

How to 3D print a dental splint

Netfabb Tutorial
for SolFlex 150|170|350|650

This short tutorial seeks to offer basic information concerning the 3D CAD software Netfabb in regards to printing dental splints on SolFlex 3D printers. After completing the tutorial, you should be able to successfully print your first dental splint and have a good impression of the digital workflow with Netfabb.

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This tutorial was created using Autodesk Netfabb 2017 Premium on Windows, other Versions might behave slightly different.

Used stl-file: *Splint_Base.stl*

All Settings shown are referring to our SolFlex 350 printer. Settings for all other printers can be found in the appendix.

1. PREPERATION

To start off preparing the print, the W2P machine workspace has to be initialized, using the **Load Machine Workspace** button located at the top-left of the window (Figure 1). After choosing 'W2P SolFlex' from the drop-down menu, a **3D model** of a SolFlex printer should show up in the main view window.

The next point of interest is the so-called **Build Job** tab, where you can find some of Netfabb's main functionality (Figure 2).

1.1. SETTINGS

There, the first thing to do is to adjust your **Machine Settings**. This is done by clicking the **Settings** button on the **Build Job** menu to open a small window called **Machine Settings** (Figure 3), where you can adjust the general settings of your build job.

- For **Machine Type** select the printer that you are going to use for the print.
- The **Layer Thickness** determines the level of detail of the print. For dental applications, a layer thickness of **50 µm** is recommended.
- The **Support Wall Thickness** determines the strength of the support structures. For smaller prints a thickness of **200 µm** is recommended.
- For the **Export Type** option select **PNG image export**.
- In terms of Material it is important to select **the exact** material you will be using for the print. For this application, **SolFlex Ortho** is recommended.

Once you are done, hit the **OK** button to continue.

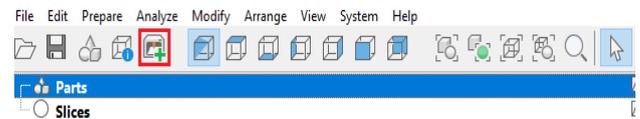


Figure 1: Load Machine Workspace

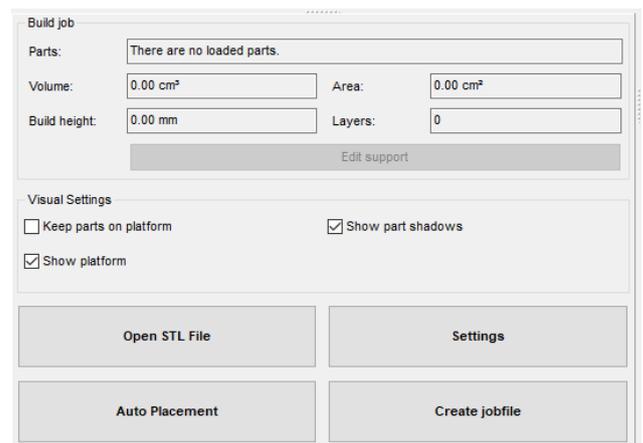


Figure 2: Build Job Menu

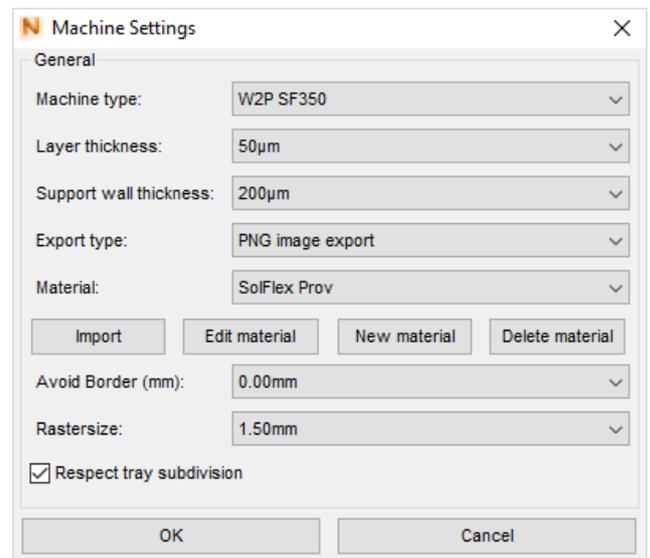


Figure 3: Machine Settings

1.2. IMPORT A STL FILE

The object to be printed will be stored as a **STL file** and needs to be imported into Netfabb, which can be done in two main ways:

- **Drag and Drop:** Simply drag and drop your STL file from the file-explorer into the Netfabb-window.
- **Opening via File-Explorer:** Hit the **Open STL File** button and open the file through Windows Explorer (Figure 4).

