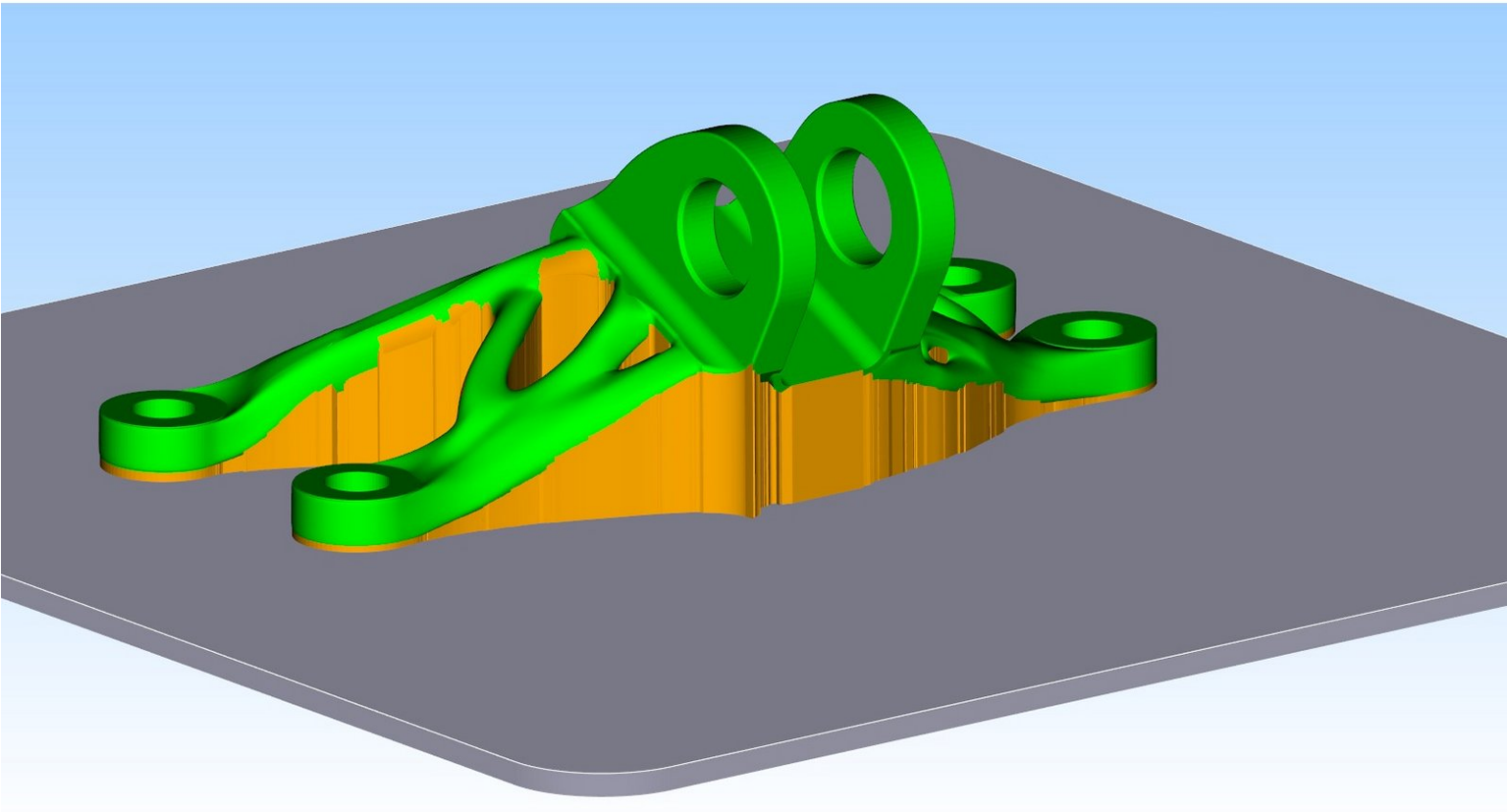




DMP ProX Manufacturing Software Usage

This guide details the process used for slicing parts in the DMP ProX Manufacturing Software

