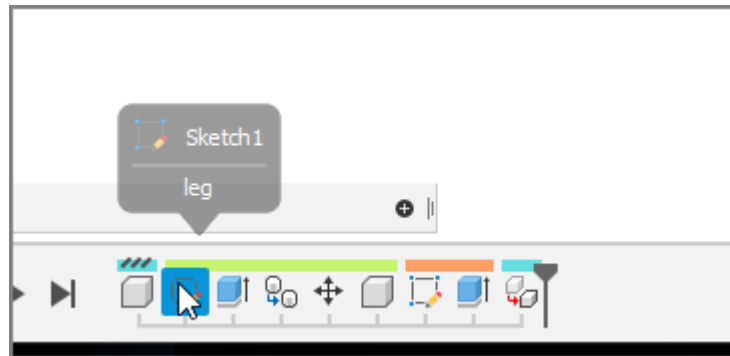
..so far .. so good!



- You should have 2 components.
- Use Inspect > Component Color Cycling

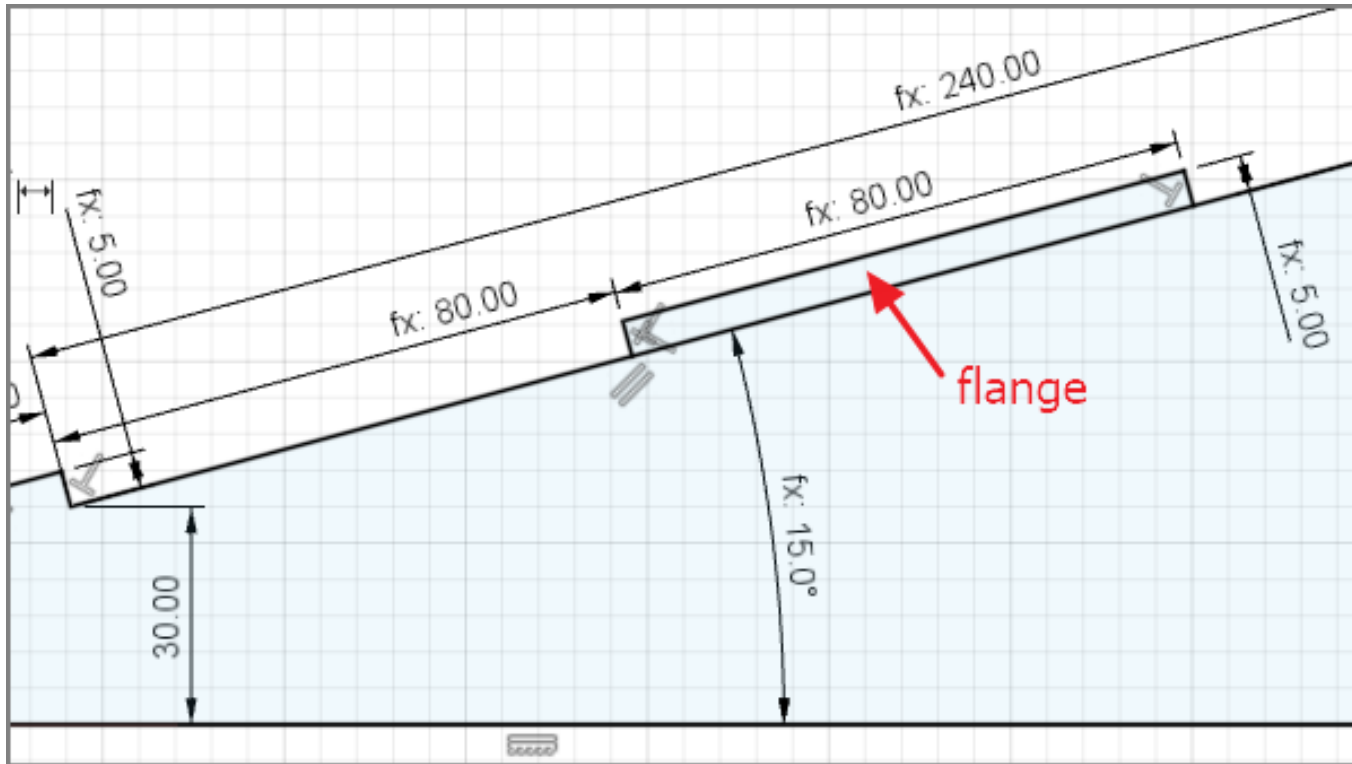
Fusion 360 History/Playback bar

- We can use the History/Playback bar to walk through and edit (sometimes) changes



