

# EP1000

## Computer Controlled Cutting 2

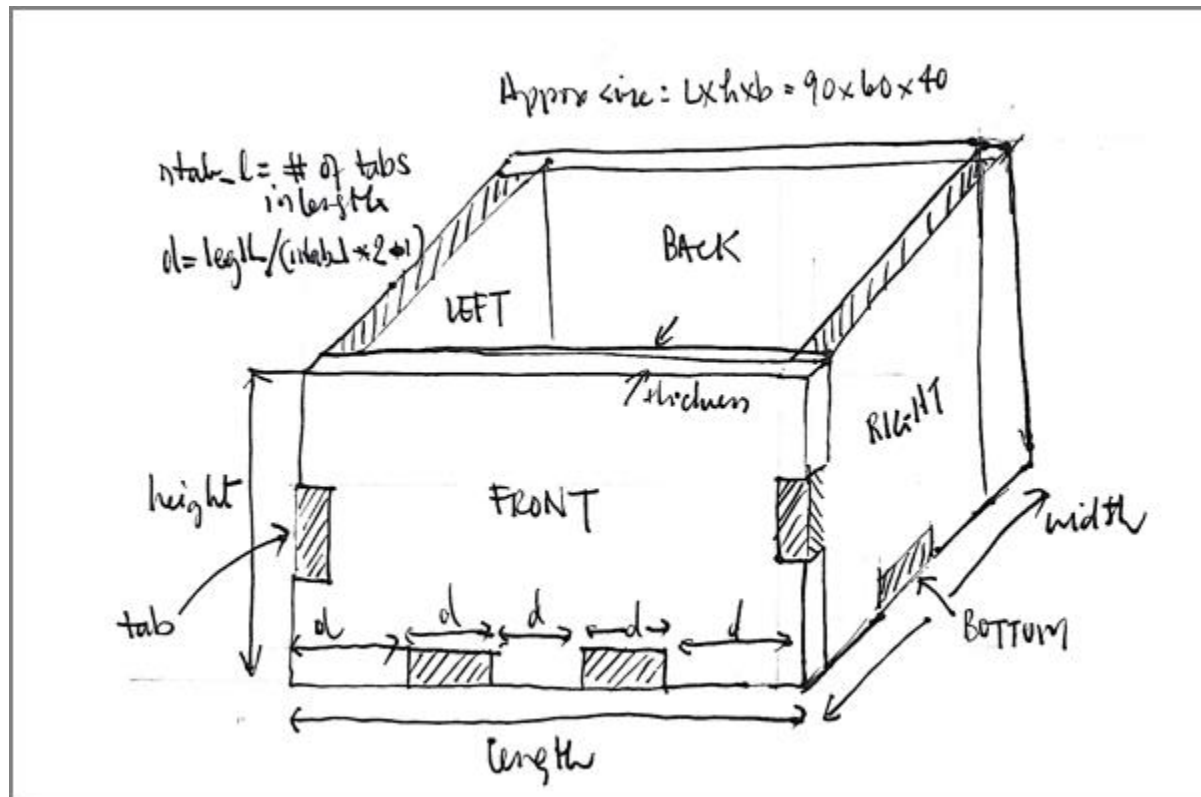
### Assignment

# Lasercut Parametric Box

- Boxes are useful in all projects as they provide housing or containment.
- Making the box parametric allows changes, accommodating for boxes of different sizes, types.
- A practical example that can be used for other projects.

# Start with a sketch

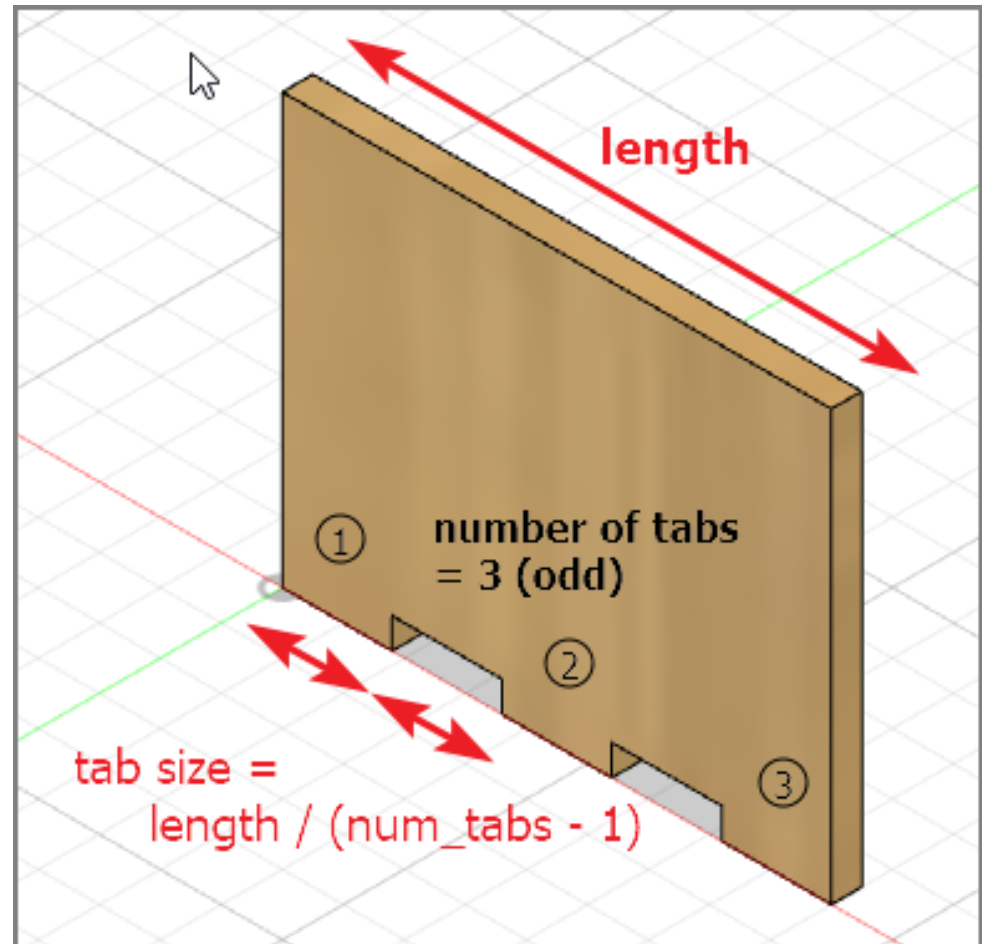
- Sketch on paper how your box looks like and the approximate dimensions.



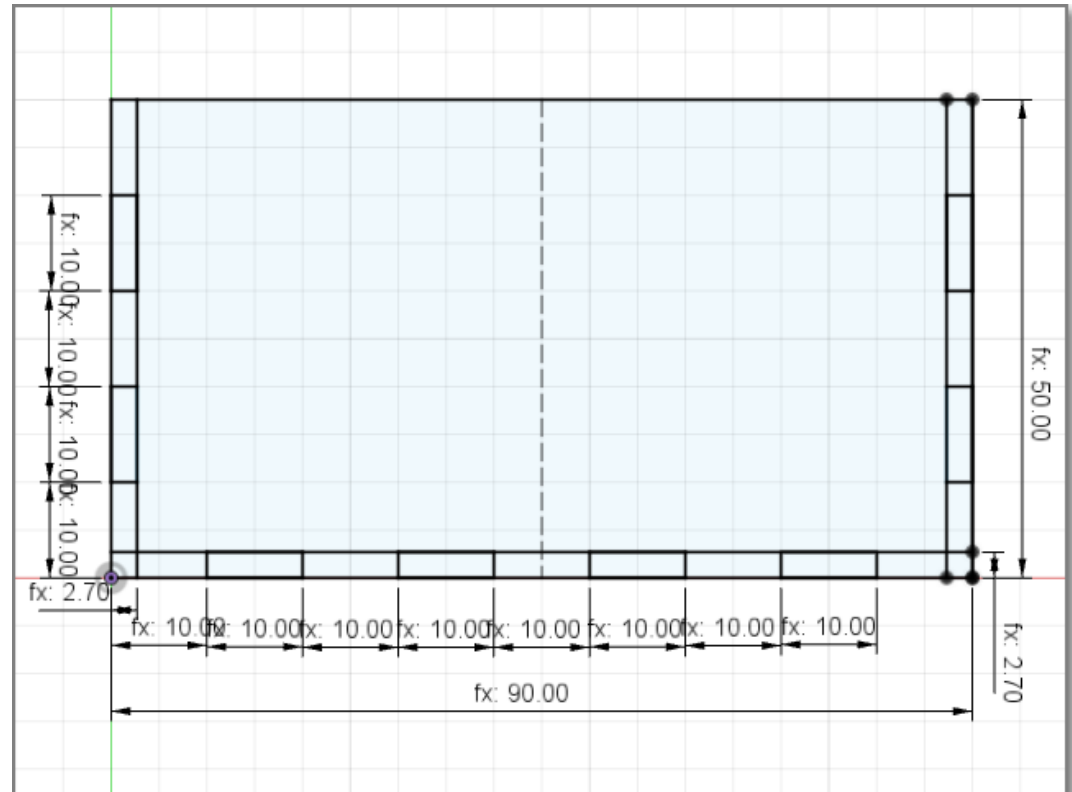
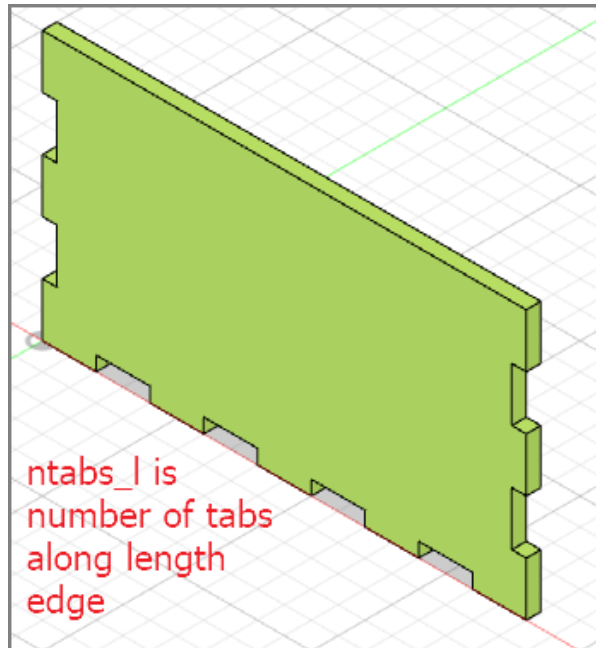
4