Written By: Peter Mnev



Introduction

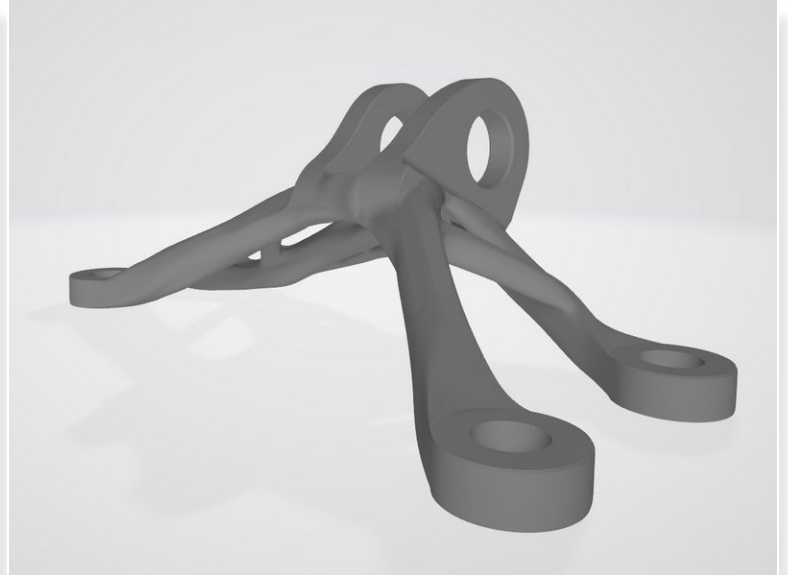
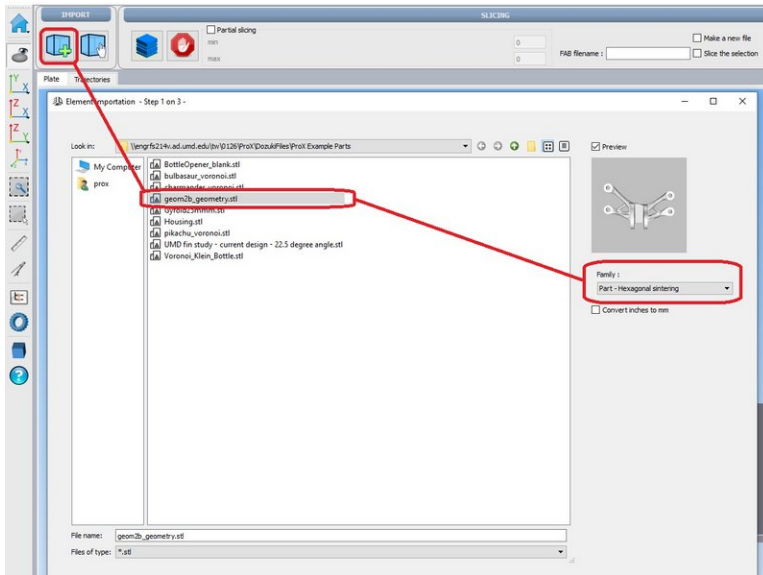
This is a step by step guide to go from a customer provided STL file to a FAB3 File that is ready to be printed on the ProX 200. Throughout the process it is important to note the special considerations that must be made for metal 3D printing. See the [3DSystems Direct Metal Printing](#) guide for a great introduction and some background.

The figure illustrates the installation process for DMP ProX Manufacturing. It includes three screenshots: the Windows Start menu showing the application, the 'Choose your machine' dialog box with the 'ProX™ 200' selected, and the application window displaying a table of machine specifications.

Filename	Hardware	Version	Comments
Installation_Rs_ProX™_PLA_Plan.docx	ProX™ 200	17-4-PLA_Plan	1800 1800000 1800 18 18 18
50082721_P5454S_ProX-200.db	17-4-PLA_Plan	jun 24 2014	Base standard 17-0H4 - VA - IND B
50082751_S12708R_P1AM.db	S12708R_P1AM	ven 10 2014	Base standard S12708R - VA
ProX200_Load.com N425 161 802.db	LoadForm N425	sat 10 24 2015	Specific Pascal 800 Load Base - LoadForm N425
ProX200_P54608R_201.db	P54608R	jun 17 2015	Specific base - S12718 - ProX200 - Hexagonal entree

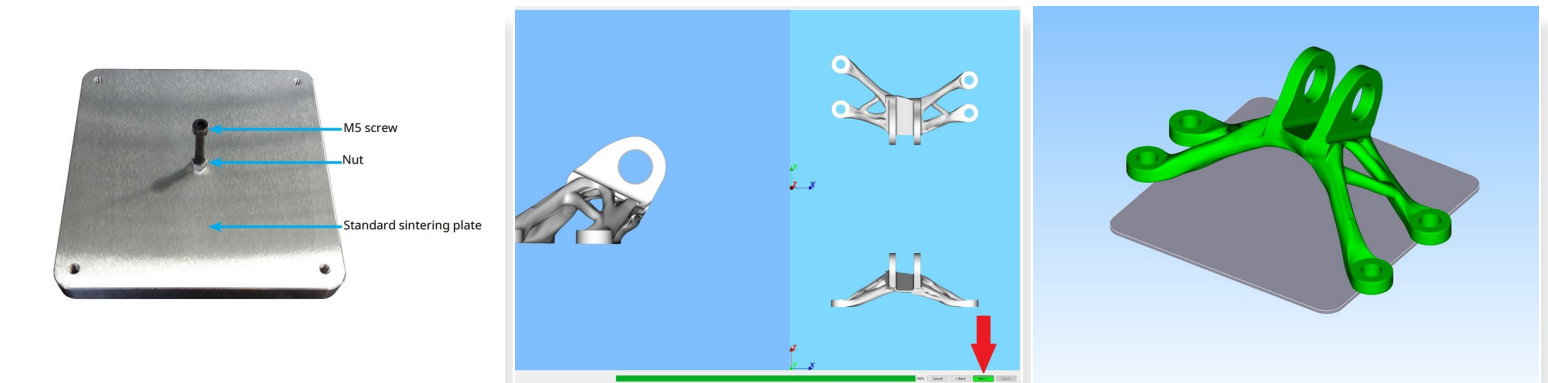
- This document was generated on 2022-07-21 08:15:39 AM (MST).
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- © 2022 dozuki.umd.edu/ Page 3 of 20