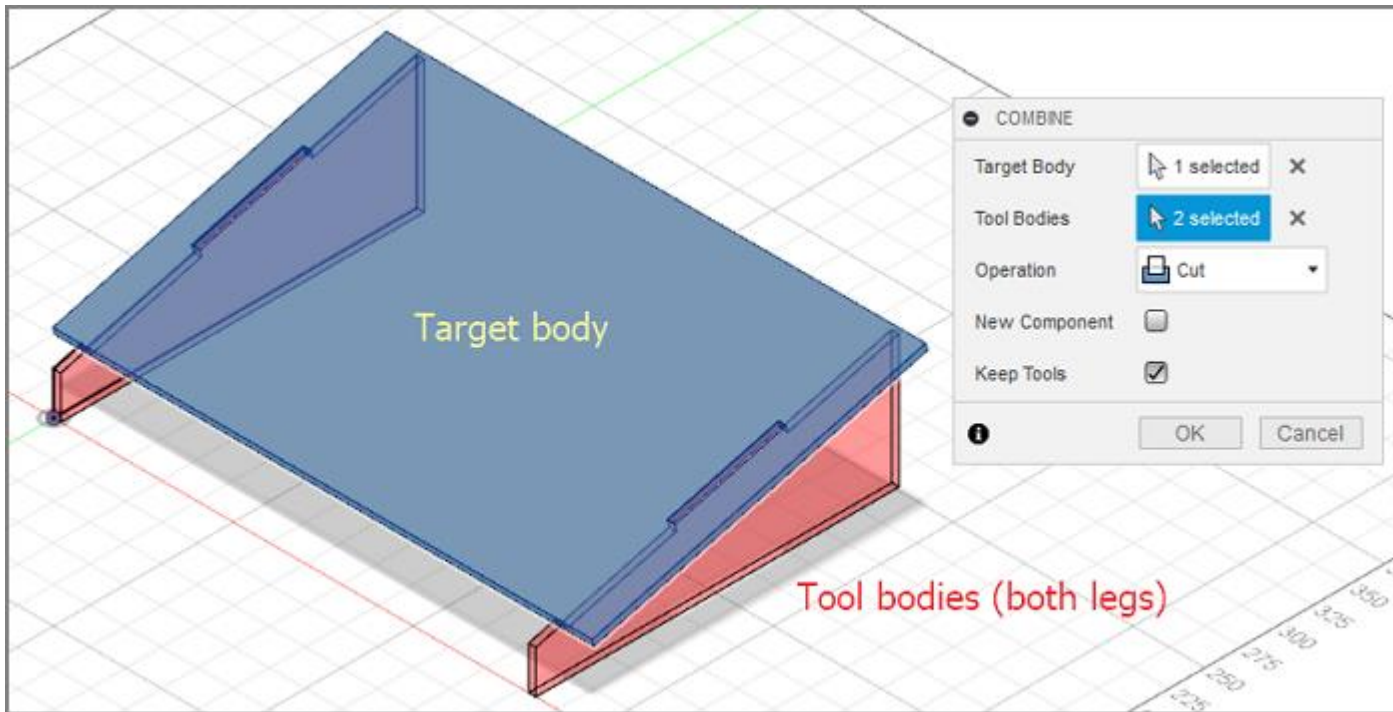
Let's add supports for our top so that it does not move while we use it