# Basic Calculations

- Odd number of tabs
- Tabs and spacers have same size
- Do **NOT** use the sketch > rectangular pattern to duplicate.
- You **CAN** use the 3D create > pattern to duplicate the **feature**.

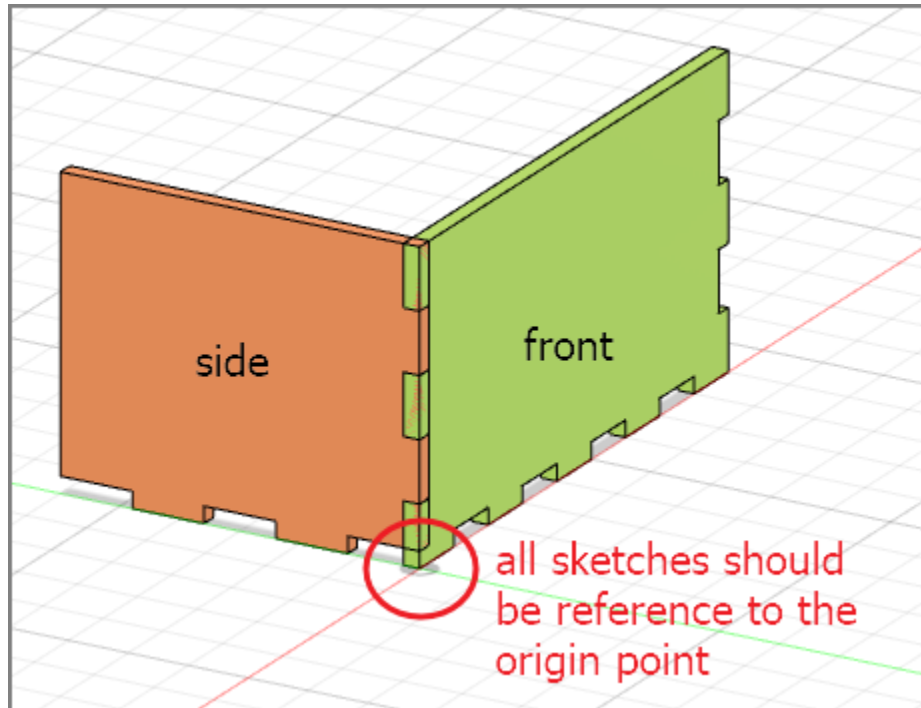


# Create the front face



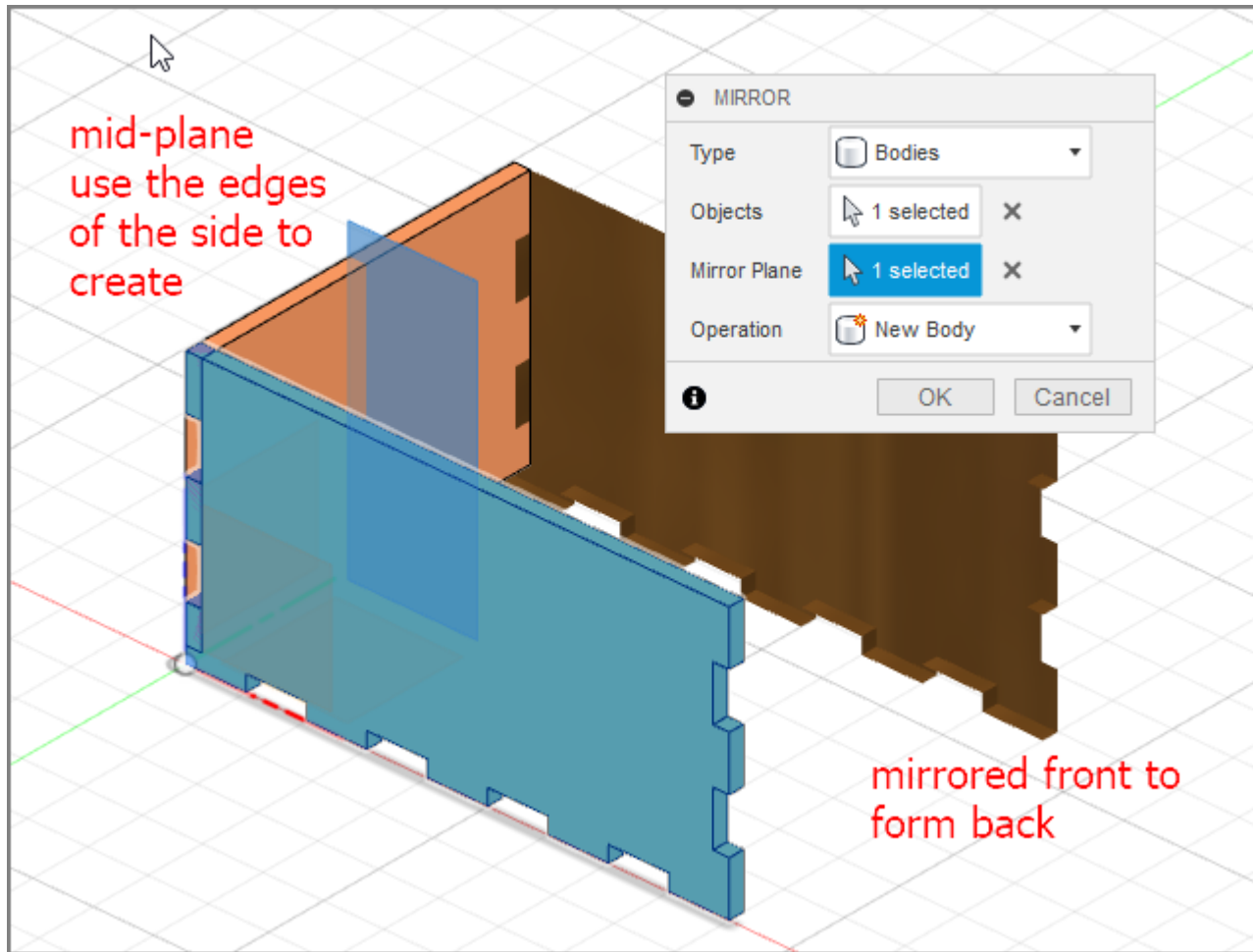
- Make a new component
- Sketch the face
  - Add the tabs
  - $\text{tabLength} = \text{length} / (\text{ntabs\_1} * 2 - 1)$
- Extrude

# Add the side component



- New component
- Create sketch
  - Start for ORIGIN
  - Choose **EDGE** face of front tab
  - Constrain sketch to the front component
  - Draw the tabs
- Extrude