Step 2 — Importing a Part



- Click the button with a cube and green plus sign to begin the part import process.
- Select the correct .stl file. (this software can *only* take STL files)
- Select the correct family - with the Inconel profile this will be Part - Hexagonal Sintering
- Once this is done, click next to go to the orientation page.

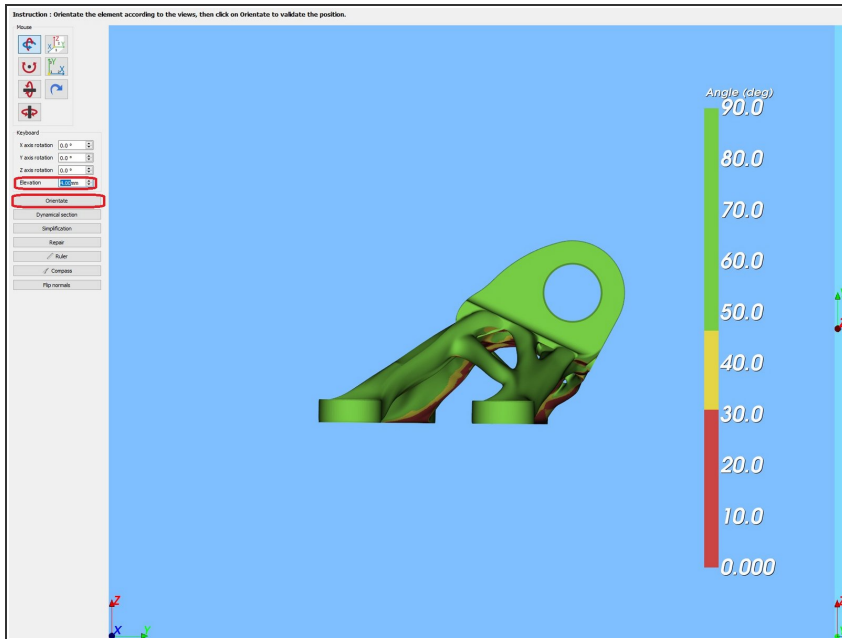
Step 3 — Part Scaling



⚠ Before starting on the orientation and supporting portion of the process, validate that the part is scaled correctly and fits within the bounds of the build plate.

- The build volume of the ProX is 140 x 140 x 100 mm (5.51 x 5.51 x 3.94in) for reference.
- To check this, click next at the bottom of the screen and then import to see how the part would look like if it was placed on the build plate.
- If the part is clearly too large or too small, it will either need to be modified if it is a design problem, or can be resized in a mesh-editing software like meshmixer.

Step 4 — Orientation



- Repeat step 2 to get back to the orientation window.
- Here you can click and drag on the part to orient it. Alternatively use the keyboard to rotate the part or manually adjust the angles on the left hand side menu.
- There are a couple of options available that allow you to lock rotation to only one axis that might be useful in some situations.
- Set the elevation to 4mm.
- To confirm an orientation, click the "Orientate" button on the left.
- Click next to go on to the supporting step.

Warning: It may feel like you are rotating the view when you click and drag on the part, however you are actually rotating the part.

Step 5 — Part Orientation Tips

Orienting the part based on overall quality is mainly based on the downfacing surfaces.

Downfacing surfaces are the worst surfaces with a high roughness of the part. So by decreasing the amount of downfacing area we can say in general that we will increase the quality of that part.

Downfacing surfaces are the surfaces below the self-supporting angle (α).

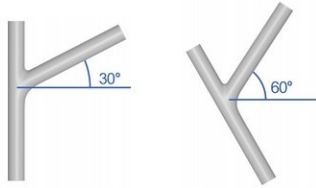
The self-supporting angle depends on material and the printing process

- Ti-alloys $\alpha=40-45^\circ$
- Steel, CoCr, Aluminium-alloys $\alpha=50-55^\circ$

The example below shows an example of this situation.

The left part has a leg that makes an angle with the buildplate of 30° , so this leg has to be supported (because it is below the self-supporting angle)*.

