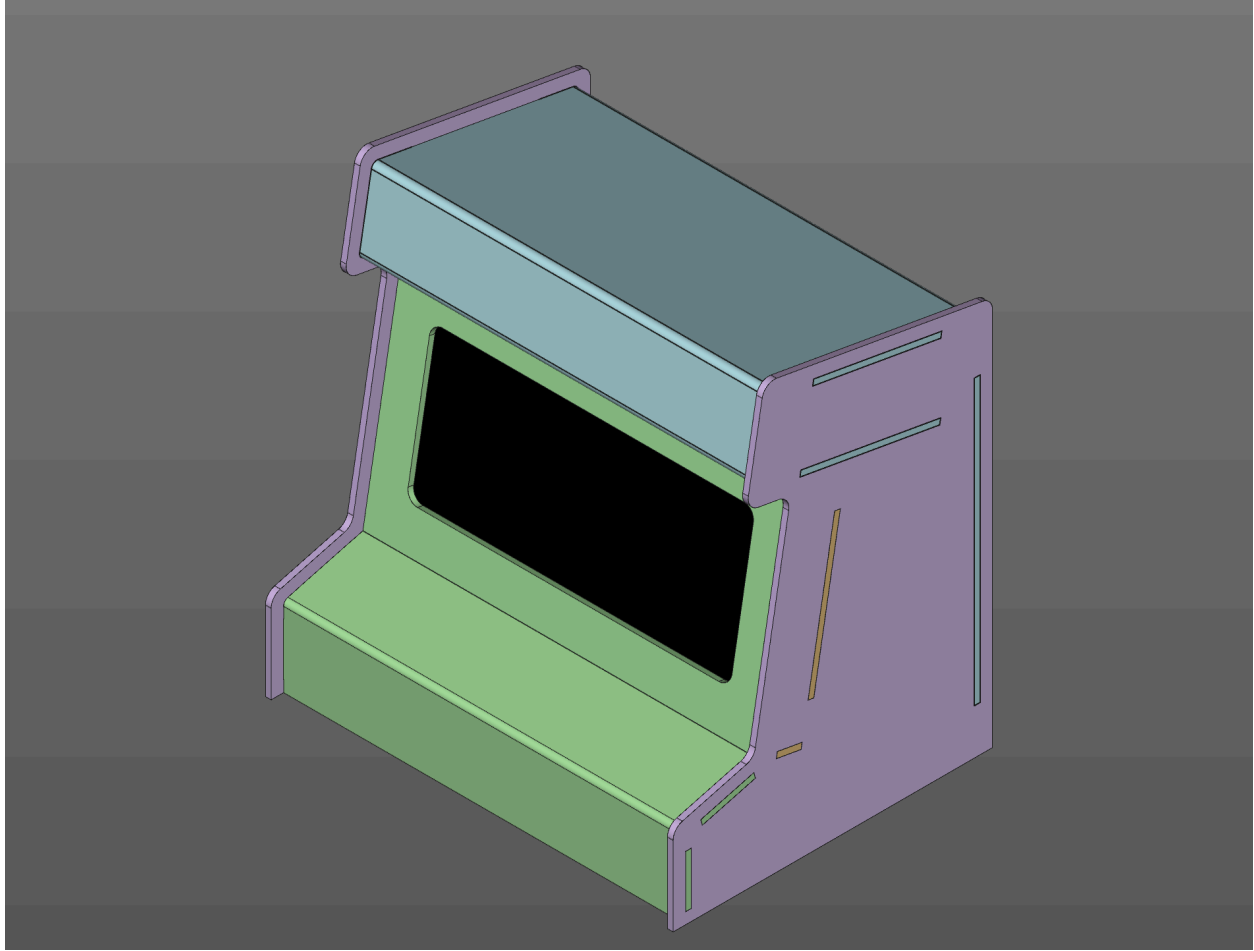




FreeCADE Mini Arcade Build Workshop

Instructions:

FreeCAD:

FreeCAD is a free, open source CAD (Computer Aided Design) program.

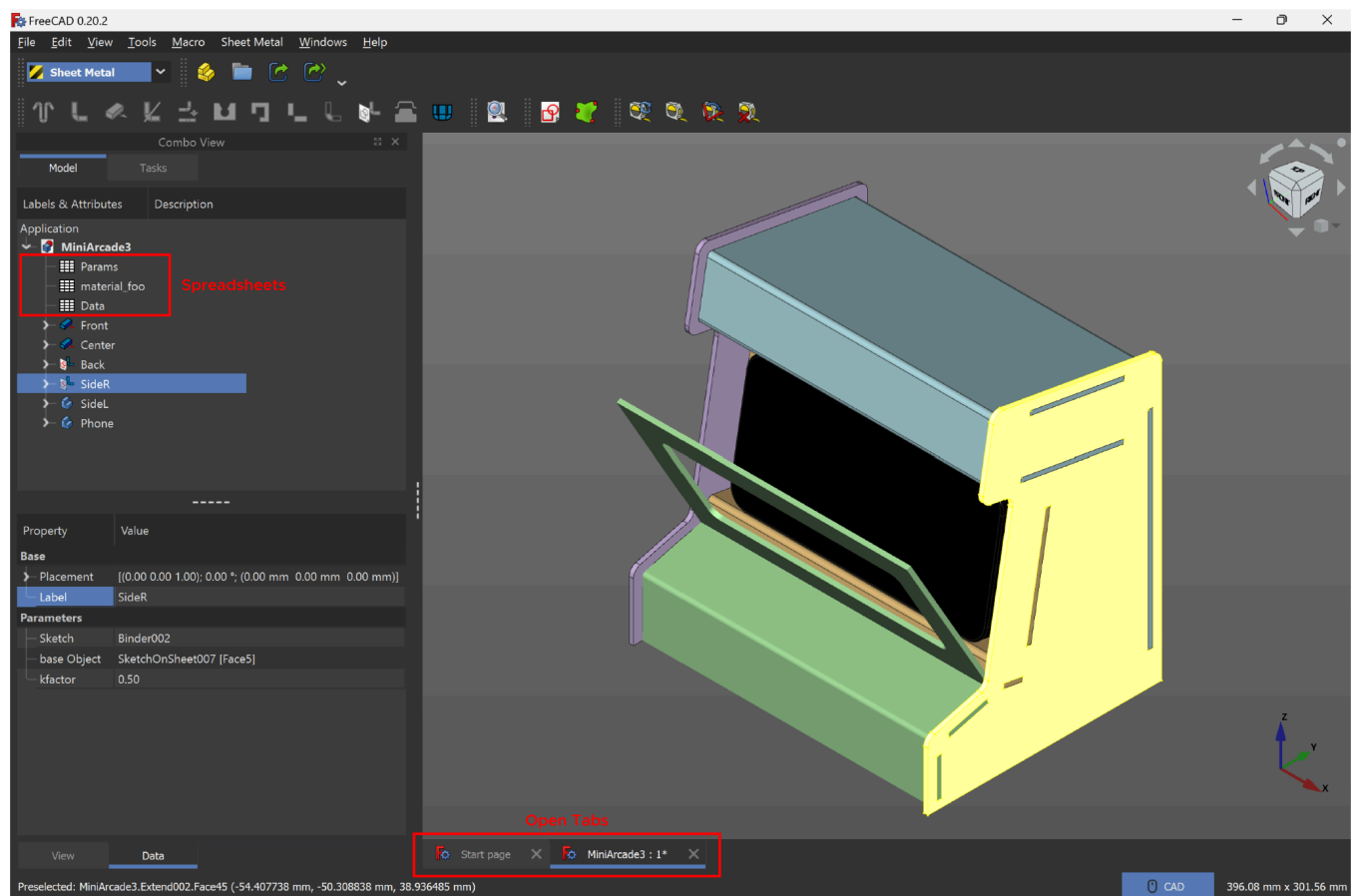
It's primarily used for **parametric design**, or design based on parameters. Those parameters are stored as data in a **spreadsheet**, then used throughout the other **workbenches**.

Each **workbench** contains a set of tools for specific types of design. For example **Part Design** is used for designing parts, or **Fasteners** is used to add standard fasteners to a model. Some of these workbenches are community contributions, and must be installed as an addon.

Spreadsheets:

The first workbench we will be using is the **Spreadsheets Workbench**.

Click on the spreadsheets in the model tree to open them, then switch between the different tabs at the bottom of the screen.



Spreadsheets in FreeCAD are used to store and calculate data. This data can then be used throughout all (or at least most) of the other workbenches.

We can then use this data to update aspects of our design, enforce limits on values, do logic operations, and much more.

Each cell could contain numbers like 1 or 7.563 , measurements with units like 7.5mm, 62deg, or 3km/h , formulas like $=7.5\text{mm} * 1.5$, or any other math or logic operations you may need.

These values can then be called from outside of the spreadsheet using giving the cell an **alias**. The cell can then be used by entering `<<spreadsheet>>.alias` anywhere you see the formula editor icon.



In this file, the data we will be editing will be in the **<<Params>>** spreadsheet. Primarily this will be the dimensions for the area around the phone, and the size of the screen.

<<Params>>:

	A	B	C	D	E
1	<u>Outer Dimensions:</u>			<u>Open Front:</u>	
2	PhoneWidth	154.50 mm		1	
3	PhoneHeight	76.00 mm		1 = Open	0 = Closed
4	PhoneThickness	13.20 mm			
5	<u>Screen Dimensions:</u>				
6	ScreenWidth	143.00 mm			
7	ScreenHeight	64.00 mm			
8	ScreenRadius	5.00 mm			
9	<u>Material Properties:</u>				
10	MaterialThickness	2.50 mm			
11	Tolerance	0.05 mm			
12	BendRadius	0.10 mm			

Outer Dimensions:

Safe to edit

- PhoneWidth = The outer width of your phone (The longer side)
- PhoneHeight = The outer height of the phone (The shorter side)
- PhoneThickness = The outer thickness of the phone (The shortest side)

Screen Dimensions:

Safe to edit

- ScreenWidth = The width of the screen
- ScreenHeight = The height of the screen
- ScreenRadius = Corner radius for the screen **!(Must have a non-zero value)!**

Material Properties:

Only adjust if parts don't fit

- MaterialThickness = How thick the material is
- Tolerance = Adjust up for an easier fit **!(Must have a non-zero value)!**
- BendRadius = How tight the material can bend **!(Must have a non-zero value)!**

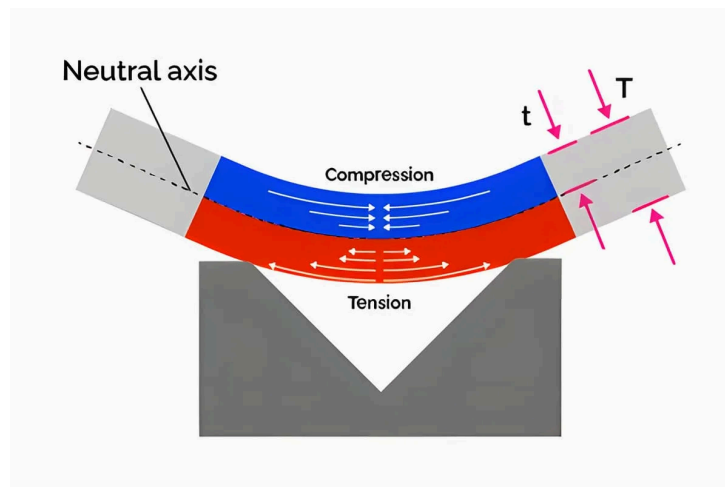
Open Front:

- Enter 1 to open the door
- Enter 0 to close the door

<<material_foo>>:

	A	B	
1	Radius / Thickness	K-factor (ANSI)	
2	1	0.50	
3	3	0.50	
4	99	0.50	

- This defines the K-Factor for the material. K-Factor is used to describe how a material warps when bent.