# Mirror front to form back

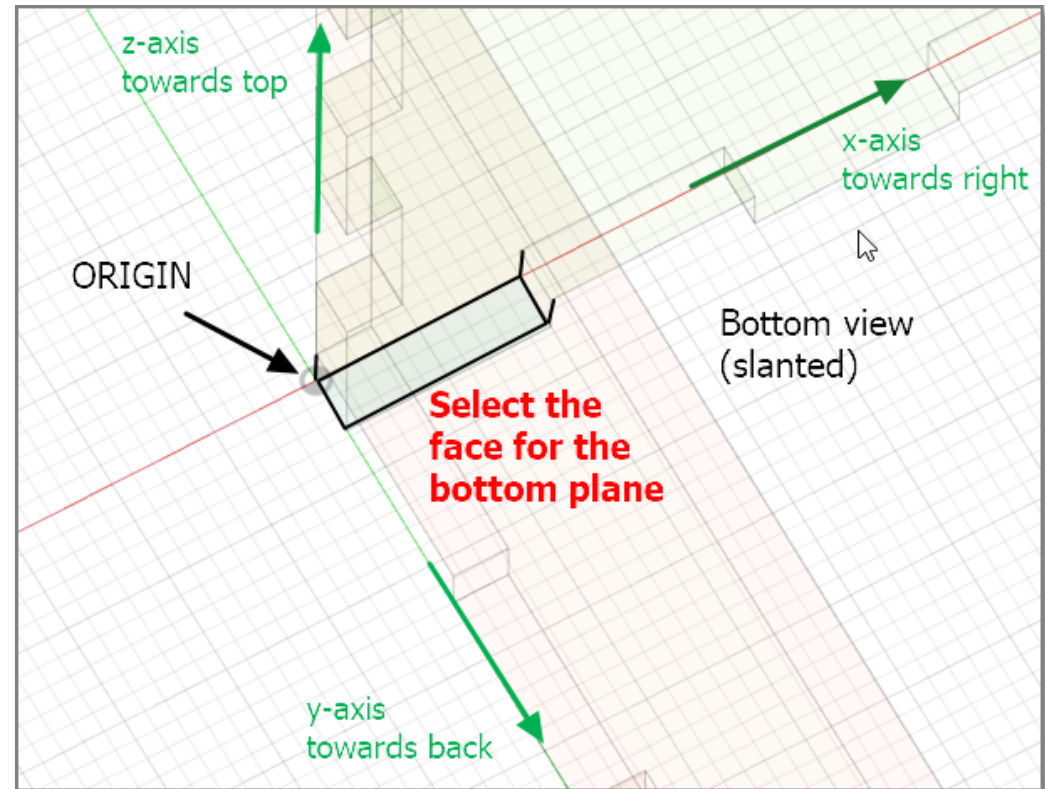


- Create a mid-plane
  - Switch off visibility of front body to help
  - Choose front and rear edges of side
- Mirror the front using the mid-plane
- Repeat for **left** and **right** sides

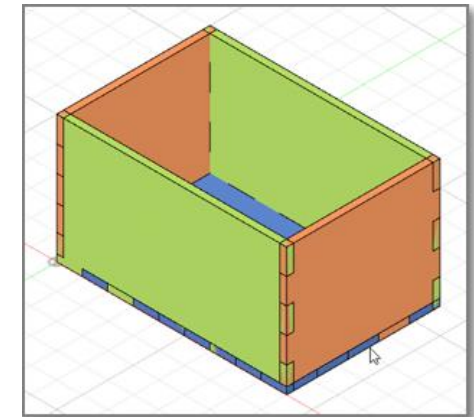
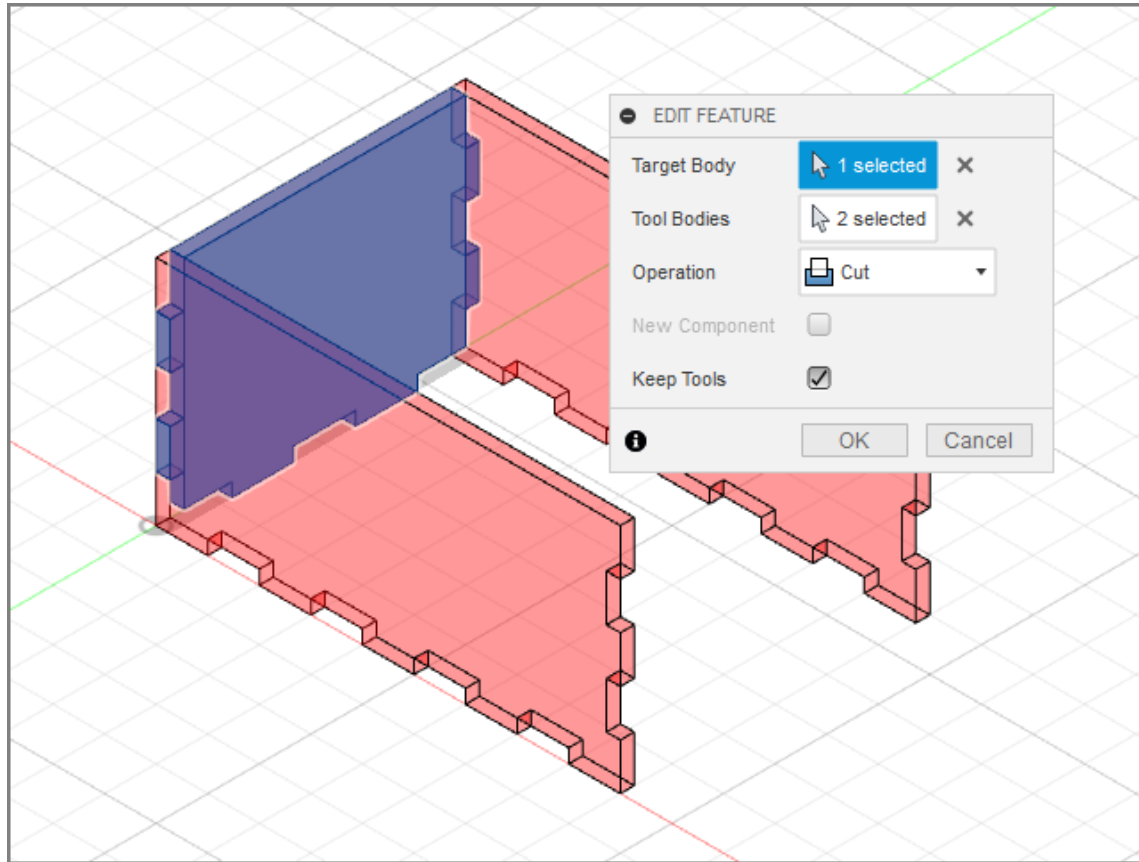


# Create the base

- Rotate the object to bottom view
- Create new component
  - Create sketch
  - Start from ORIGIN
  - Sketch the base
  - Constraint to edges
  - Extrude