By rotating the same part 30° we see that the leg makes a 60° angle with the buildplate. In this way we don't need to put support in this region increasing the overall quality of that part.



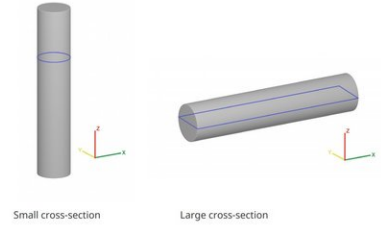
*Metal Printers with a roller system, like ProX DMP 100, 200 and 300 can reach angles for Ti as low as 30°


Part Orientation Thermal stresses

When orientating the parts we want to keep the thermal stresses as low as possible.

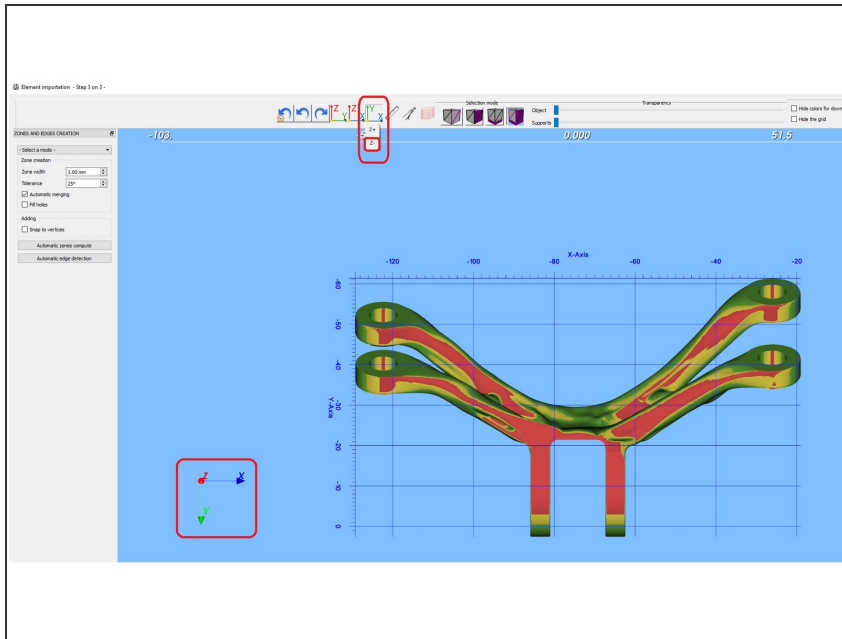
These thermal stresses are created by first heating locally the powder and a rapid cooling after melting the powder. One way to keep the stresses as low as possible is to keep the cross-sections (so what is actually scanned every layer) as small as possible.

In the picture on the right: The left orientation has the smallest cross-section and the thermal stresses would be reduced to a minimum. The orientation on the right can be printed but a very rigid support structure is necessary to keep the part in place.



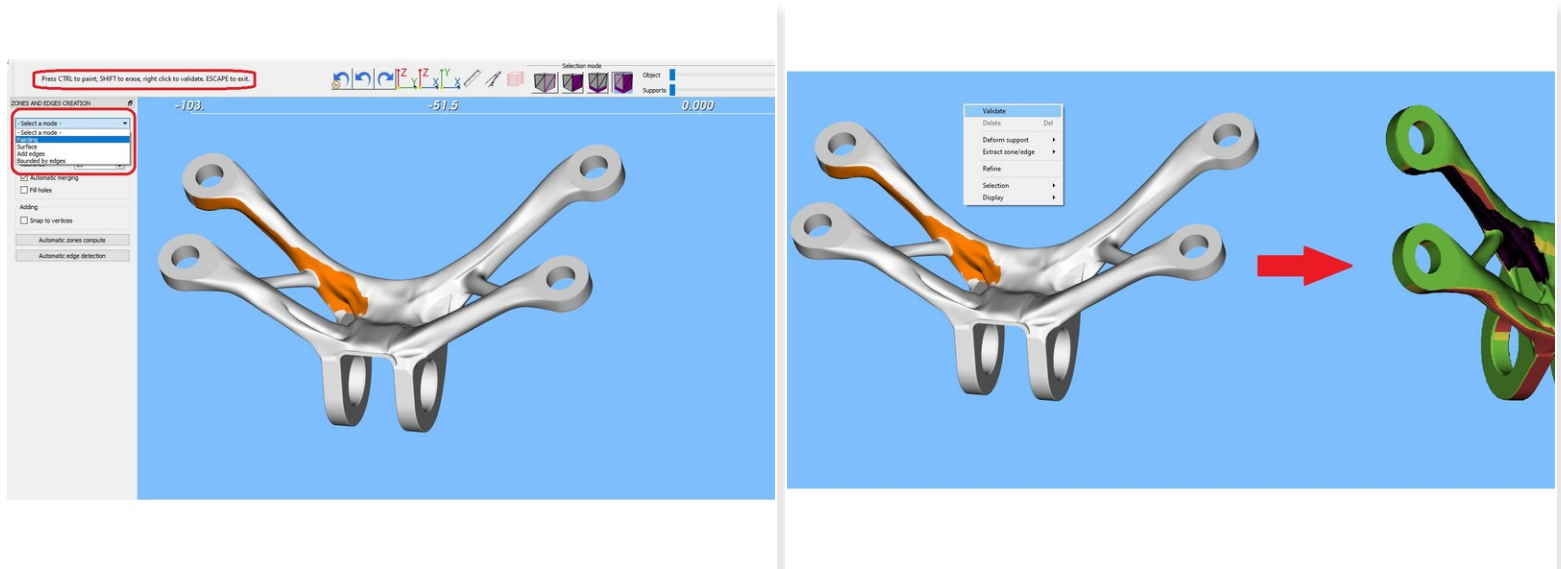
 To better understand how to orient parts optimally, ready this document: [3DSystems DirectMetalPrinting Guide](#)