- Since the bends in the cardboard either crumple or are partially cut through, the K-Factor stays the same.
- This prevents manually inputting K-Factor values later

<<Data>>:

	A	B	C	D	E	F	G	H	I
1	Controls:			Display:			Totals:		
2	ControlHeight	35.00 mm		DisplayHeight	100.20 mm		TotalDepth	8	
3	ControlDepth	35.00 mm		DisplayAngle	80.00 °		TotalWidth	180.00 mm	
4	ControlAngle	15.00 °		SideBezel	5.75 mm				
5				BottomBezel	6.00 mm				
6				ThumbHoles	25.00 mm				
7				PhoneTolerance	0.50 mm				
8									
9	Connection Points:			Marquee:					
10	TabGap	5.00 mm		MarqueeDepth	20.00 mm				
11	SideBorder	5.50 mm		MarqueeHeight	35.00 mm				
12	VelcroThickness	1.50 mm							
13	VelcroWidth	12.00 mm							
14	VelcroLength	50.00 mm							
15									

- These are all the dimensions that should only be edited if you know what you're doing.
- There's also some calculators for frequently used values.

Editing The Spreadsheet:

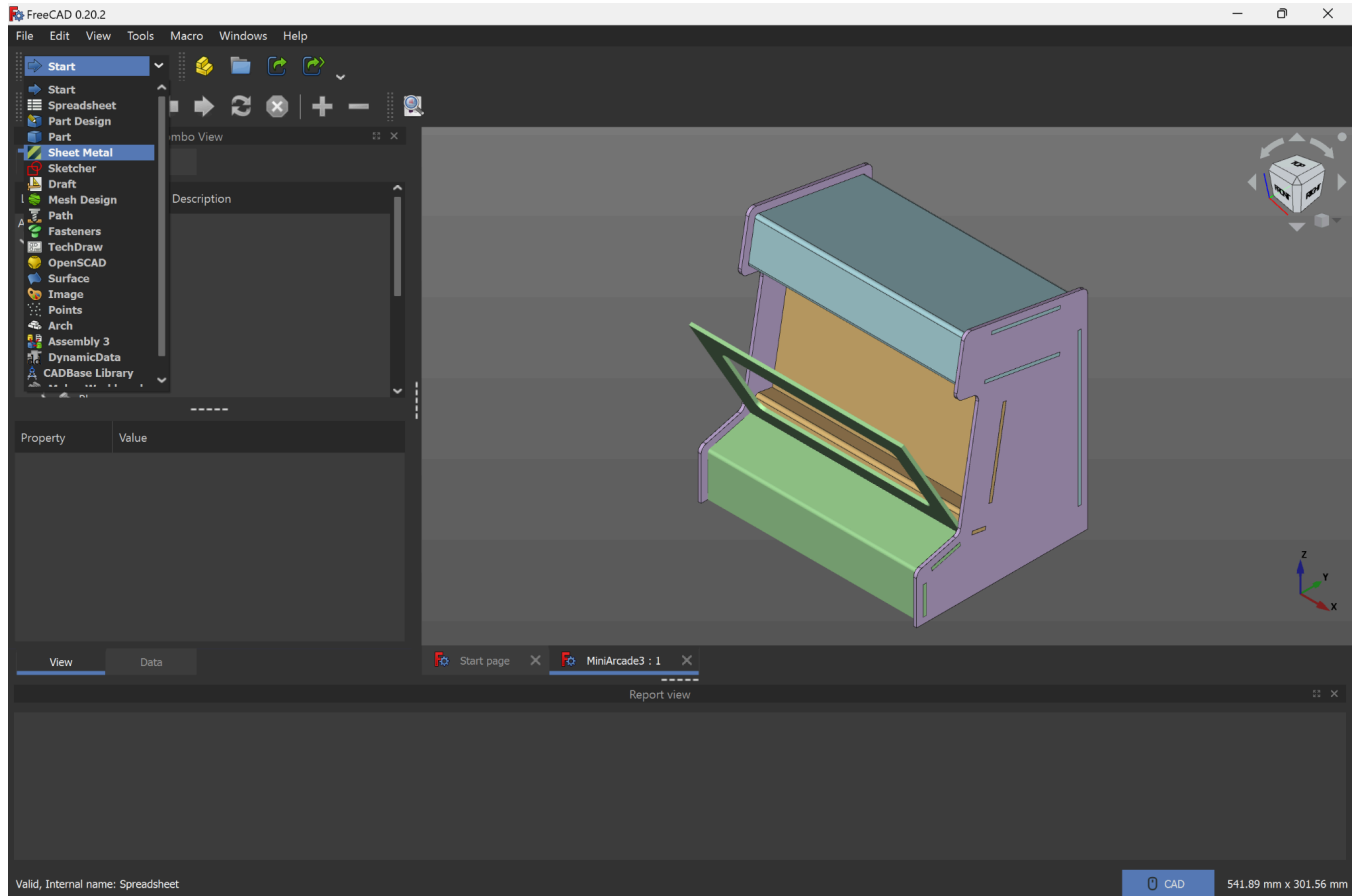
Spreadsheet info:

- The **yellow highlighted cells** can be referenced outside of the spreadsheet, so can be used to update the size of the arcade cabinet.
- Double click the cell and type in the new value
- Units must be specified! [12.7mm / 1.27cm / 0.5in / 0.5i" / 1in/2] [10deg / 10° / 0.175rad]
- If a unit is not specified, the number will be unitless [3]
- Units will always display in metric
- If you make a mistake, just deselect the cell, then double click it again

Steps:

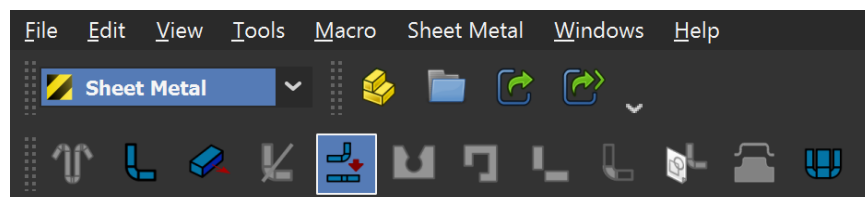
1. Using calipers, measure the size of your phone (case included)
2. Enter those values in **<<Params>> Outer Dimensions**
3. Using calipers measure the size of your screen (Easier with the screen on)
4. Enter those values in **<<Params>> Screen Dimensions**

Sheet Metal Workbench:



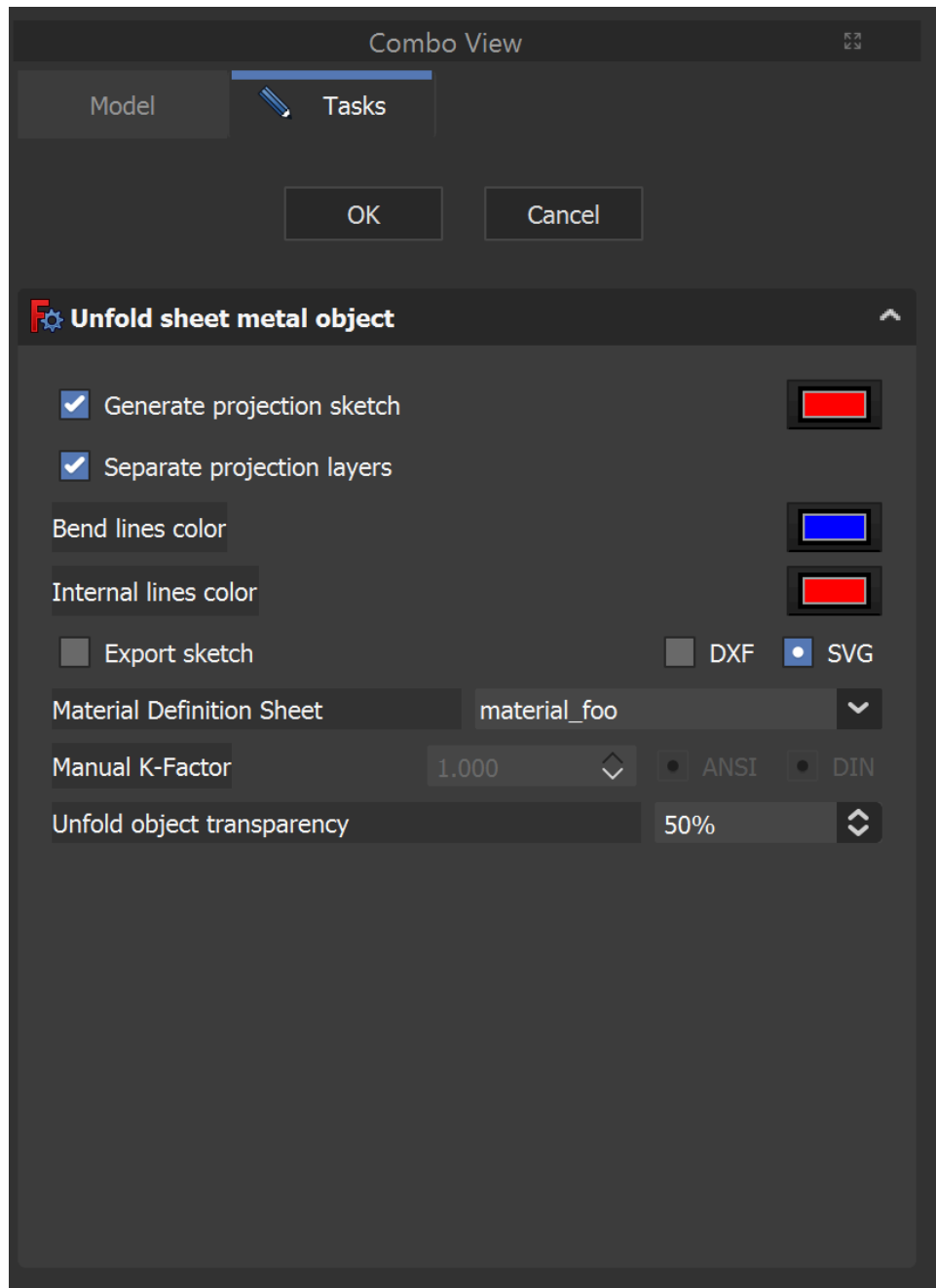
In the top left corner of FreeCAD you'll see a drop down menu. Each workbench contains tools for specific types of design.