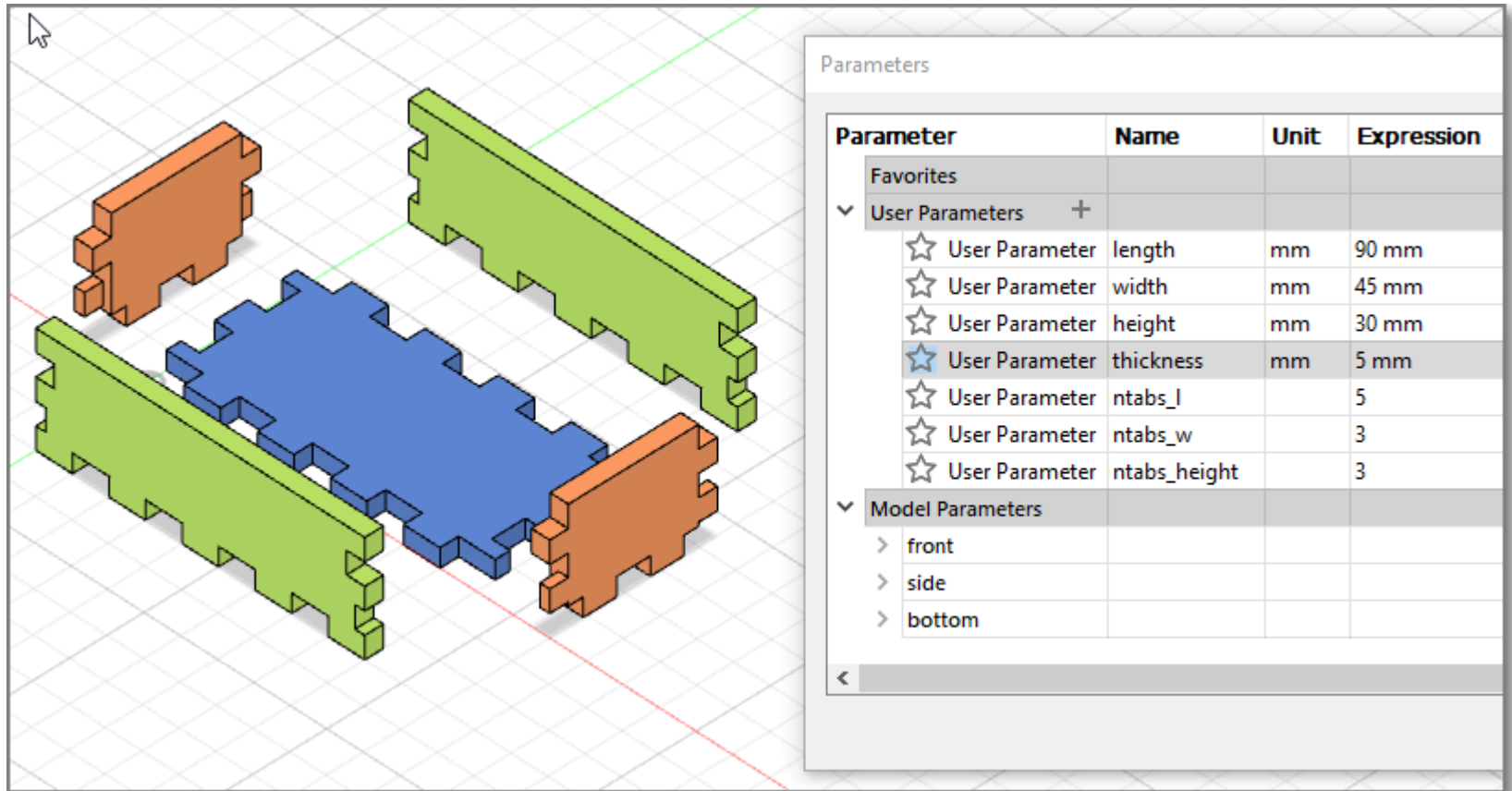


# Combine



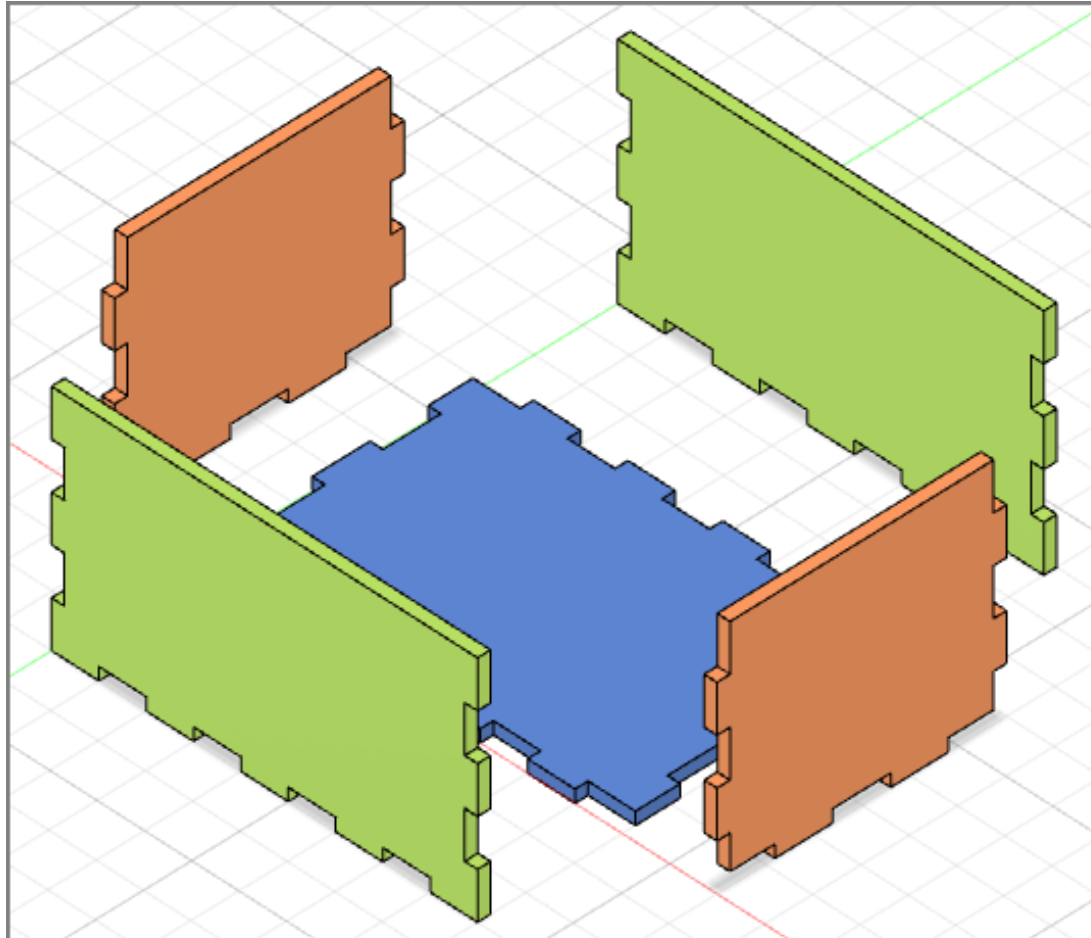
- Use the combine tool to create the tabs.
- Turn OFF components that are not used to improve visibility

# Completed Model



- Change your parameters, the box should change without problems
- Some parameters do not work that well (which ones, why?)

# Check Model

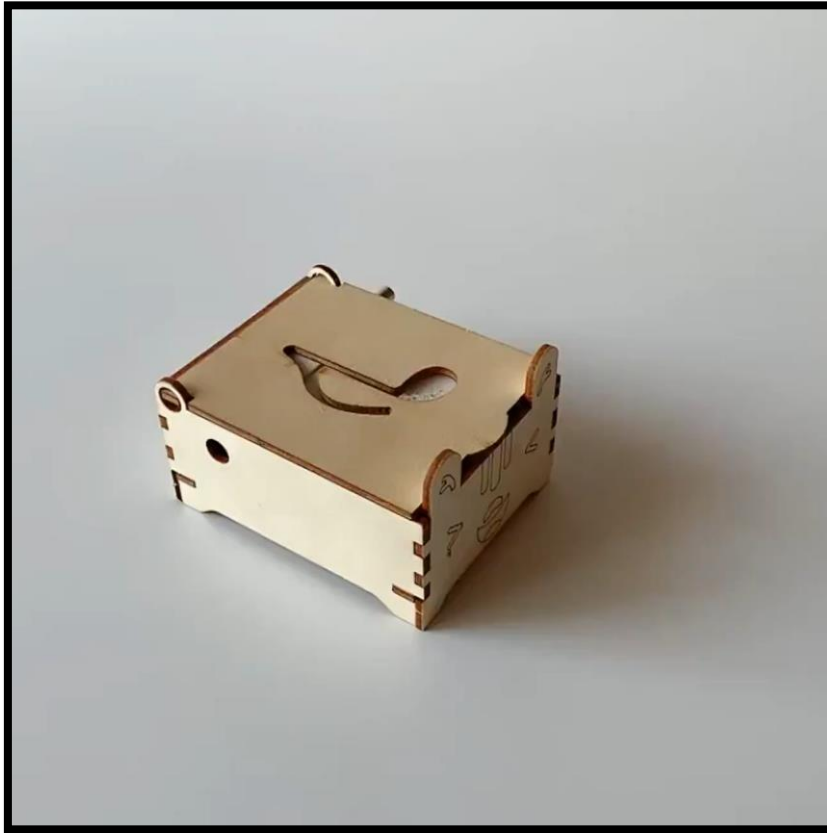


- Export and check the DXF of each of the components. Align them for laser cutting
- **Q:** Does the thickness of the material affect the DXF output for laser cutting?