Step 6 — Introduction to Supports



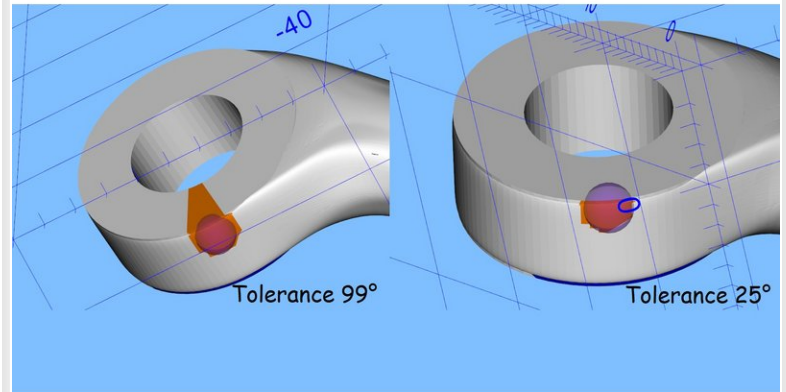
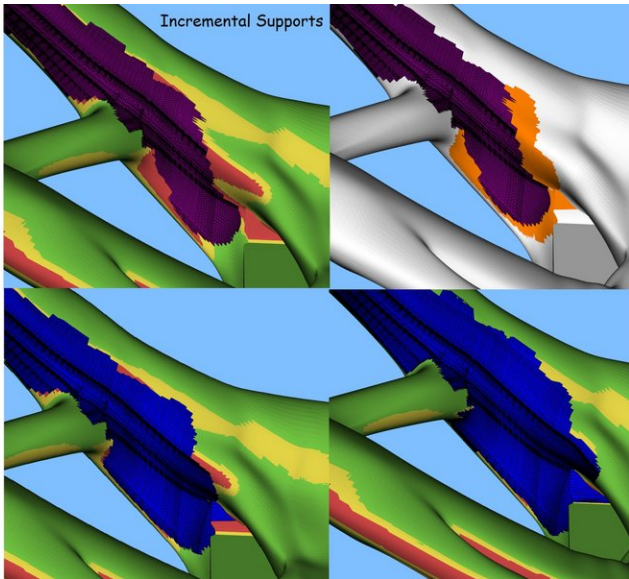
- Supporting the part is the most complicated part of slicing for the ProX and must be done carefully to ensure the part comes out well.
 - It is also important to take care to not add too many supports as they are difficult to remove.
 - It might be useful to orient the view to see the part from the bottom. Select the Y-X plane and the Z-direction in the top menu.
 - Areas colored red will need to be supported (30 degrees from the horizontal or lower).
 - Do supports in separate individual steps if you suspect support deformation is necessary.
- ⚠ Portions that are the lowest point of the part (i.e. touching the build plate) still need to be supported as the support acts as a spacer between the part and build plate in the 4mm gap between them.**

Step 7 — Support (Painting Mode)