1. Open the **Sheet Metal** workbench
2. To get vector files we will use the **Unfold** tool



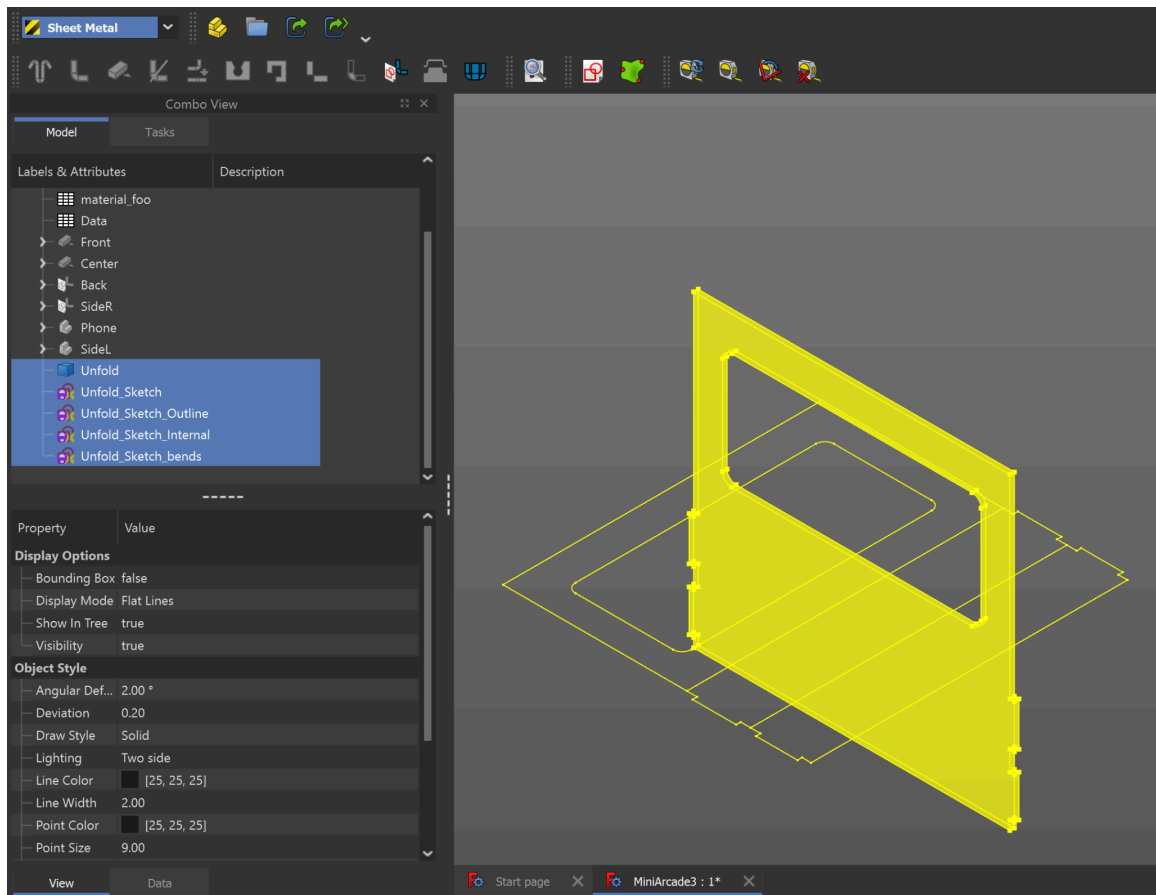
3. Select a flat face from one of the parts
4. Select **Unfold**

5. Set up your task as follows:



- a. Generate projection sketch **on** [Color: **#ff0000**]
- b. Generate projection layers **on**
 - i. Bend lines [Color: **#0000ff**]
 - ii. Internal lines [Color: **#ff0000**] Export sketch **off**
- c. Material Definition Sheet: **material_foo**
- d. Press **OK**

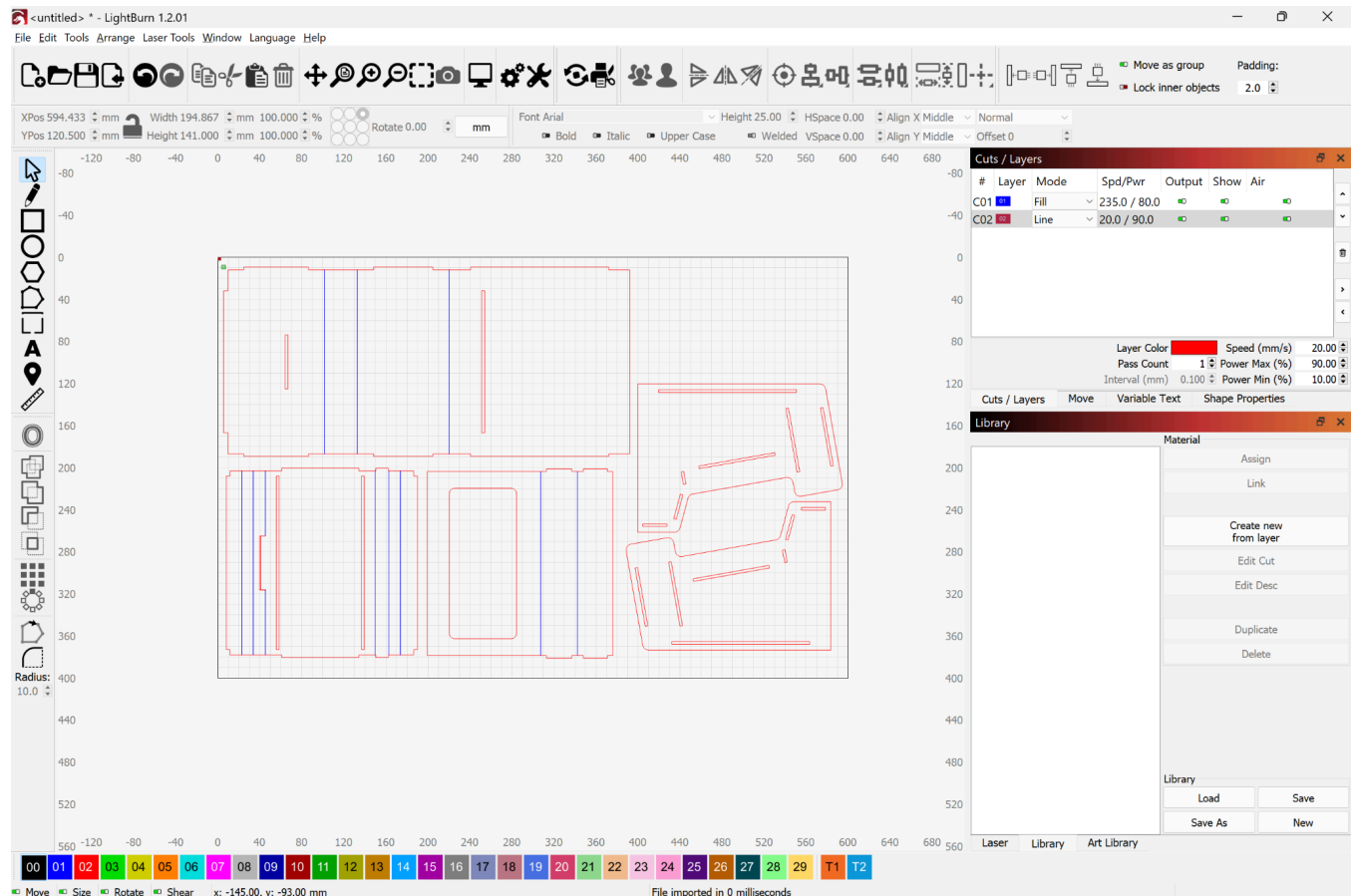
6. This will generate a number of items...



- a. **Unfold** (Body) is a flattened model of the selected part, oriented to the selected face
 - b. **Unfold_Sketch** contains all the cut lines
 - c. **Unfold_Sketch_Outlines** contains the outer perimeter of the part
 - d. **Unfold_Sketch_Internal** contains all the inner cut lines
 - e. **Unfold_Sketch_Bends** contains all the bend lines
7. We have no need for **Unfold** (Body) and **Unfold_Sketch** so to avoid duplicates, just delete those two objects. (**del** on the keyboard)
8. Select the remaining sketches, and go to file → export...
- a. Name the files: "NamePart.svg".
 - example: "KyleBack.svg"
 - b. Set the file type to "Flattened SVG"
 - c. Save the files to Documents
9. Repeat for each part (we only need on side, since they are identical)
10. You only need to do the side panels once

Lightburn:

Lightburn is the equivalent of a “printer driver” for a laser cutter. We use it to lay out and prepare files for cutting.



Steps:

Drag each svg file into lightburn, select it, then press ctrl+G to group the parts. Repeat for each file. This would then have power/speed settings applied for the red and blue operations, and be cut out by the laser.

This will be handled by the laser attendant.