# Assignment: Musical Box

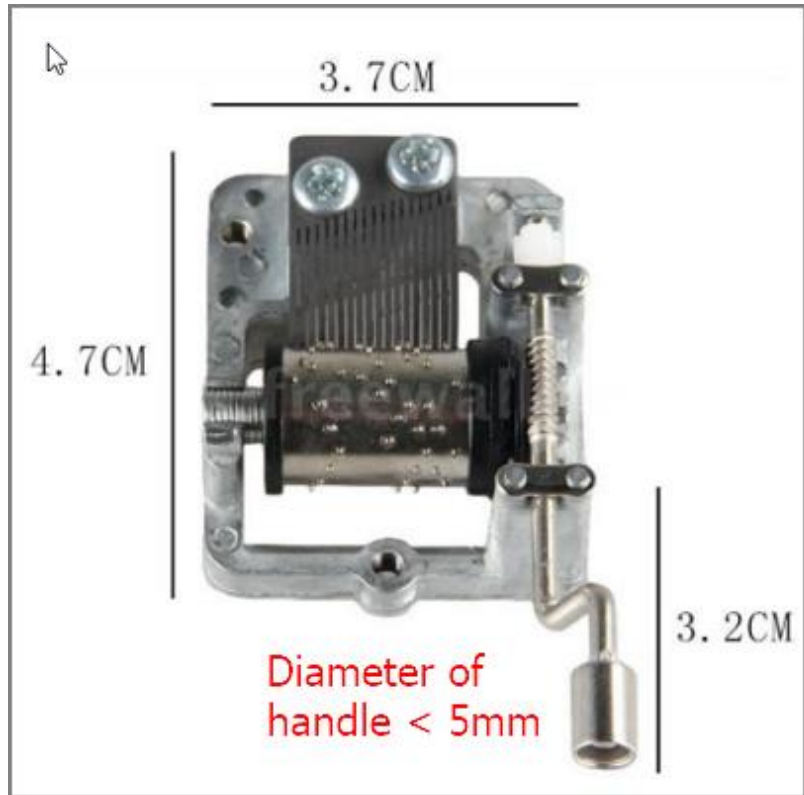
- You are to create a closed box with a movable lid, specifications are as follows:
  - Must have a movable lid
  - Must be lasercut (wood 2.5~3.6mm)
  - Must be able to accommodate “mechanical hand-cranked music box movement”
  - Drawn and modelled in Fusion 360
  - Can be glued together (no nails, hinges etc)
  - Must be “decorated” in some manner

# Example: Music Box



- Search:  
Musical Box Mechanical Hand  
Crank

# DIY Music Box



- Hand Crank Musical Mechanism Craft DIY Music Box
- Must accommodate musical hand crank
- Measurements are approximate
- You can omit the hole for the crank until the box is assembled.

# Marking Scheme

Item	Description	Score
1	Fusion 360 <ul style="list-style-type: none"><li>• Box design (.f3d included) – 25%</li><li>• Lid – 25%</li></ul>	50%
2	Laser cut box fitting	20%
3	Write-up (how-to)	20%
4	Fitting, Enhancements	10%

**Deadline** for submission: Friday, Week 2 Term 2 (tentative)



# EP1000

## Computer Controlled Cutting

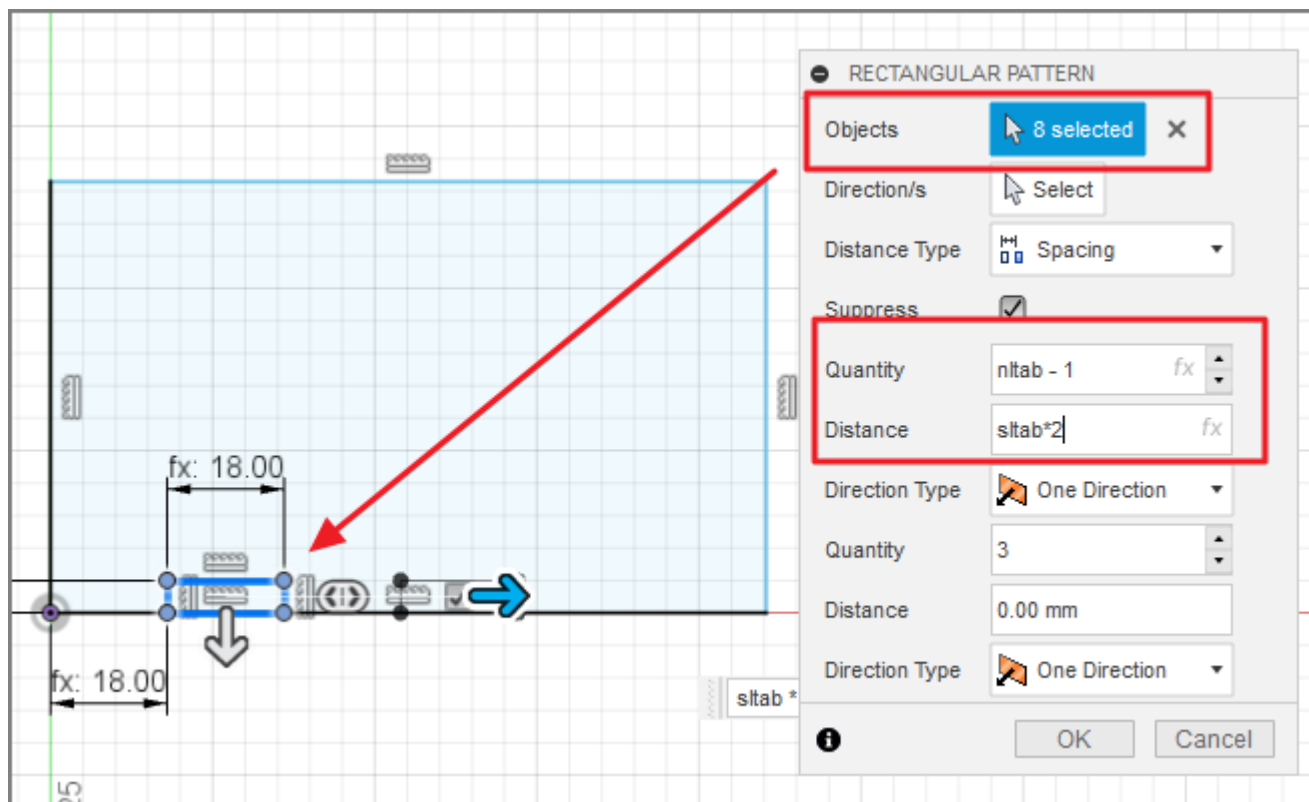
**End**

# Parametric drawings...

- Some parametric drawings do not work.
- The parametric changes made to the sketch (2D profile) do not carry over to the 3D model
- Functions not recommended with parameters:
  - Sketch: rectangular/circular patterns
  - Sketch: mirror
  - Hard coded profiles
- Alternative: use 3D patterns with **Features** instead