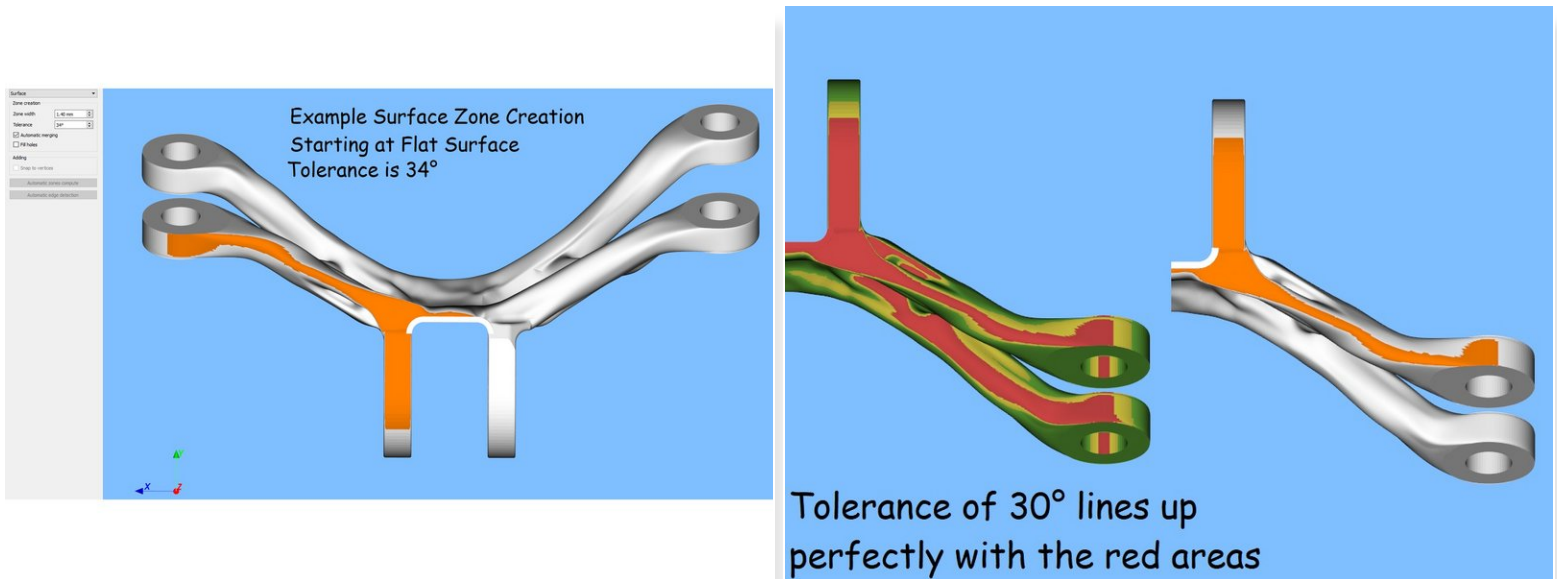
- Painting mode is useful for creating supports on complex surfaces.
- To use painting mode select 'painting' from the <select a mode> drop down on the left.
- Ctrl click to begin painting a **zone**.
- Zones will be the areas that get supported.
- Once you are satisfied with your zone, right click and click validate.

Step 8 — Painting Support Tips



- Since the shading of the part disappears when going into the zone creation modes, you need to use an incremental approach to adding supports.
- If the zones are touching, they will automatically be merged into one.
- Ctrl-z does work in the support window but may need to be done multiple times if combining zones.
- Adjust zone width to make grabbing larger or smaller areas easier
- Tolerance affects how surface gradation is handled

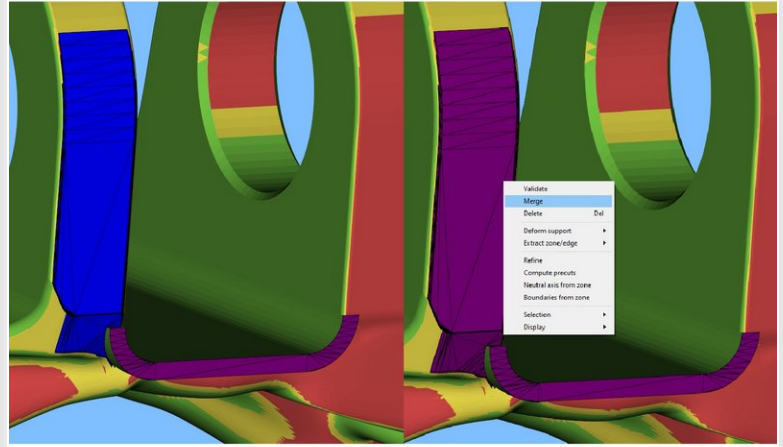
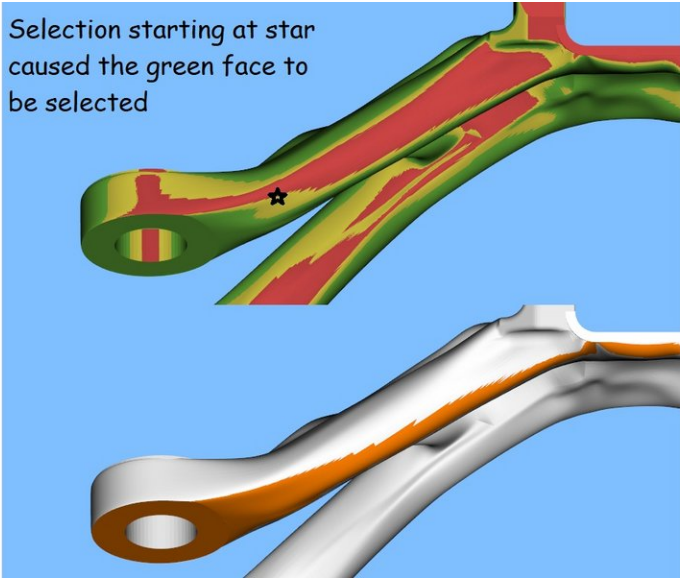
Step 9 — Support (Surface Mode)