Edit/Add flanges to the legs



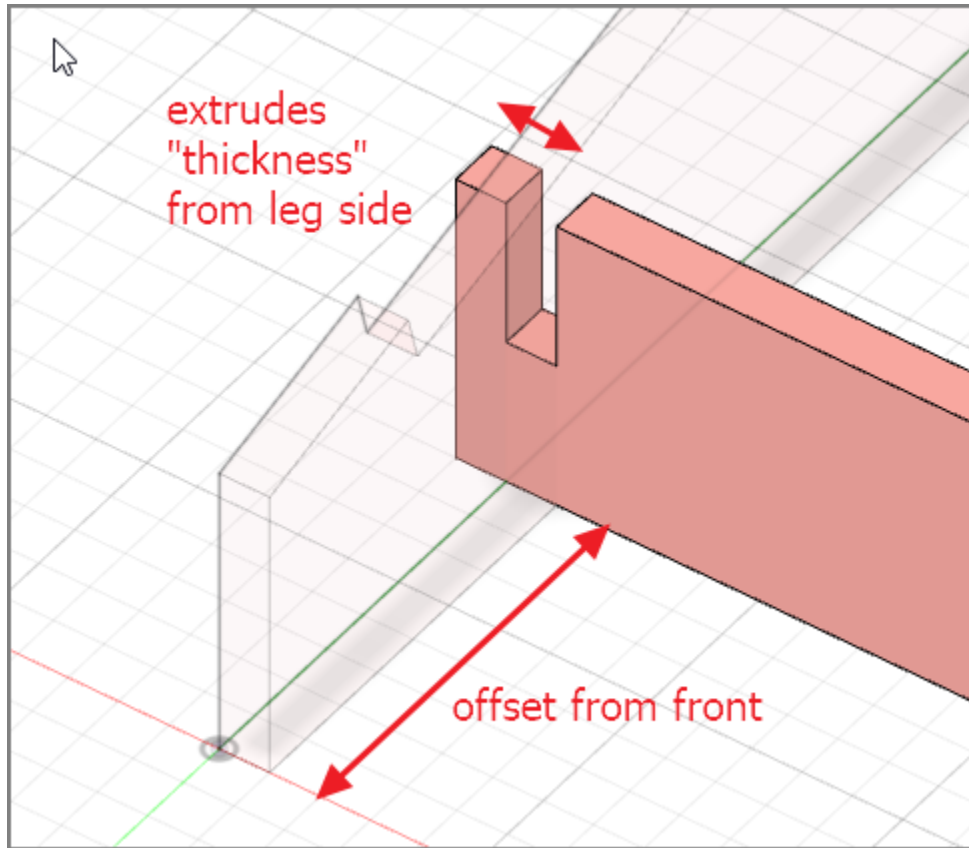
- Use the history bar to add the flange
- The rest of the design will auto-correct itself to accommodate the change

Modify > Combine



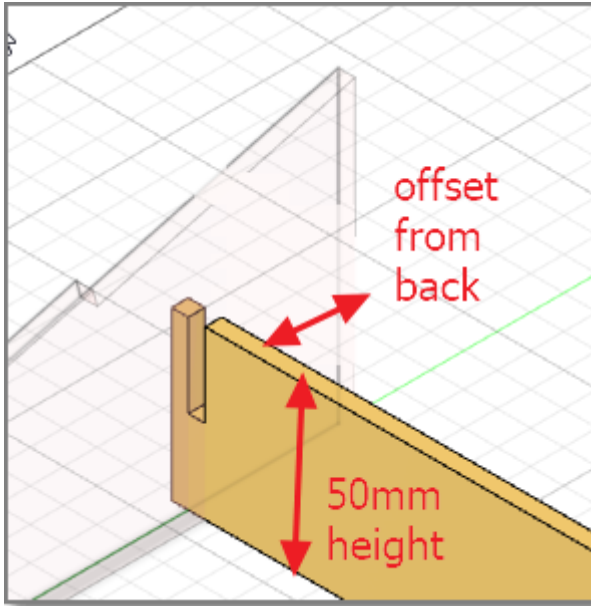
- Use the combine function to cut the slots into the top
- Remember to “keep tools” after cutting