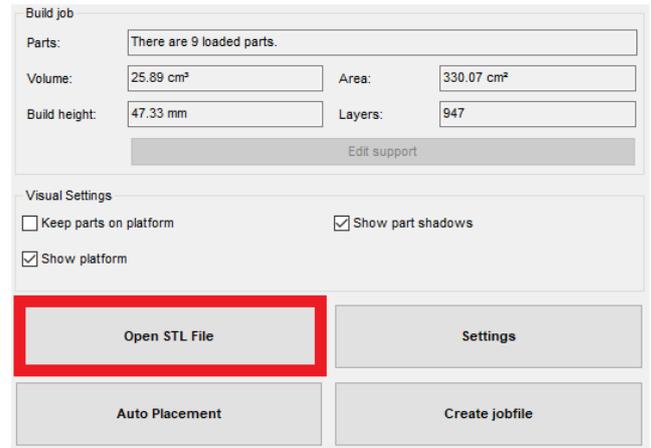


Figure 4: Open STL File

2. OBJECT ORIENTATION

Now that the object is imported into Netfabb it needs to be positioned carefully to ensure correct printing.

2.1. NAVIGATE IN NETFABB

On the top-left of the screen, Netfabb’s **view options** can be found (Figure 5). These consist of one isometric and six directional view options which control the **viewing angle**. Use these options when positioning the object.



Figure 5: View Options



When using one of the six **directional view options**, you can only move the object in two dimensions. This can be extremely useful if an object needs to be reallocated while keeping the same distance from the building platform.

2.2. ROTATE PARTS (X/Y LAYER)

First select **top view** mode from the **view options** menu. Then proceed to left-click the splint to select it. Now you can rotate it by left-clicking and dragging on one of the corners. Rotate the part as shown in **Figure 6**.

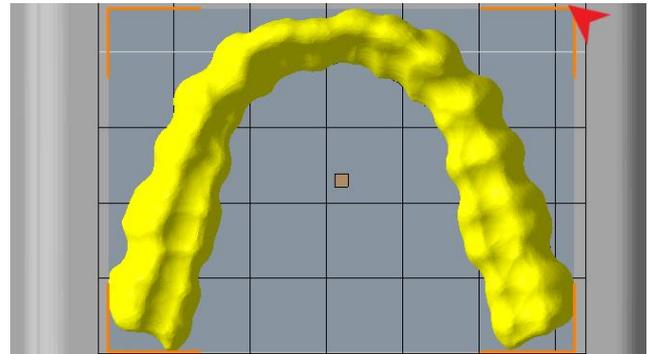


Figure 6: Rotate on the x/y Layer

2.3. FIX PARTS TO THE PLATFORM

For the next step, it is convenient to fix the object to the building platform. This can be achieved by checking the **Keep Parts on Platform** option in the **Visual Settings** tab located on the left-hand side of your screen (Figure 7).



Figure 7: Keep Parts on Platform



Figure 8: Rotate Parts

2.4. ROTATE PARTS (Y/Z LAYER)

Click the **Rotate Parts** button on the top-centre of your screen (Figure 8). This will open up a window labelled **Rotate Parts**.

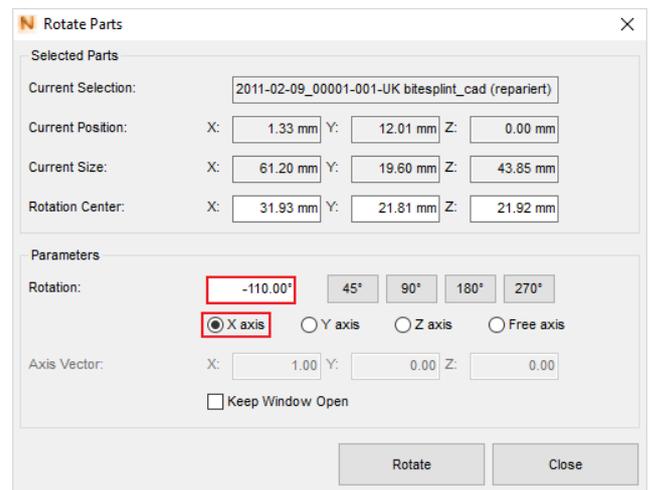


Figure 9: Rotate Parts - Settings

Now select the **x-axis** and set the rotation-parameter to about **-110°**. Then simply hit the **Rotate** button (Figure 9).