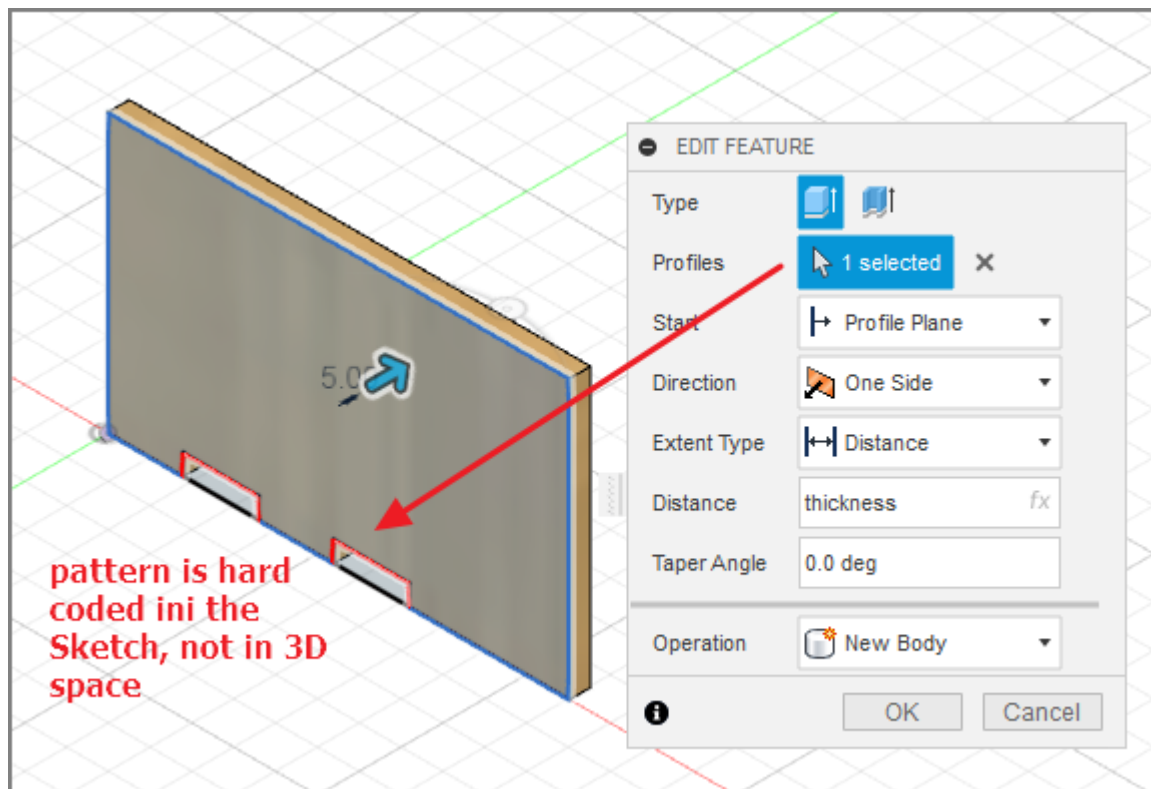
# Sketch: Rectangular Patterns 1

- Sketch is made using rectangular pattern with parameters



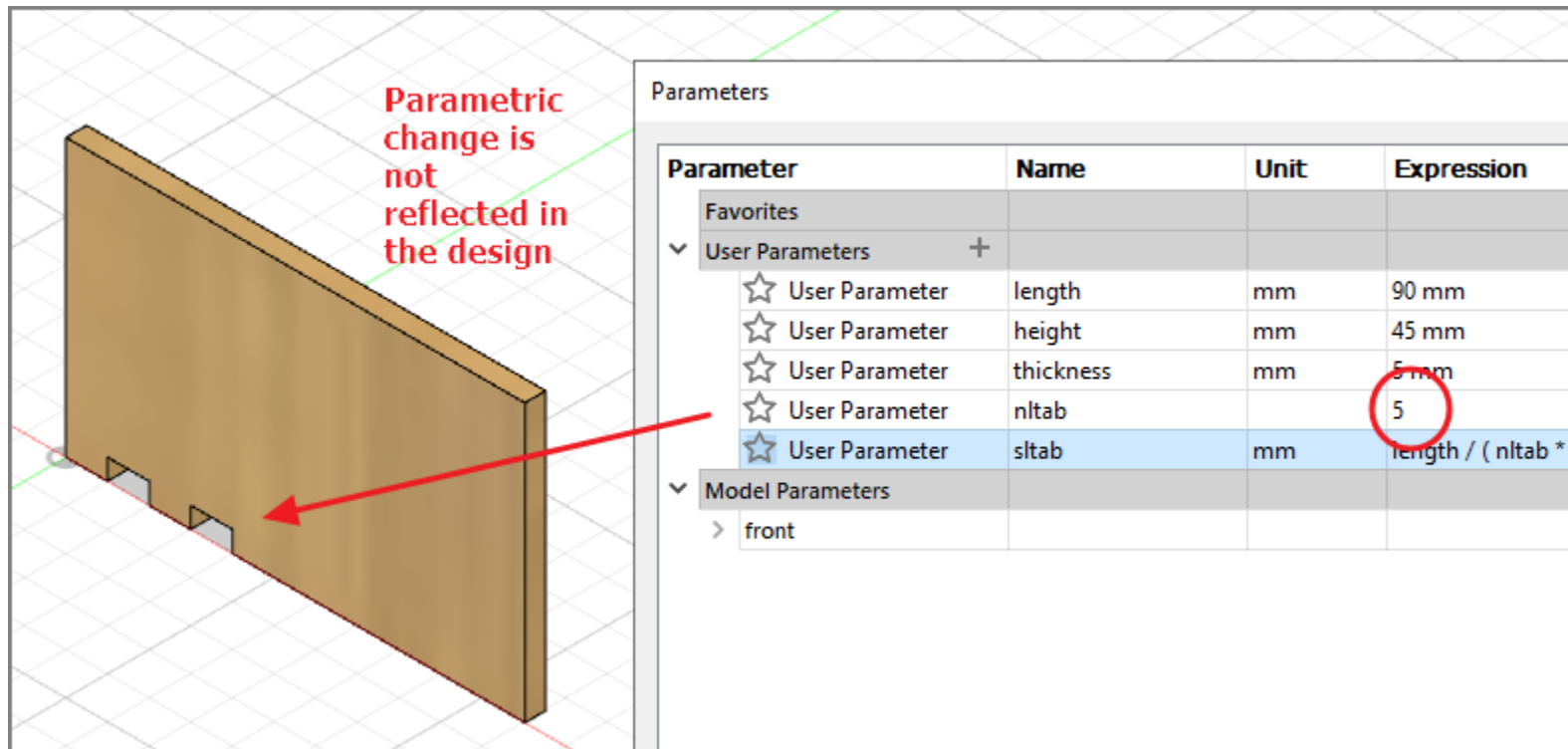
# Sketch: Rectangular Patterns 2

- Pattern with parameters does not exist in 3D space as extrude is done on profile