Add front support



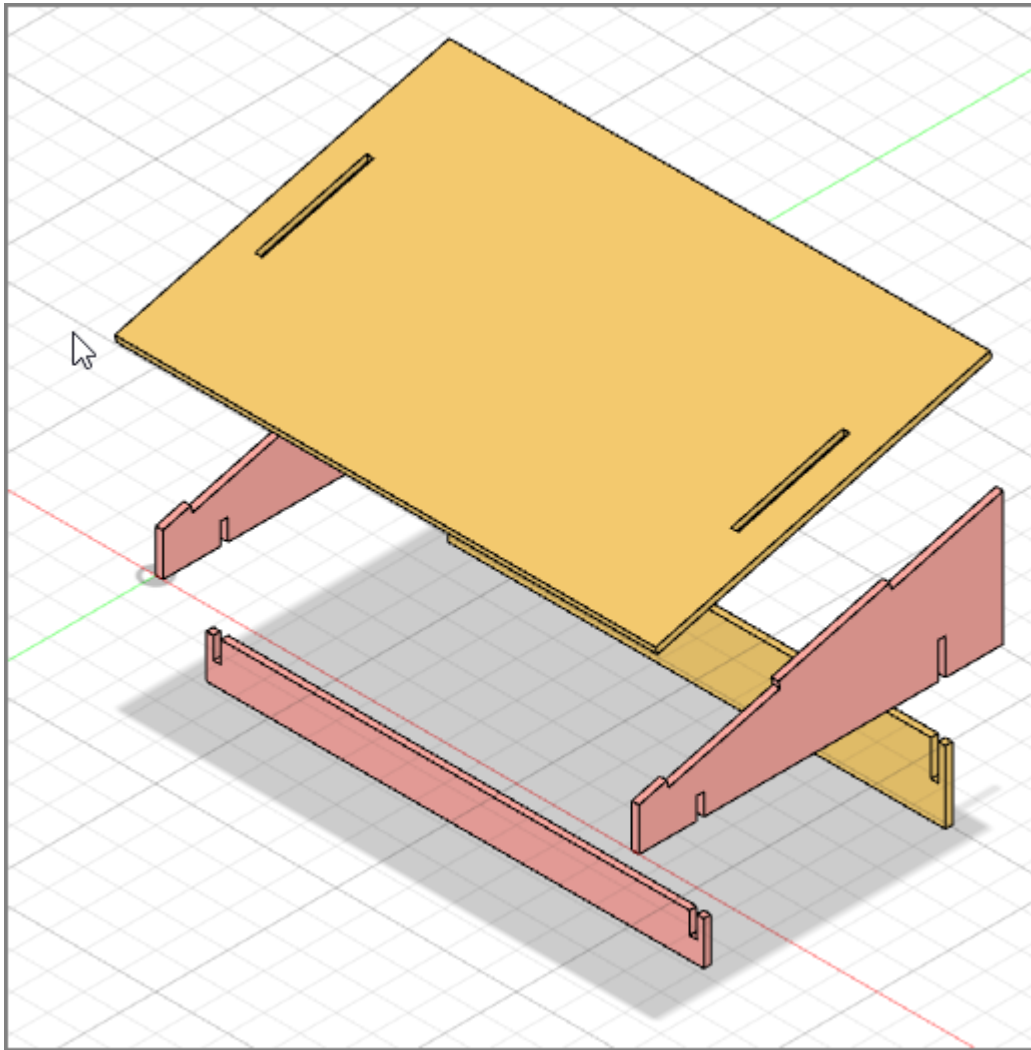
- The front support adds strength to the frame
- Offset the spar from the front e.g. 40mm
- Protrude the side for support
- Use Combine to cut the slots on the legs

Add back support



- Create new component
- Create offset plane from back leg
- Create new sketch
- Draw structure, ensure constraints
- Modify > Combine to cut out the slots