Your part should now look similar to the one shown in **Figure 10**.

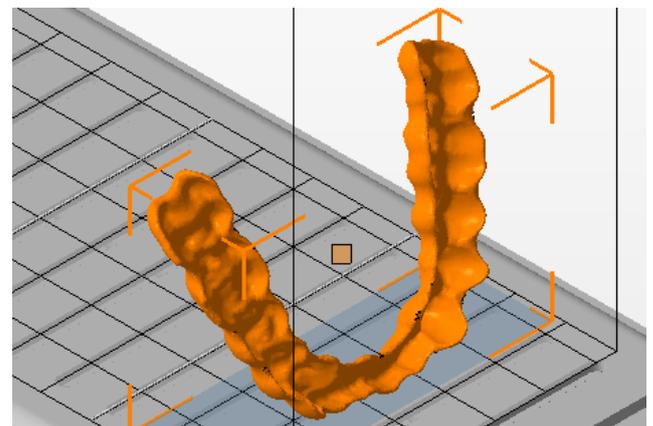


Figure 10: Correctly Oriented Splint

2.5. RAISE PARTS OFF THE PLATFORM

To improve printing results, the splint should **not** be printed directly on the building platform, but rather be elevated a few millimetres.

First navigate to the **Visual Settings** tab and uncheck **Keep parts on platform**. This step is crucial, as the next step will not be possible otherwise.

Now hit the **Move Parts** button located on the top-centre of your screen (Figure 11).

This will result in a window opening up labelled **Move Parts**. Set the **Z-Translation** value to 5mm and hit the **Translate** button (Figure 12).

3. SUPPORT STRUCTURES

Now that the splint is positioned properly you can proceed to adding **support structures**.

First click the **Edit Support** button on the **Build job** tab (Figure 13).

Now navigate to the **Run Support Script** which is located at the bottom-left of your screen (Figure 14).

Clicking it will result in a window opening up labelled **Choose Support Sscript** (Figure 15). Select a script suitable for splints and hit **Execute**.