Settings:

Layer 1: Score

- Speed: 175 mm/s
- Power: 60% max / 10% min

Layer 2: Cut

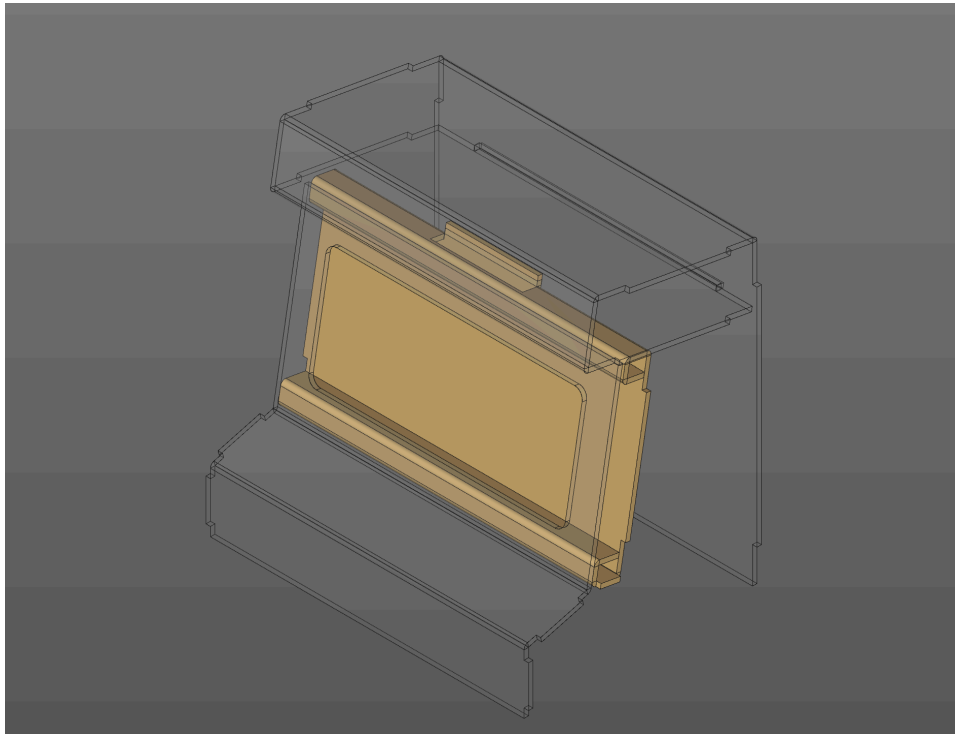
- Speed: 75 mm/s
- Power:

Assembly:

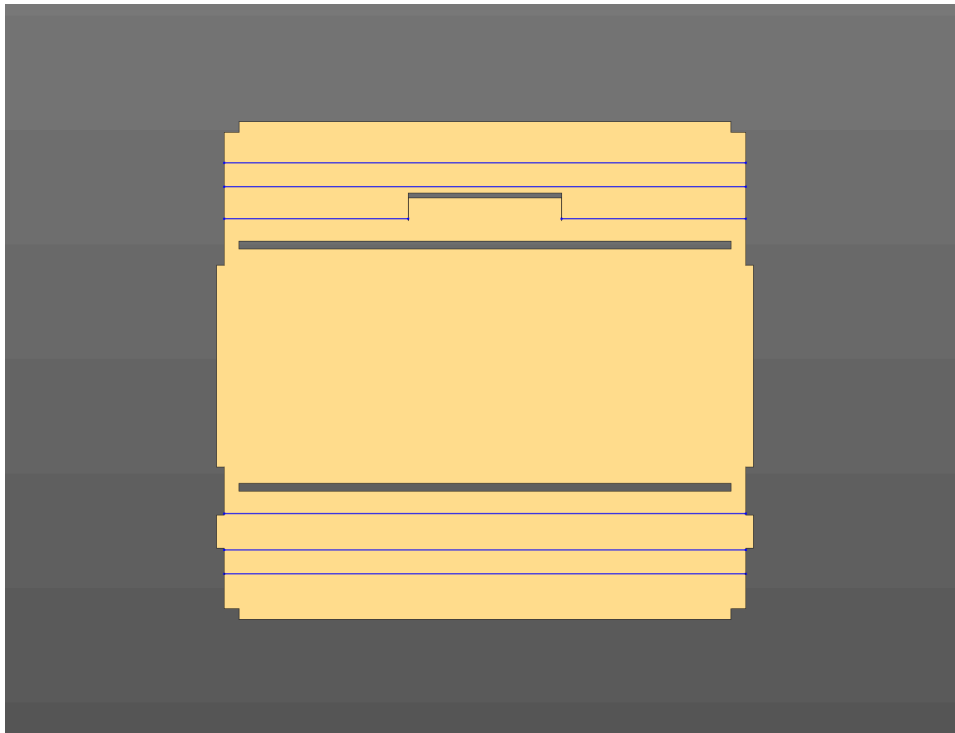
! Use hot glue on or in as many of the joints as possible !

It will hold together without it, but parts can fall off relatively easily.

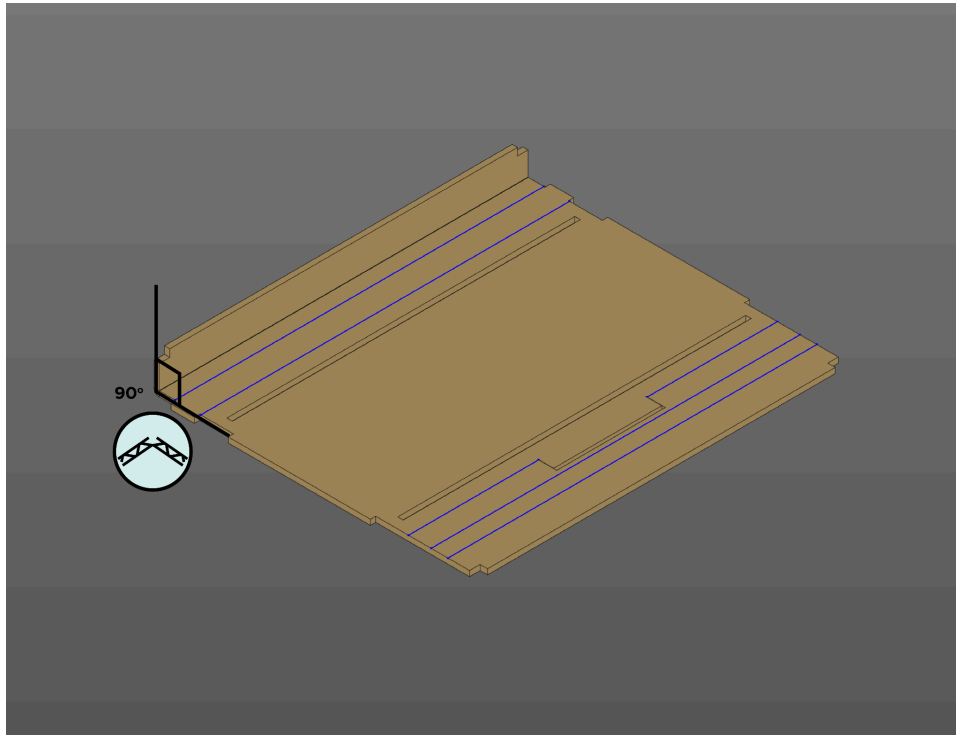
Center Panel:



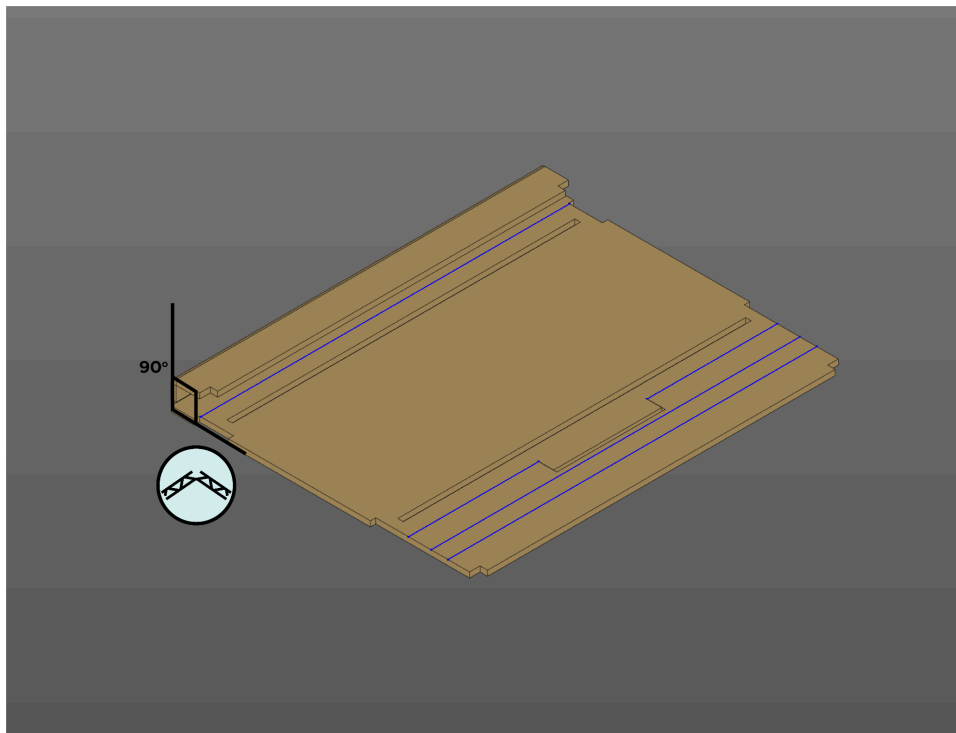
Part:



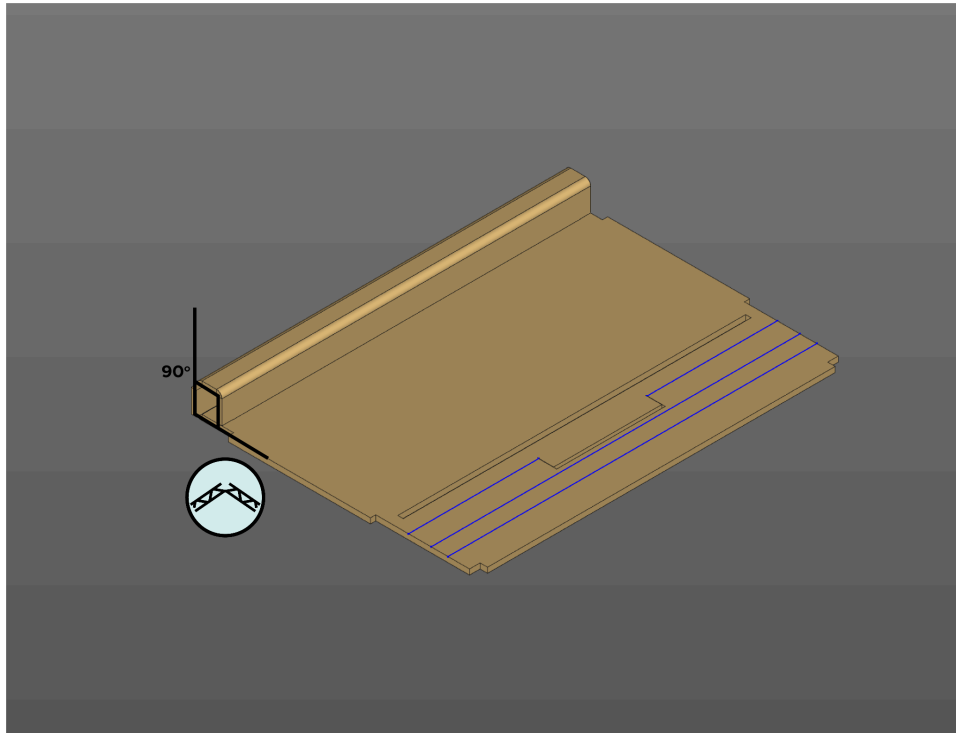
Step 1:



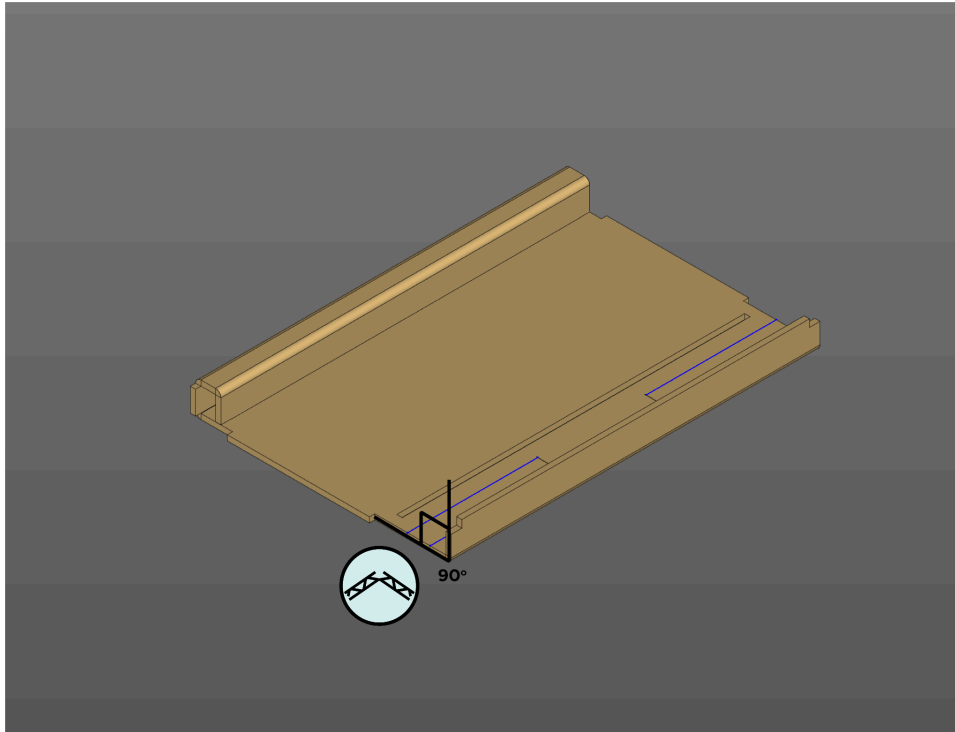
Step 2:



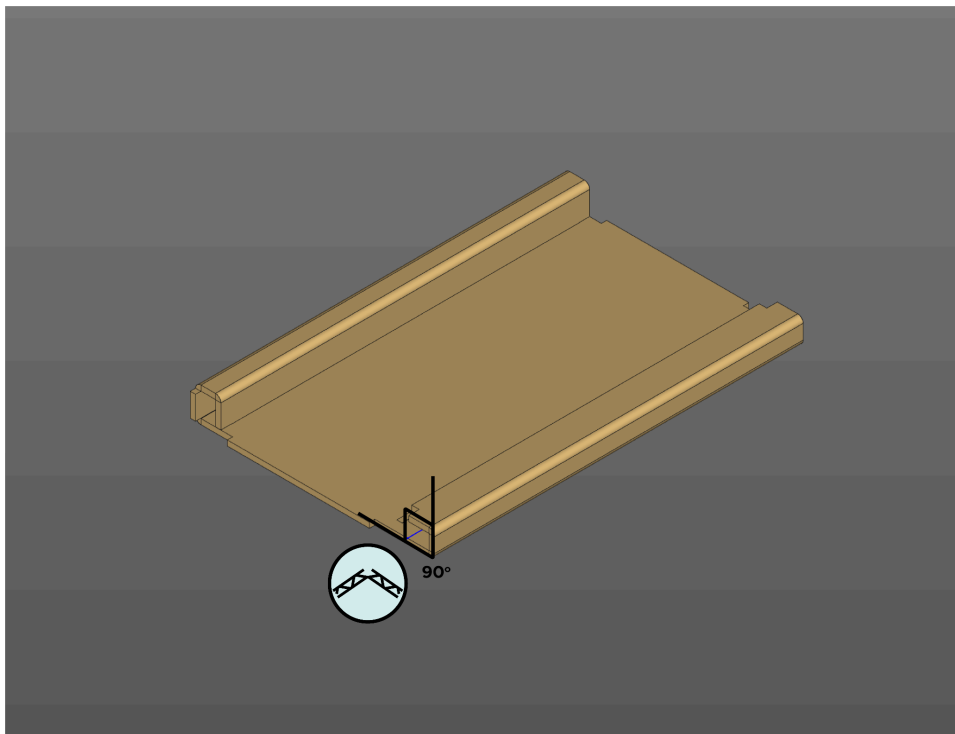
Step 3:



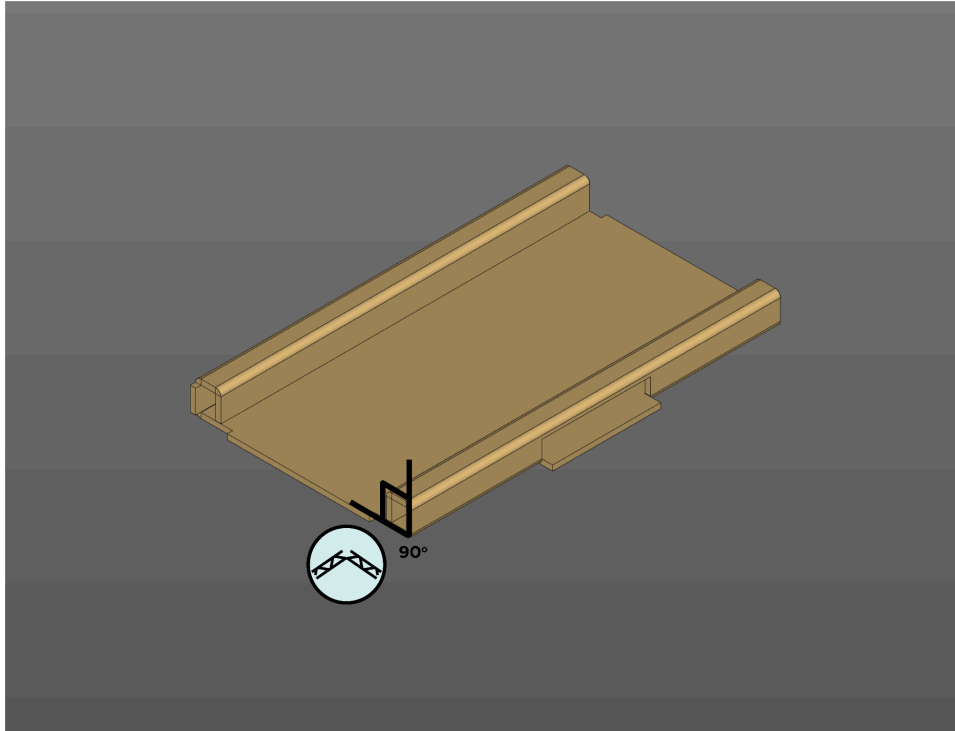
Step 4:



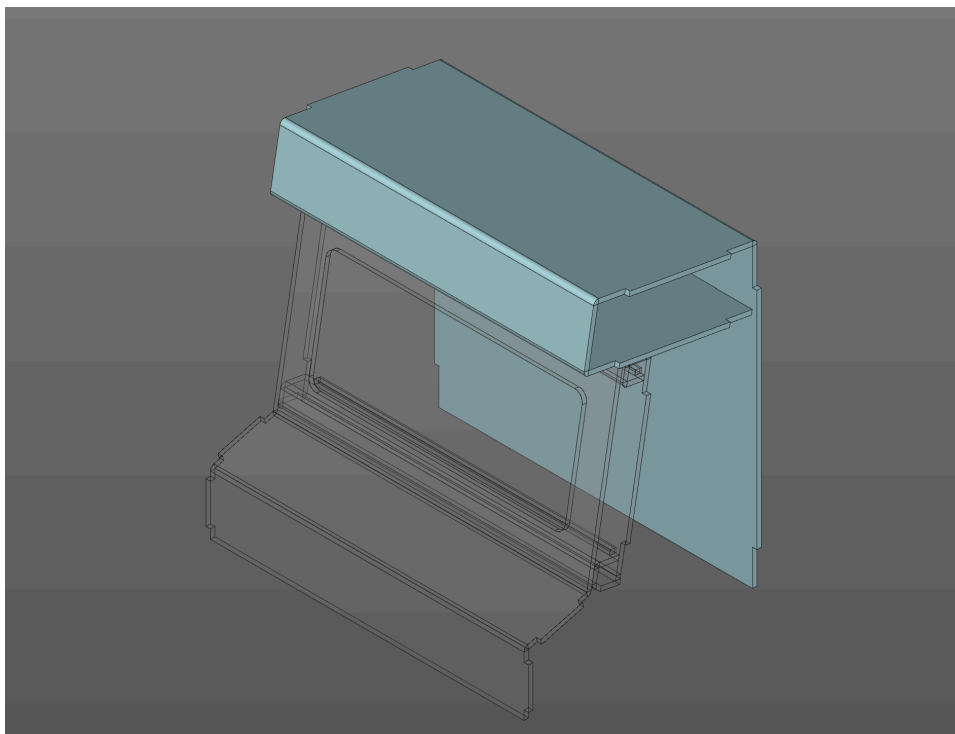
Step 5:



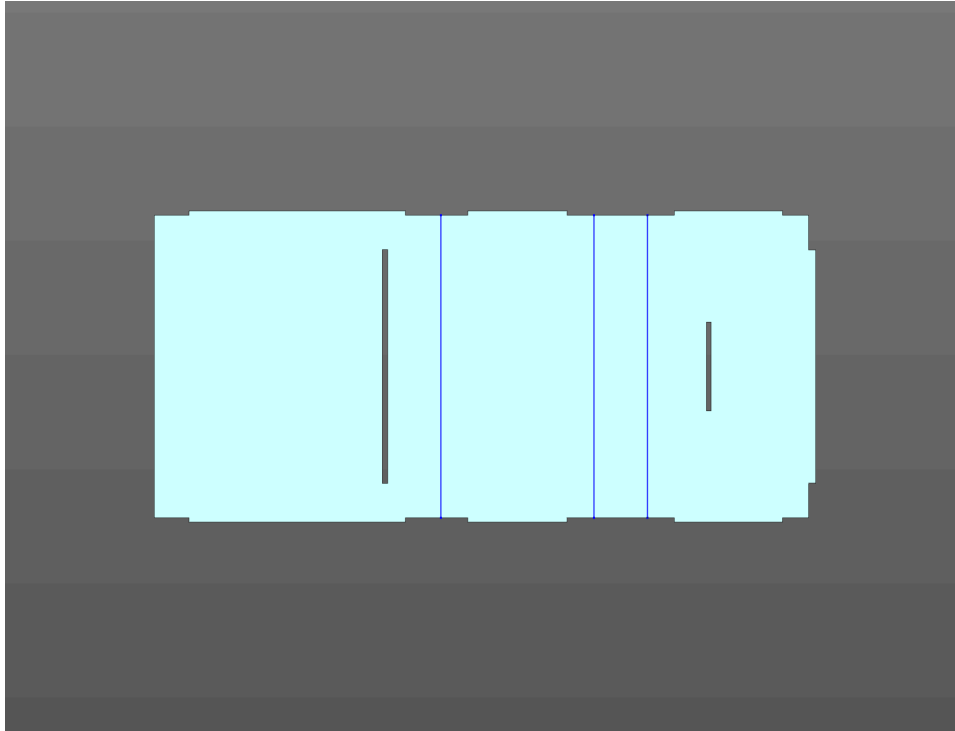
Step 6:



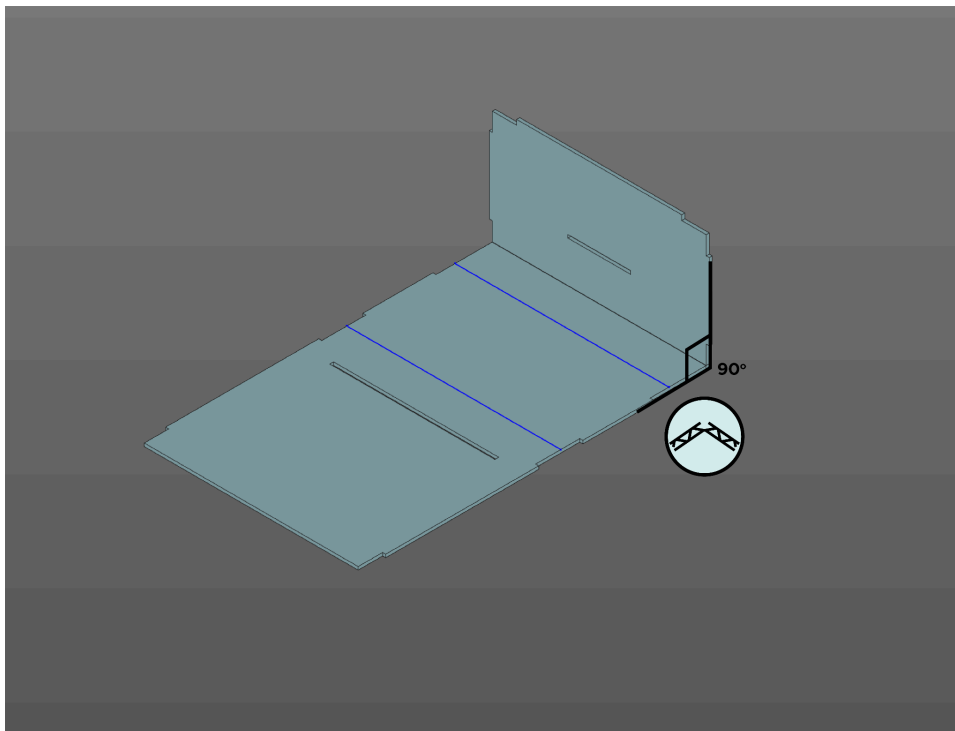
Back Panel:



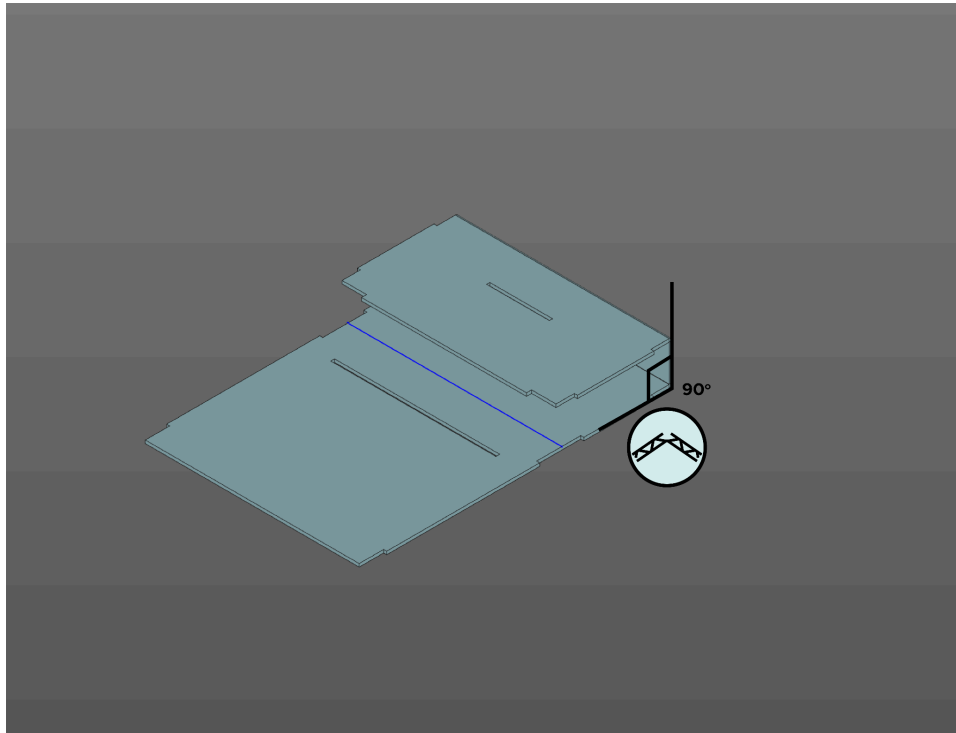
Part:



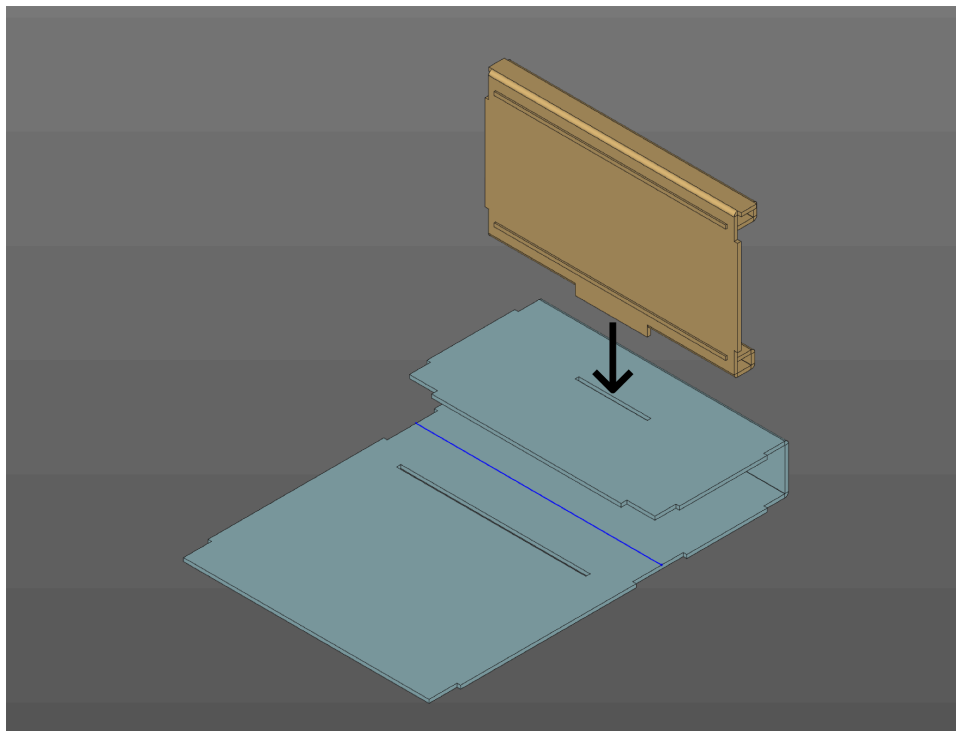
Step 7:



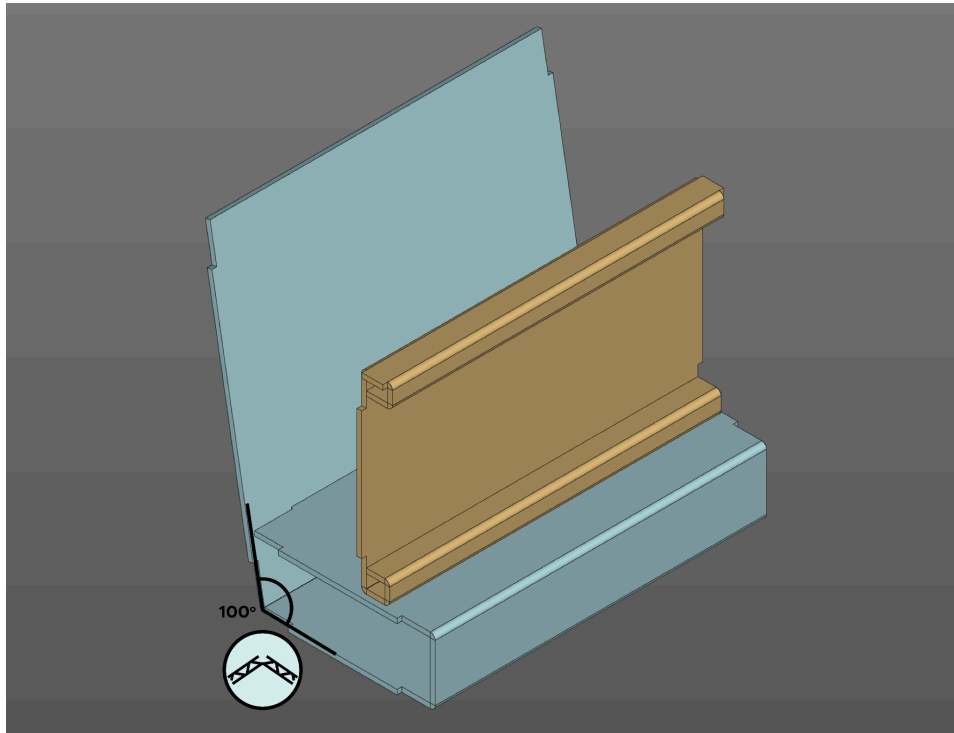
Step 8:



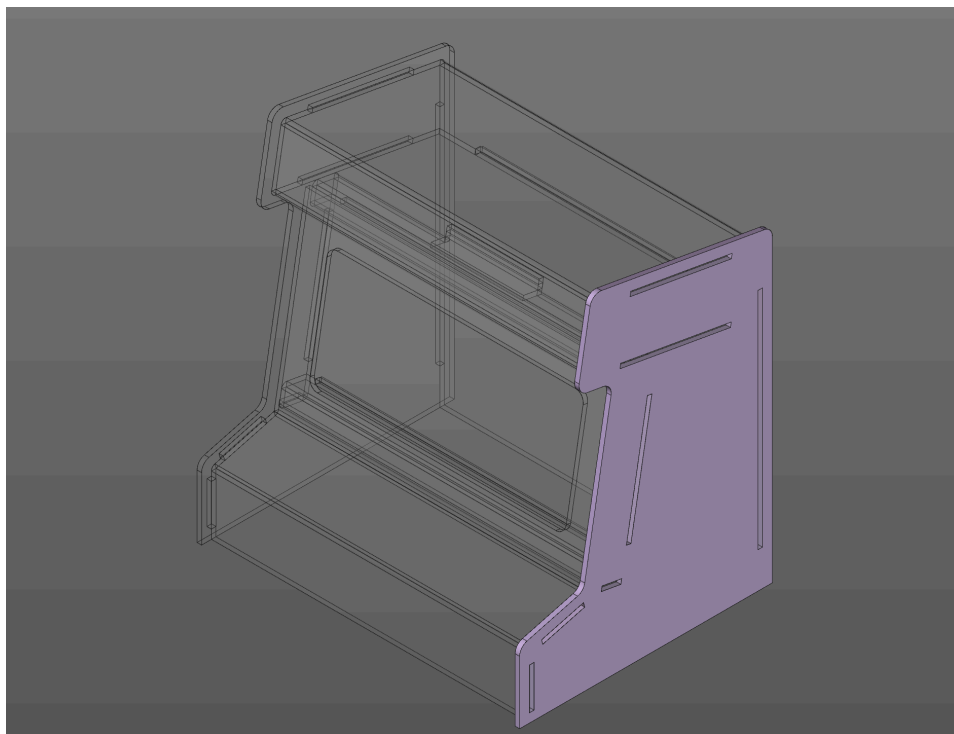
Step 9:



Step 10:



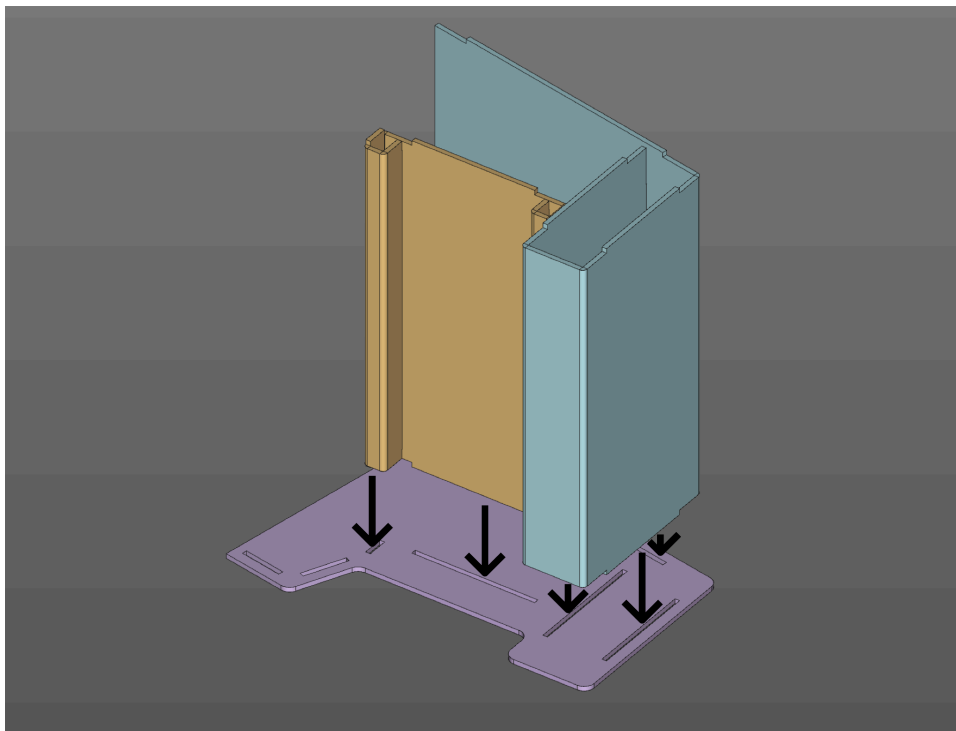
Right Side:



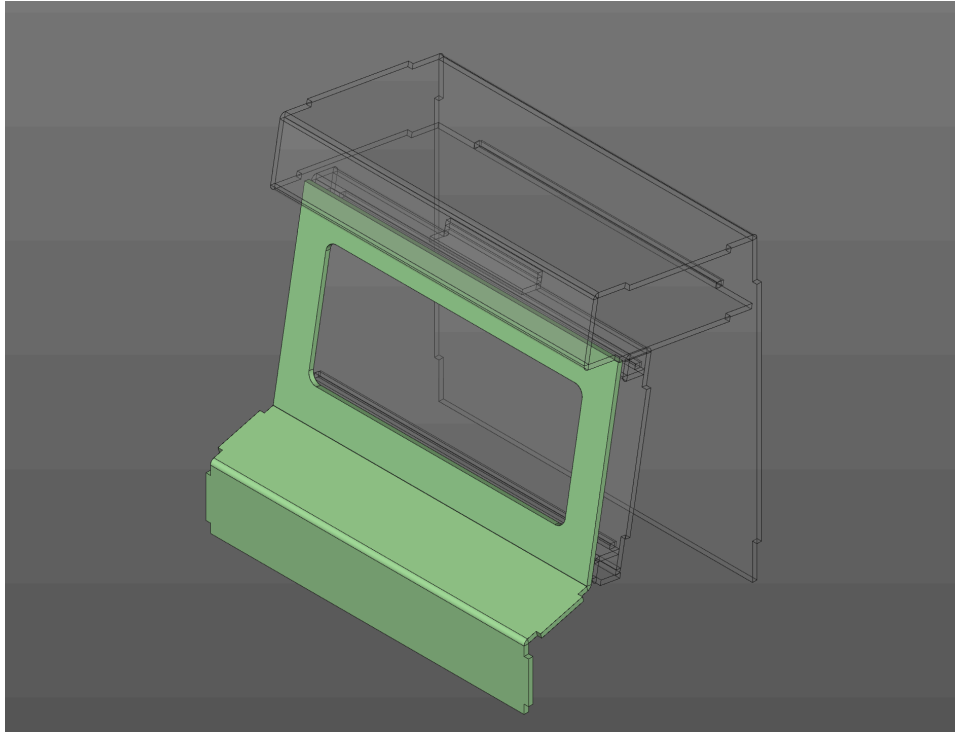
Part:



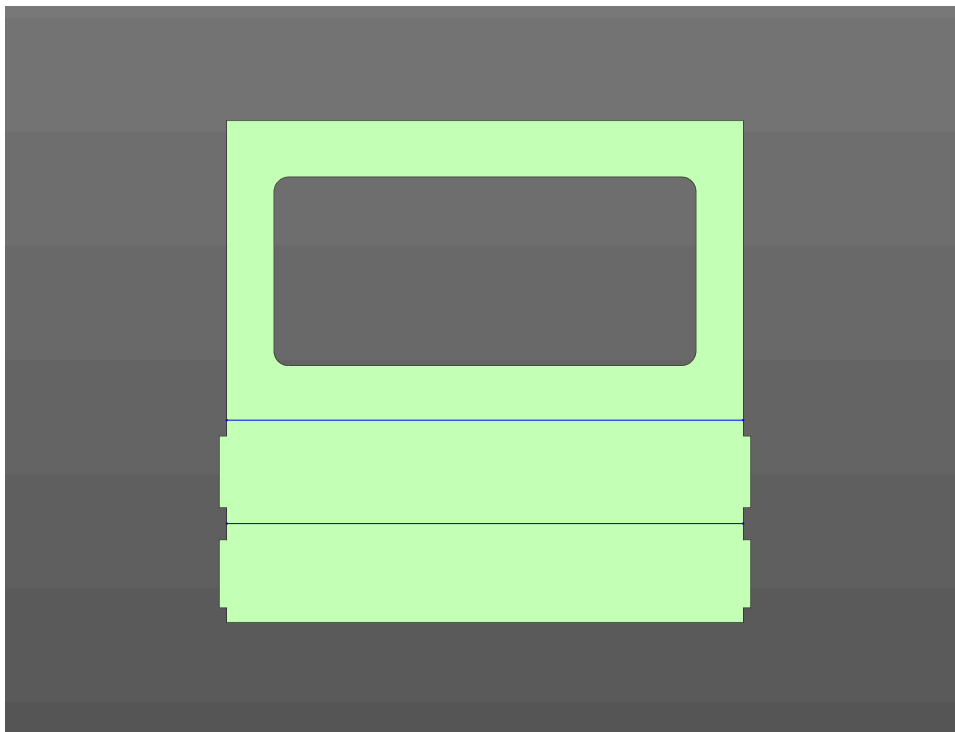
Step 11:



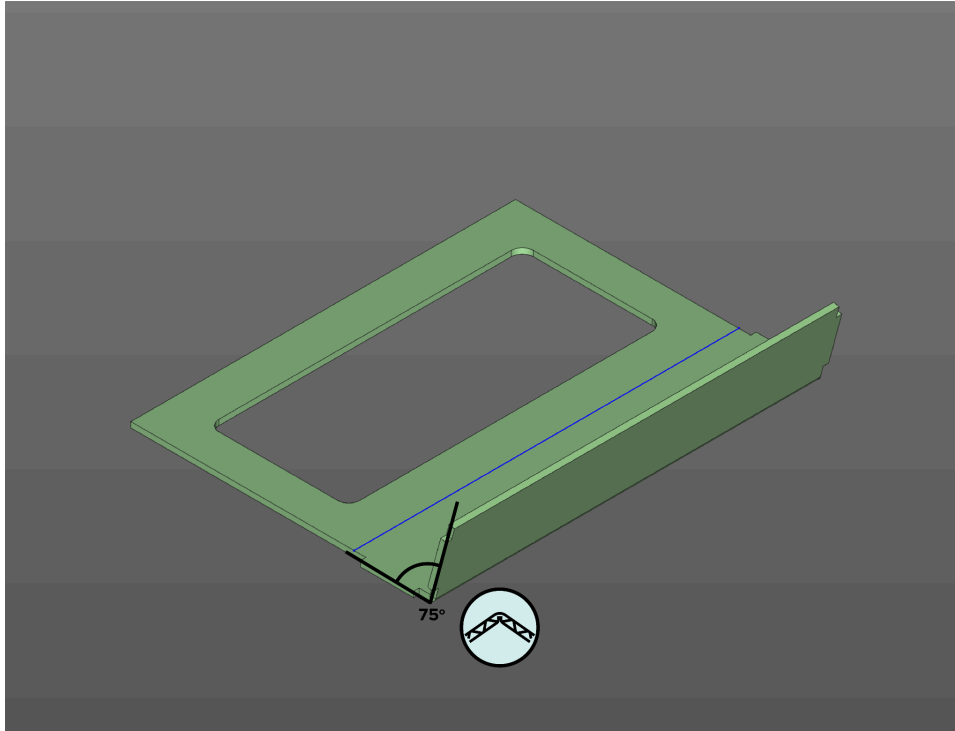
Front Panel:



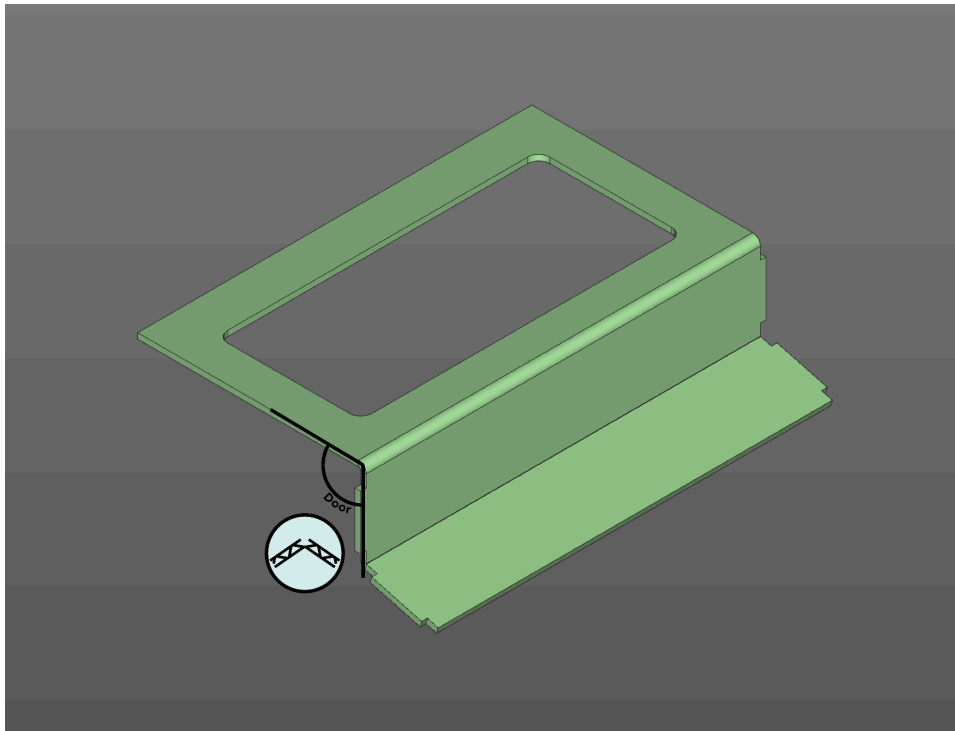
Part:



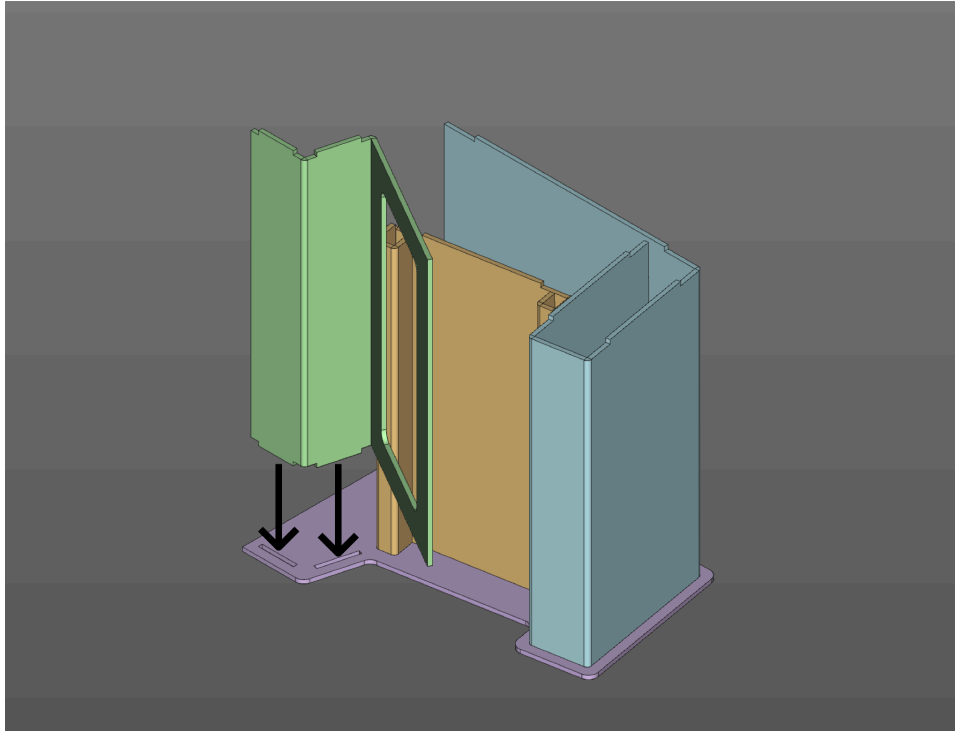
Step 12:



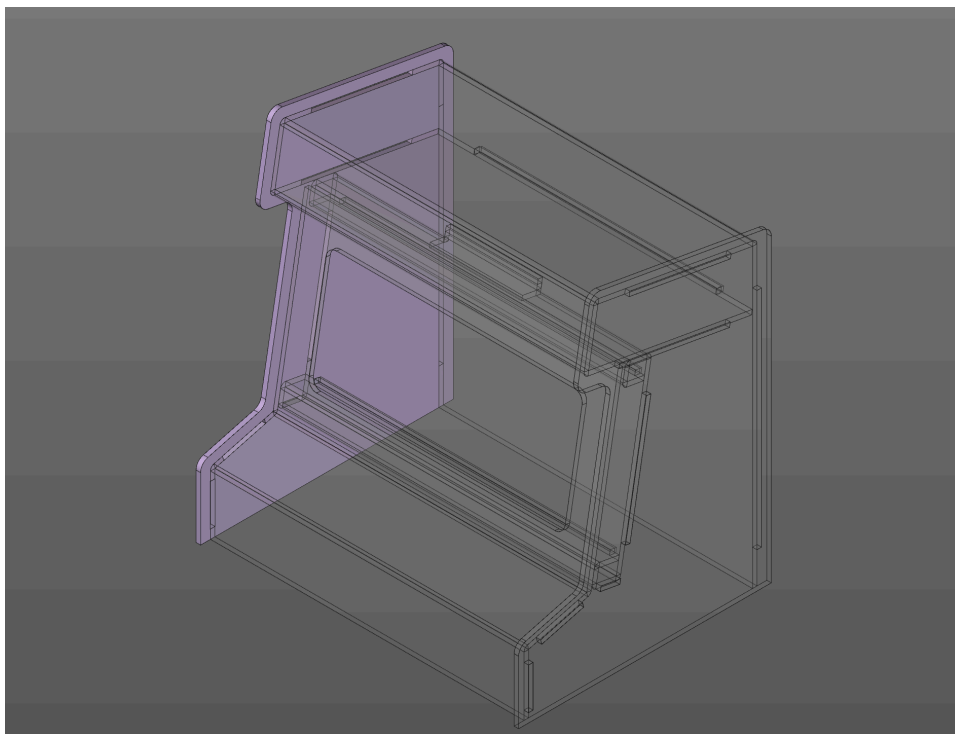
Step 13:



Step 14:



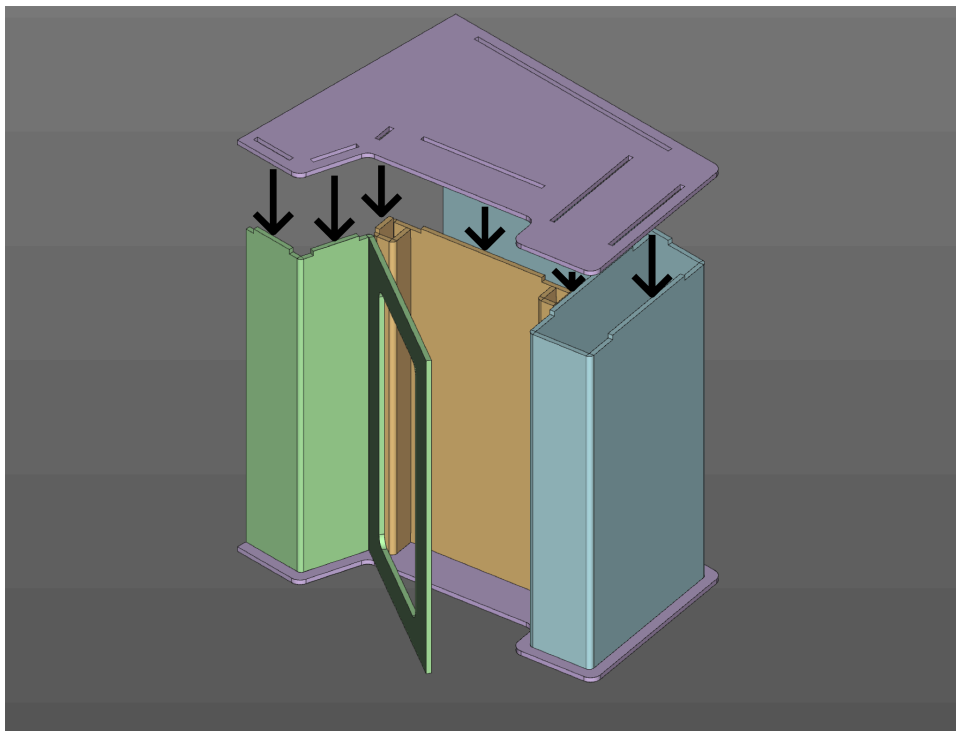
Left Side:



Part:



Step 15:



Finished Assembly!