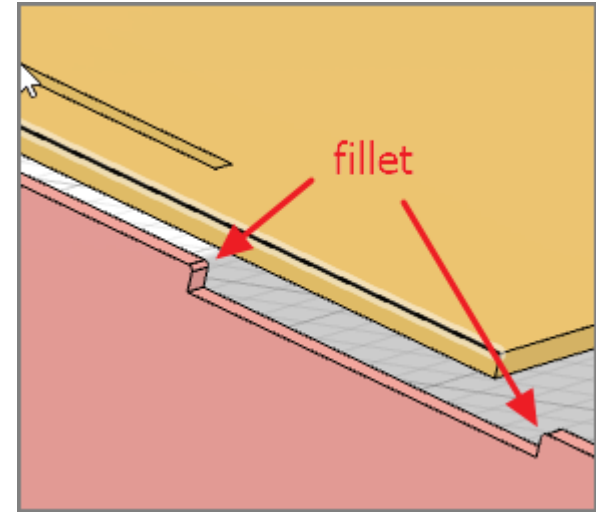
Completed Model



- Move the bodies and examine the result
- Check for clearances and cuts

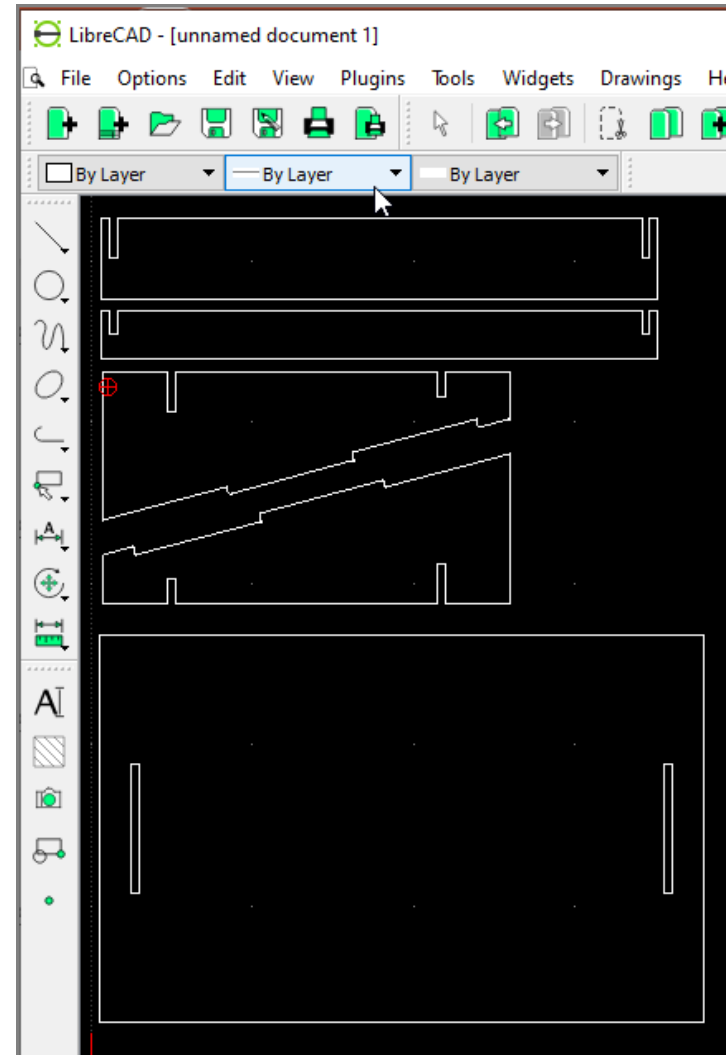
Finishing touches

- Fillet (smooth) the edges
- Fillet/Chamfer the joints for easy insertion




Export & check the DXF for cutting

- For each body
 - Turn off other components/bodies
 - Create new sketch for cut profile
 - Rename the sketch for reference
 - Export to DXF
- Use LibreCAD to check or layout the cuts




Task: Draw your laptop stand

- Draw your own laptop stand (measure your laptop)
- Add features (?)
- Ref:
<https://youtu.be/7riGolu7BpA>



Designing a Lasercut Laptop Stand with Fusion 360

308K views • 5 years ago

 Autodesk Fusion 360

Fusion 360 Evangelist, Taylor Stein (@taylor_stein), takes you through the complete workflow of designing an lasercut laptop ...

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End