Figure 11: Move Parts

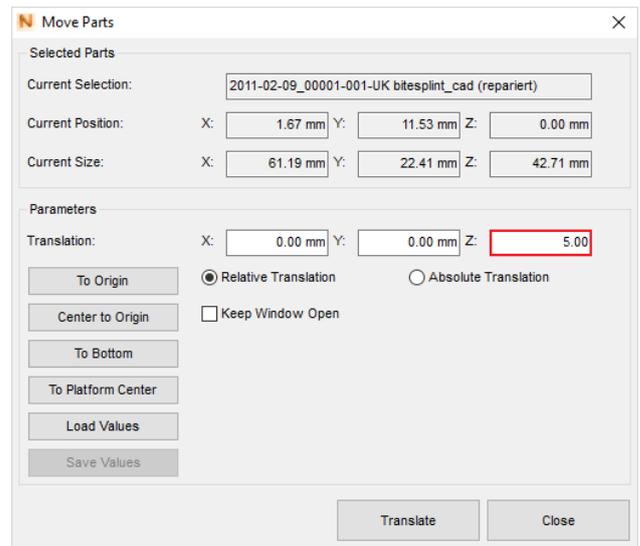


Figure 12: Move Parts

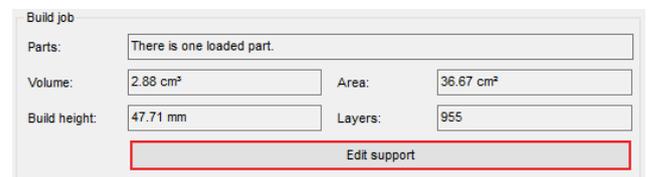


Figure 13: Edit Support



Figure 14: Run Support Script

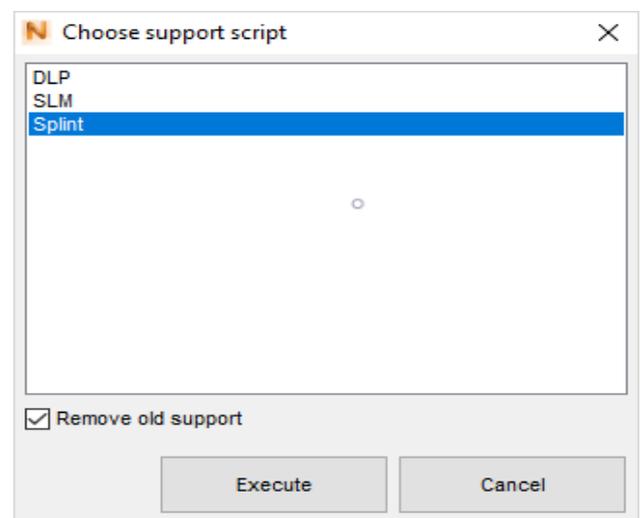


Figure 15: Choose Support Script

With the newly added support your part should now look something like the one shown in **Figure 16**.

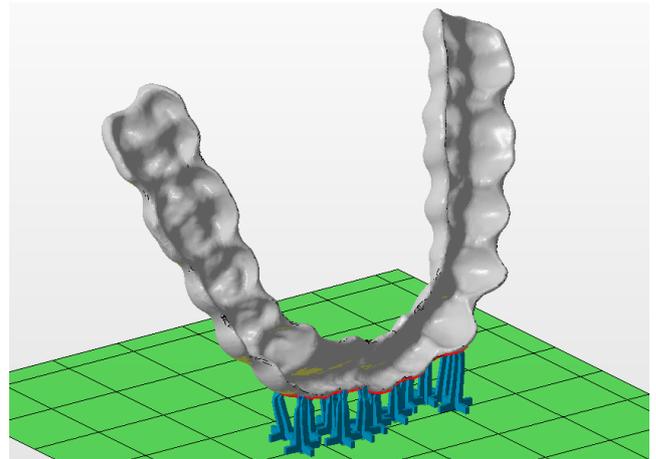


Figure 16: Support Structures

To end the process simply hit the **Apply support** button located at the bottom-left of the screen (Figure 17).



Figure 17: Apply Support

4. DUPLICATE PARTS

This step is optional. If you only need a single part skip this, but if you want to get as much out of one print as possible, duplicating it is highly recommended.

To duplicate the splint, first **right-click** the part, then navigate down to **Duplicate** (Figure 18). This will open up a window labelled **Duplicate Parts**.

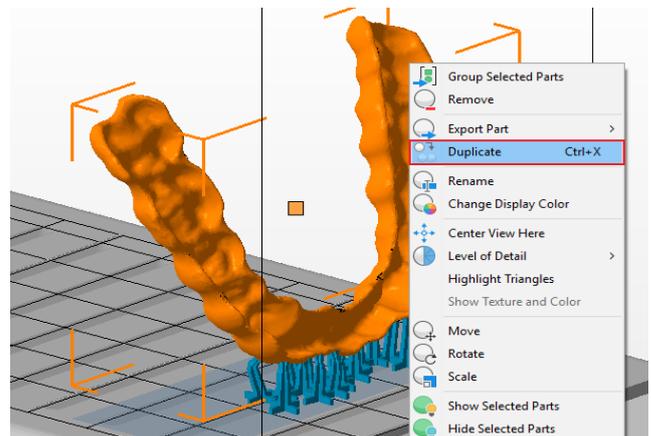


Figure 18: Duplicate

Now you set the **Total Count** of duplicates. Note that this number may vary depending on the **model** and the **printer** you are using. In this case however 9 is the perfect number of duplicates (see appendix for other printers).

Then navigate down to the **Placement** tab and make sure only to check the **Y** option. This will result in the duplicates being placed in a nice line.

After you are done simply hit **Duplicate** (Figure 19).