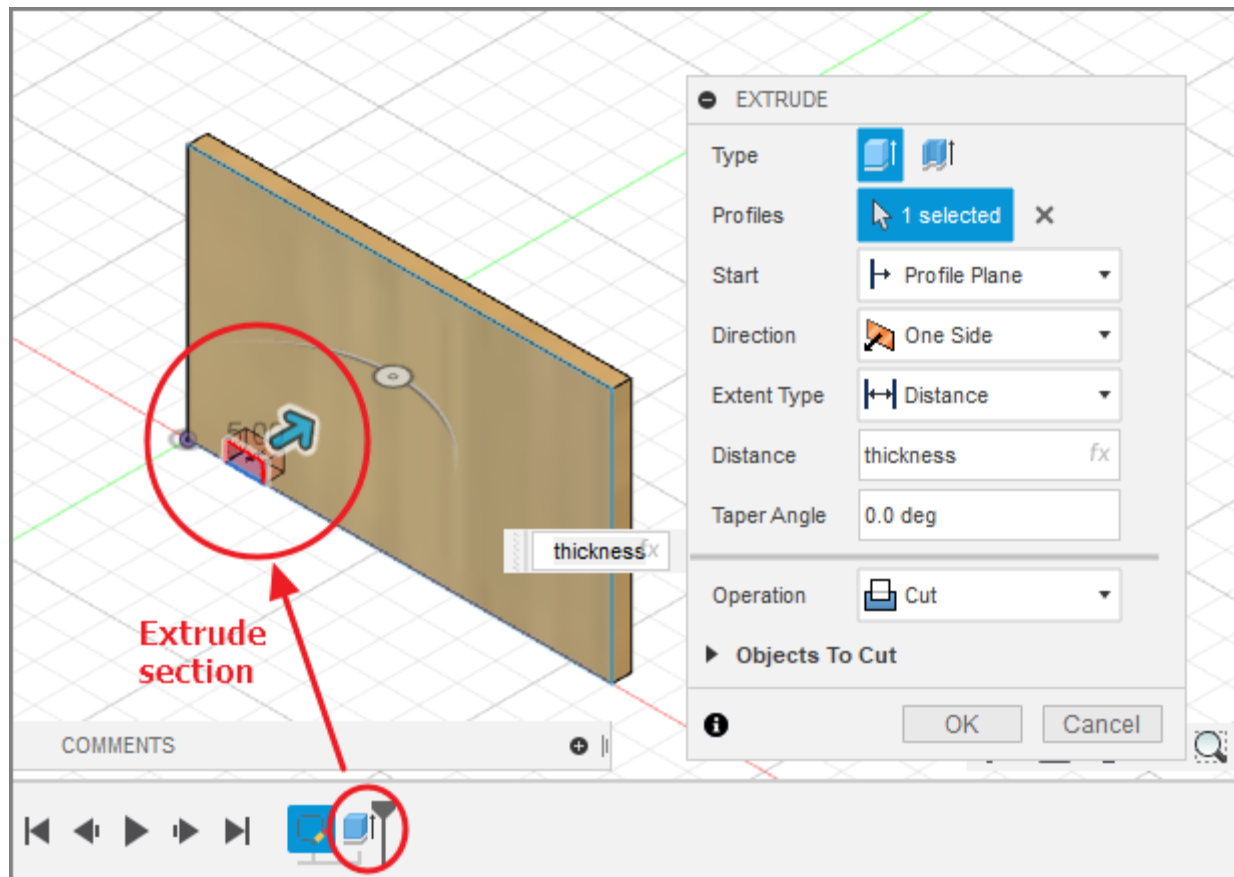
# Sketch: Rectangular Patterns 3

- Parametric change has no effect on 3D design



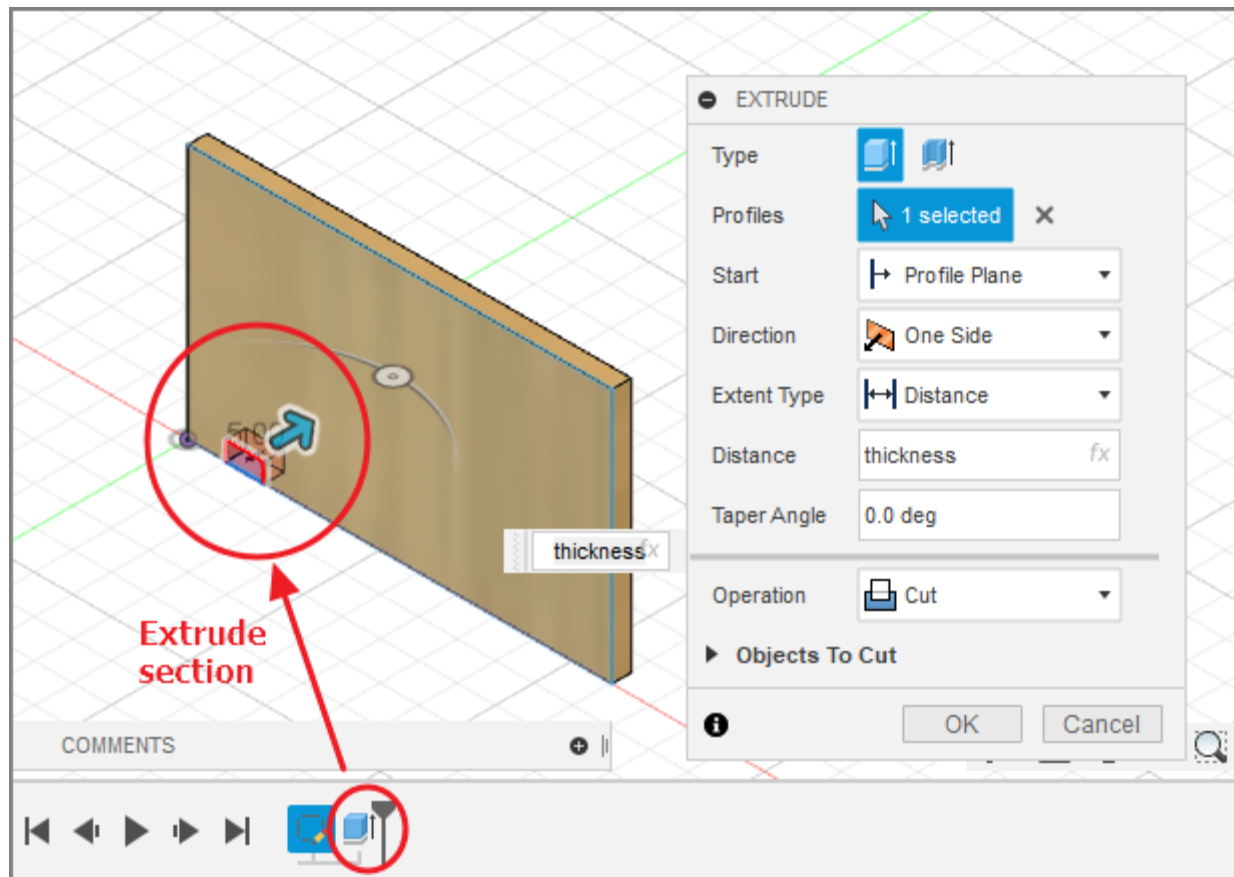
# 3D Parametric Features 1

- Effect the feature (extrude) in 3D space



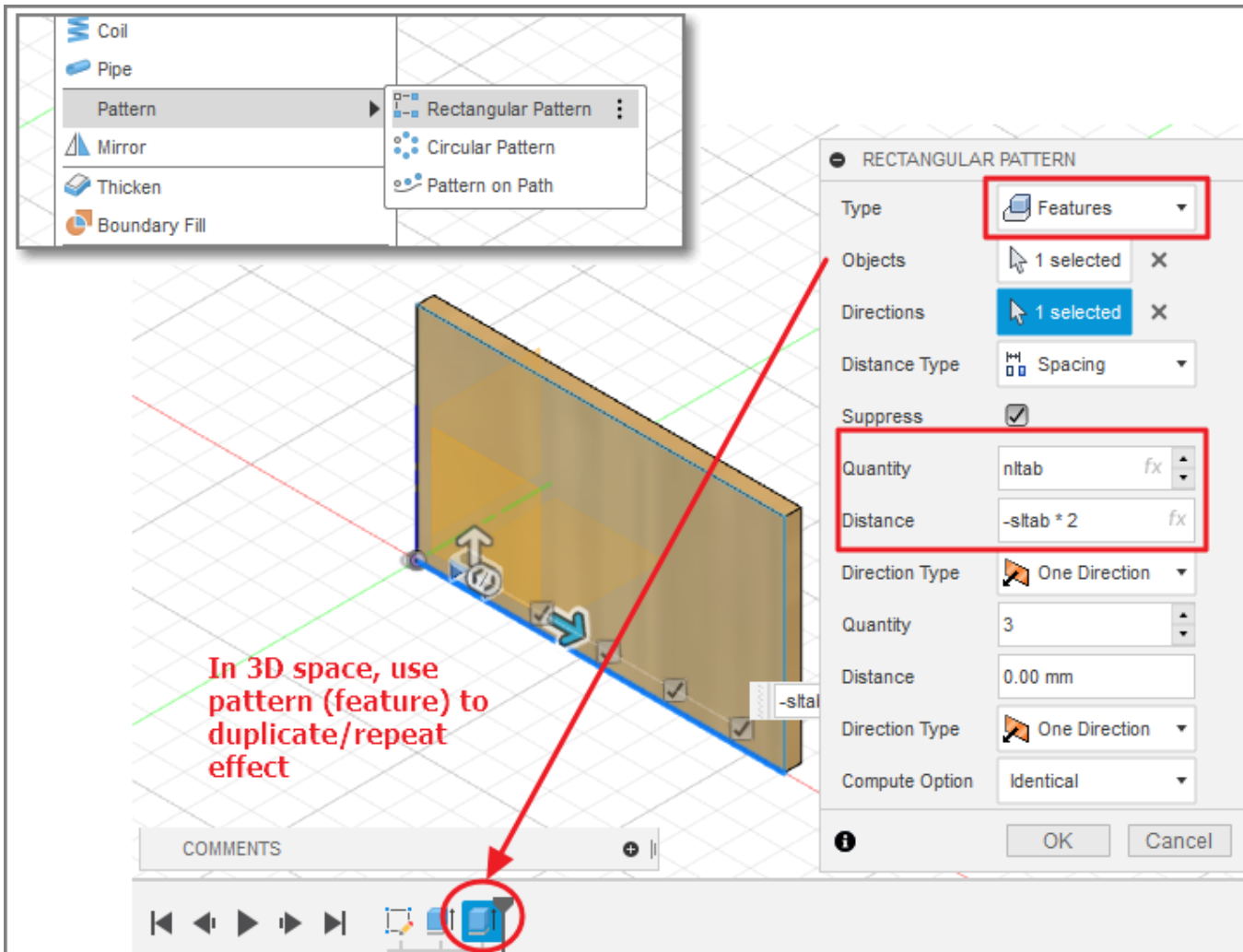
# 3D Parametric Features 2

- Effect the feature (extrude) in 3D space



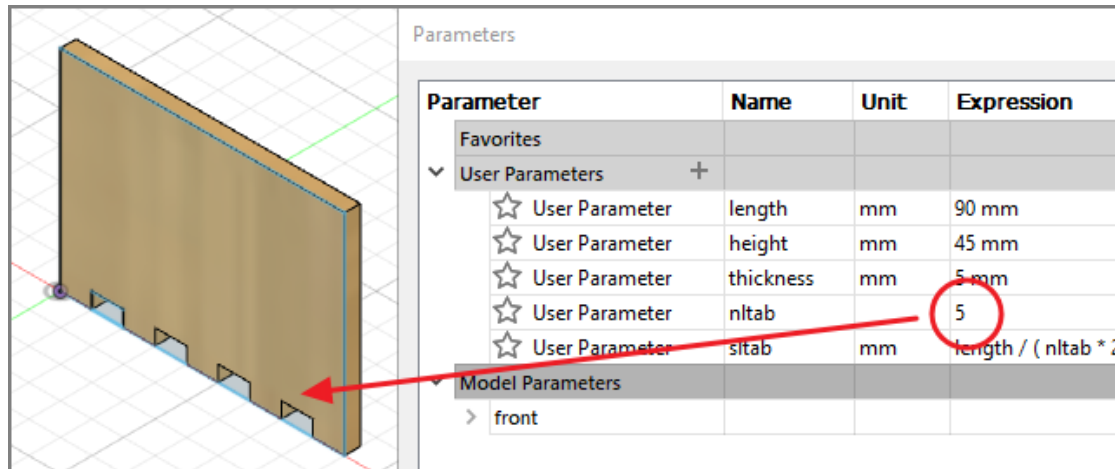
# 3D Parametric Features 3

- Pattern the feature

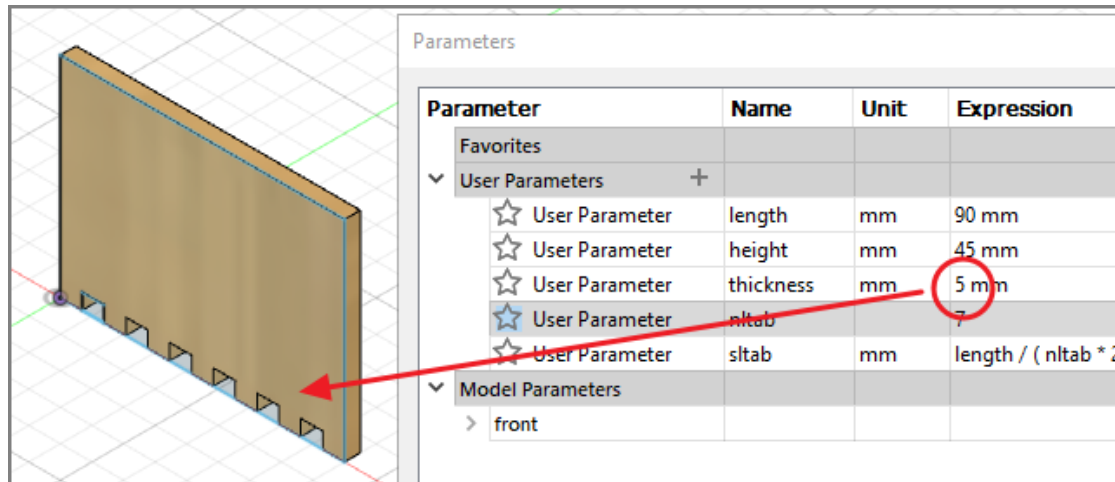




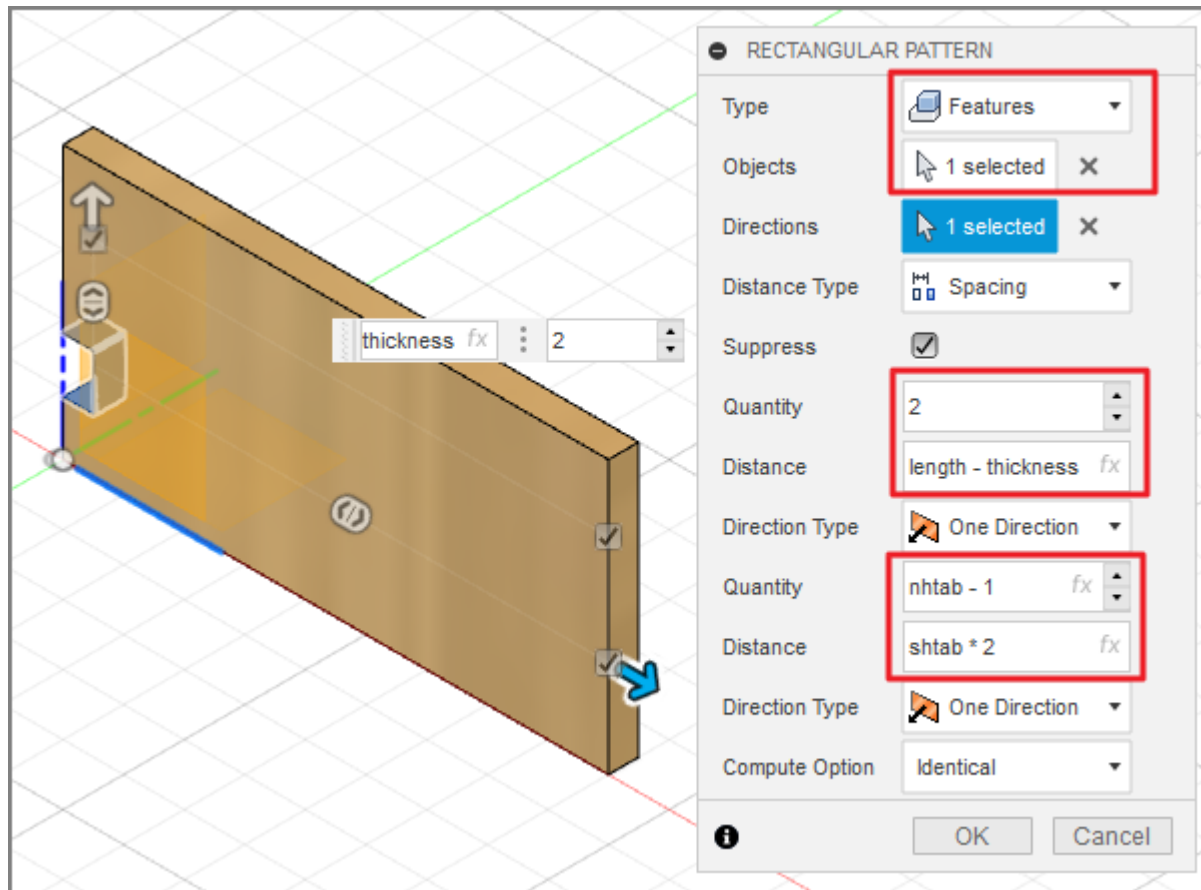
# Results



- Parametric design can still be applied in 3D space

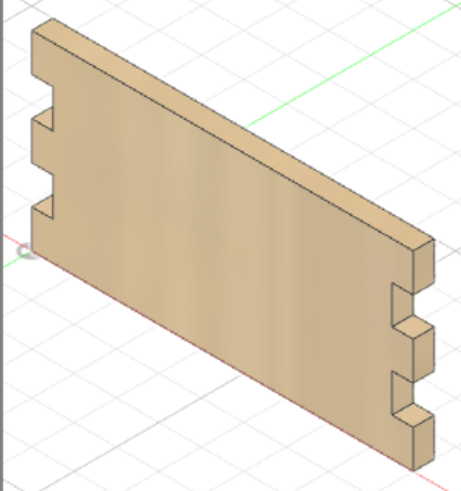


# Parametric design in 2 axes



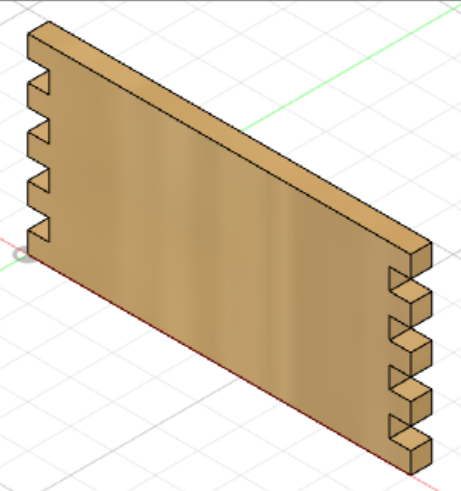
- Need consideration on values to use as parameters
- Perform some quick calculations and use them as the parameters
- Select the proper axes/direction in which to apply

# Results 2 axes



Parameters

Parameter	Name	Unit	Expression
Favorites			
▼ User Parameters	+		
☆ User Parameter	length	mm	90 mm
☆ User Parameter	height	mm	45 mm
☆ User Parameter	thickness	mm	5 mm
☆ User Parameter	ntab		3
☆ User Parameter	sltab	mm	length / ( ntab
☆ User Parameter	nhtab		3
☆ User Parameter	shtab	mm	height / ( nhtab
▼ Model Parameters			
> front			



Parameters

Parameter	Name	Unit	Expression
Favorites			
▼ User Parameters	+		
☆ User Parameter	length	mm	90 mm
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☆ User Parameter	ntab		3
☆ User Parameter	sltab	mm	length / ( ntab
☆ User Parameter	nhtab		5
☆ User Parameter	shtab	mm	height / ( nhtab
▼ Model Parameters			
> front			