- Surface mode is good if you have one large flat area that doesn't have much variation.
- The surface tools works by selecting all surfaces that are at most <tolerance> degrees away from the surface you **left** clicked.
- This can give some very predictable behavior if you click on a surface parallel to the horizontal X-Y plane. If you set the angle to 30 degrees you will select every face that is 30 degrees from the horizontal plane or lower.
- Hold ctrl and left click on different surfaces to select multiple surfaces.

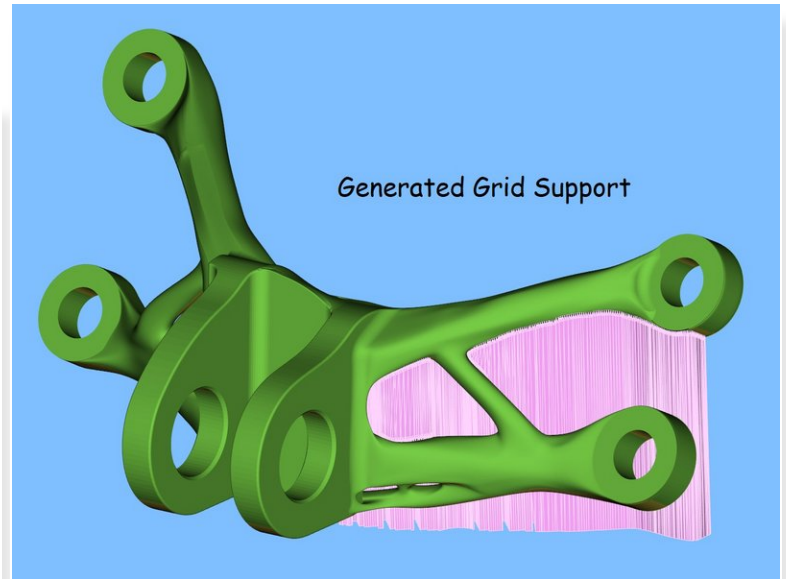
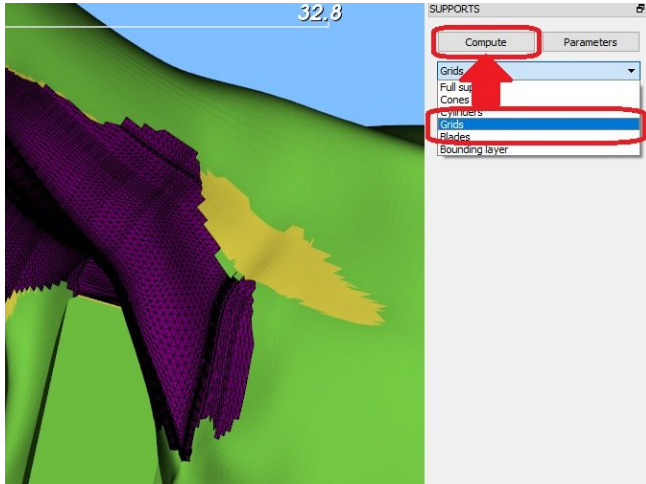
Step 10 — Surface Support Tips

Selection starting at star
caused the green face to
be selected



- Clicking on surfaces that are not parallel to the horizontal as a starting point with high tolerance may lead to poor selections.
- If you want, you can merge zones into one at any point even if they are not touching by left clicking both to turn them purple and then right clicking one and selecting 'merge'. This can be convenient in some situations.