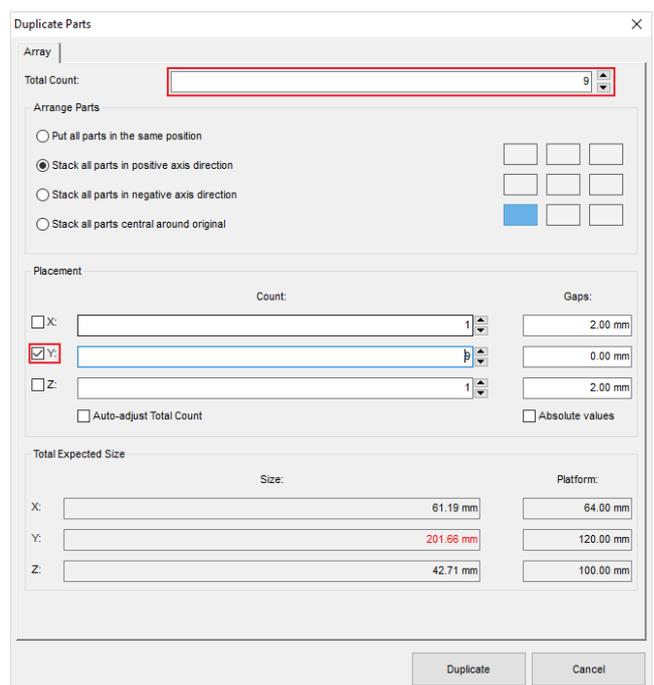


Figure 19: Duplicate Parts

4.1. ADJUST PART ALIGNMENT

After the duplication process your building platform should look close to the one shown in **Figure 20**.

As you can see not all of the parts are on the building platform, which is indicated by them being **colored red**.

In order to fit all the parts, you will need to adjust their positions and move them as close together as possible.

For repositioning the splints, using the **directional view options** is highly recommended. Especially the **top view** option should be used for this application (Figure 21).

After carefully moving the parts closer together your building platform should now look like the one shown in **Figure 22**.

Make sure to also check the platform from the side using either the **left** or **right view** option to see if any of the parts are touching (Figure 23 and 24).

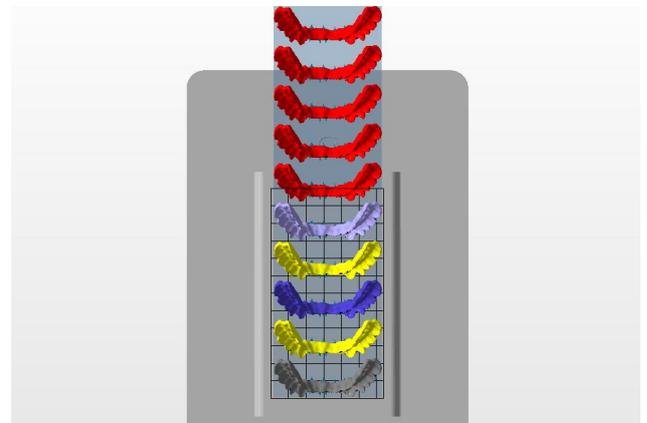


Figure 20: Duplicated Parts



Figure 21: Top View

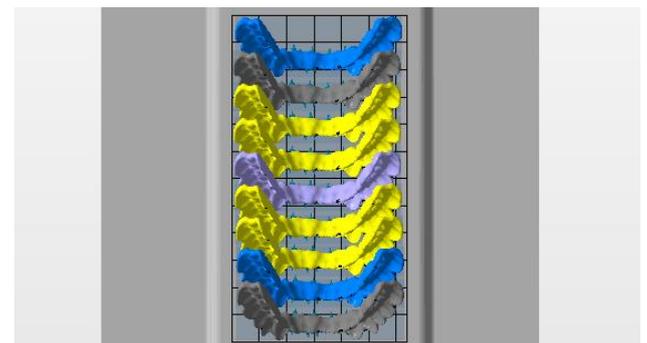


Figure 22: Adjusted Parts



Figure 23: Left View

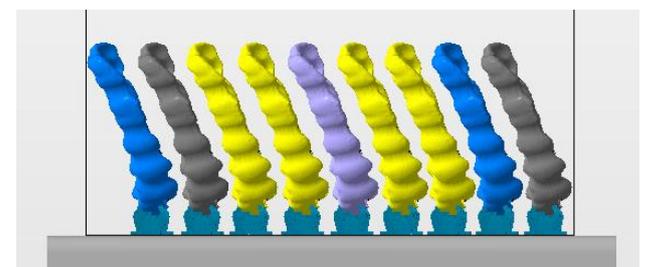


Figure 24: Adjusted parts (Left View)

4.2.ADD A SUPPORT GRID

To ensure that all the parts are stable and fixed to the platform adding a **support grid** is recommended.

If you already have a STL file of a support grid you can simply import it into your Netfabb project as described in 1.2. **Import a STL file** and ignore the following steps.

Otherwise you can create one yourself. To do so, first navigate to the **Part Library** button located on the top-left of your screen (Figure 25). Then enter the **Technical** tab and select the **Hexagonal Grid** (Figure 26).

Now you will be greeted with a **preview** of the grid and a **Settings** tab. Simply adopt the settings from **Figure 27**. Note that the **the number of holes** necessary in x- and y-direction may vary depending on the printer you are using (settings for other printers can be found in the appendix).

To then bring the grid to your project simply hit the **Create Part** button (Figure 28).

After successfully adding a hexagonal grid your building platform should look similar to the one shown in **Figure 29**.



Figure 25: Part Library



Figure 26: Hexagonal Grid

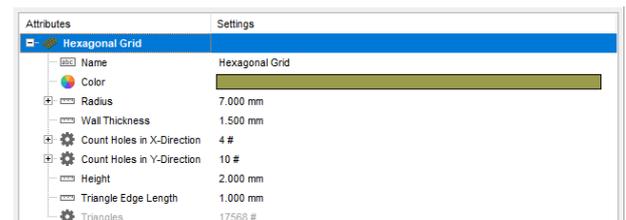


Figure 27: Grid Settings



Figure 28: Create Grid

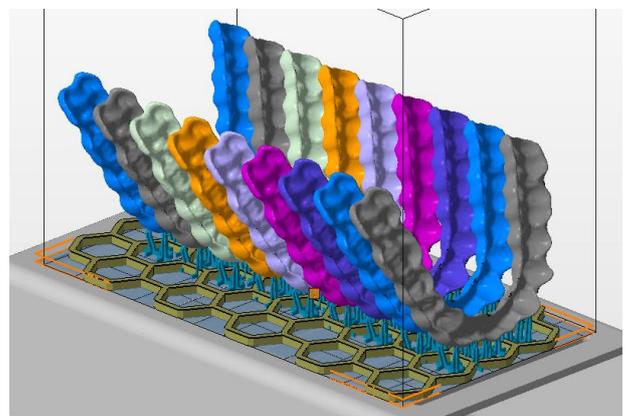


Figure 29: Splints with Support Grid

5. CREATE A JOBFILE

The last step before you can finally print the parts is to create a **Jobfile**. To do so, navigate to the bottom-left of your screen and hit the **Create Jobfile** button (Figure 30).



Figure 30: Create Jobfile

This will result in an **explorer-window** opening up. Here you can choose a location where you want to save the file and name it.



To make handling a lot of jobfiles easier, it is recommended to use a naming scheme like this:

'PrinterModel_LayerThickness_SupportThickness_Material_Description'

Now your jobfile is being created. Note that this process may take up to several minutes depending on the **amount** and **size** of the parts and your computer's **CPU** (Figure 31).

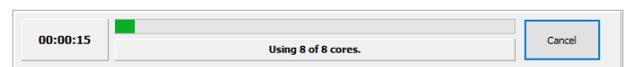


Figure 31: Process of Creating the Jobfile

After the jobfile has rendered, you are done and can simply select it on your **SolFlex 3D printer** either from a **USB flash drive** or a **network connection**.

REFERENCE FILES

Netfabb project: Splint_Base.fabbproject

Jobfile: 350_50_200_SolflexOrtho_SplintBase.zip

6. APPENDIX

SolFlex 650

In total, the SolFlex 650 printer can print 18 splints using settings shown in figure 32. Parts in two rows can be arranged simultaneously by selecting both of them using the CTRL key.

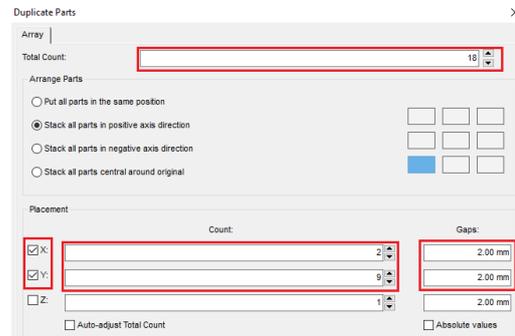


Figure 32: Duplicate 650

The correct grid settings shown are shown in figure 33.

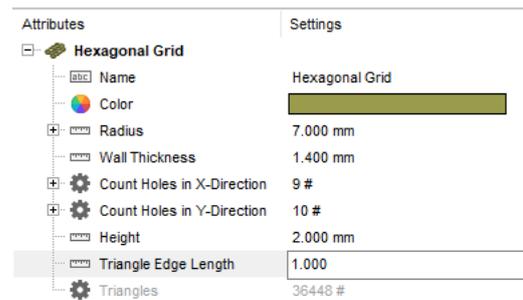


Figure 33: Grid Settings 650

SolFlex 150

In total the SolFlex 150 printer can fit 2 parts as shown in figure 34.

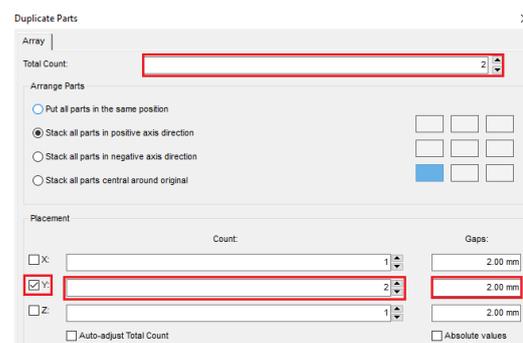


Figure 34: Duplicate 150

Correct grid settings are shown in figure 35.

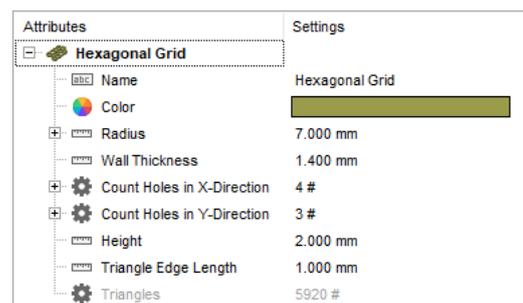


Figure 35: Grid Settings 150

SolFlex 170

In total the SolFlex 170 printer can fit 4 parts in an alternating manner as shown in figure 36 and 37.

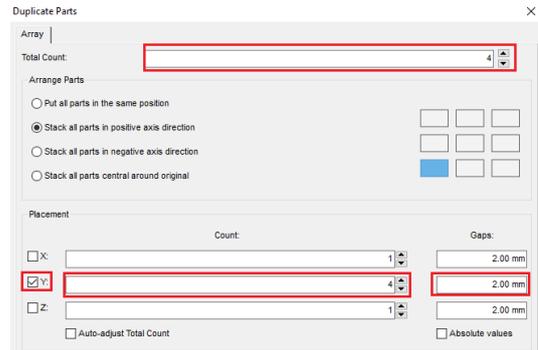


Figure 36: Duplicate 170

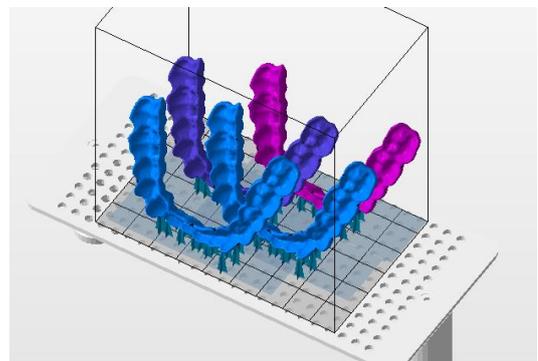


Figure 37: 170 Splint Arrangement

Correct grid settings are shown in figure 38.

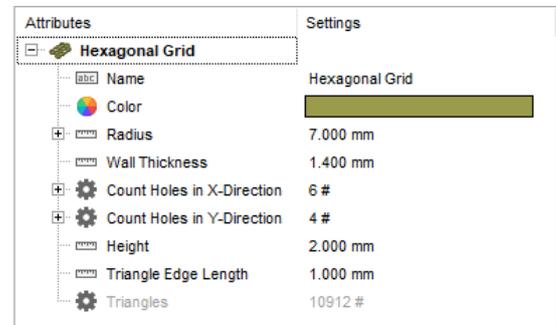


Figure 38: Grid Settings 170