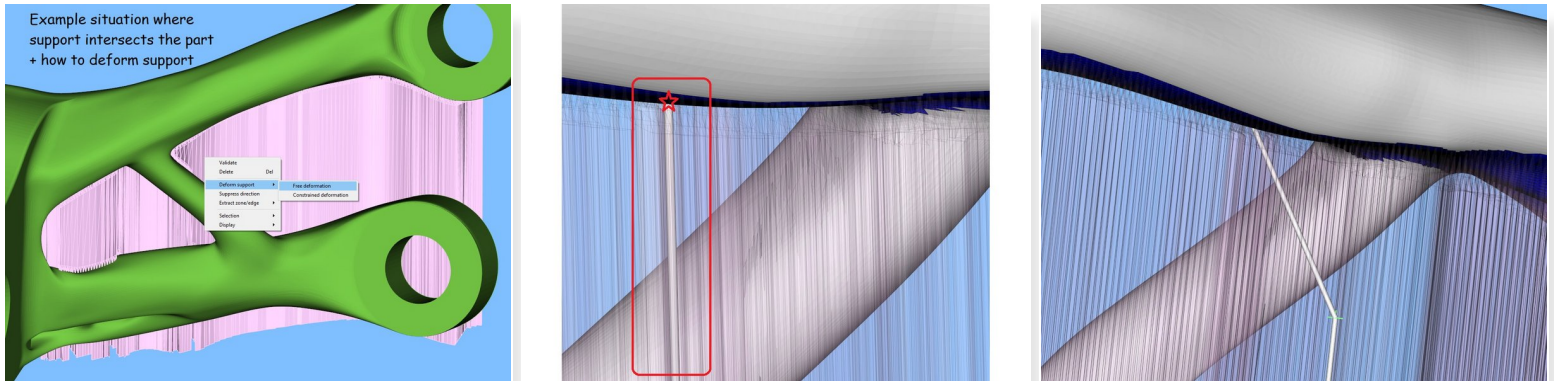
Step 11 — Support (All Modes)



- To complete your support, select the zone of interest so it turns purple.
- Select Grid support from the drop down menu on the right (this is the type of support that we use all the time)
- Click Compute.

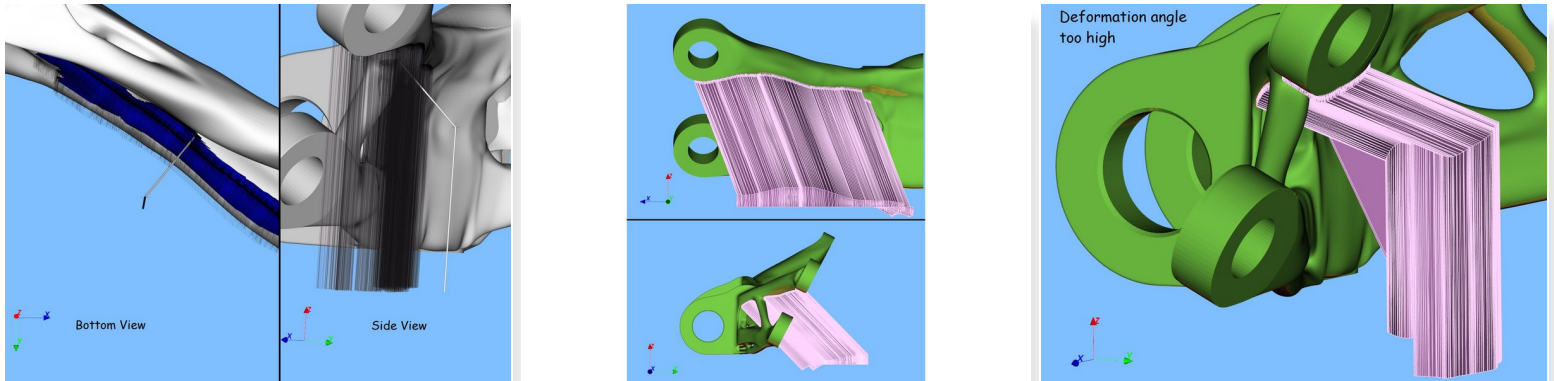
⚠ Wait for the support to be generated. If this is taking too long or the software freezes, consider making the zone smaller.

Step 12 — Support Deformation



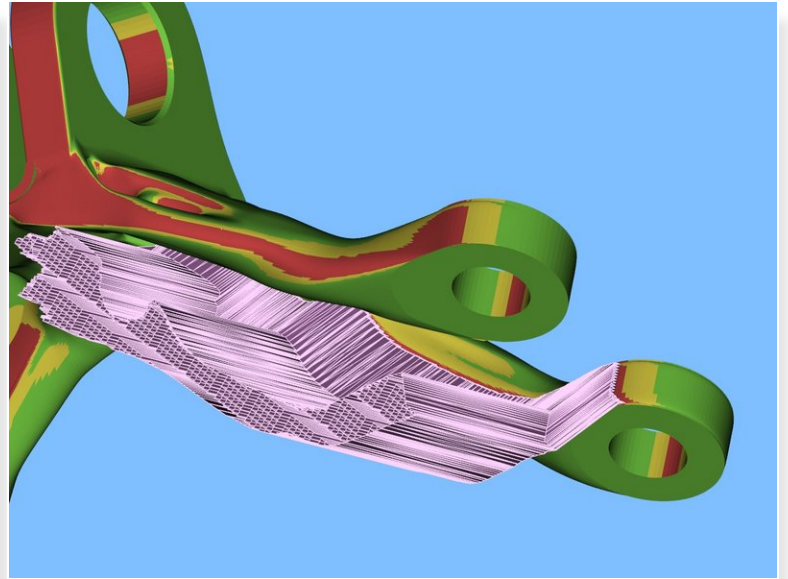
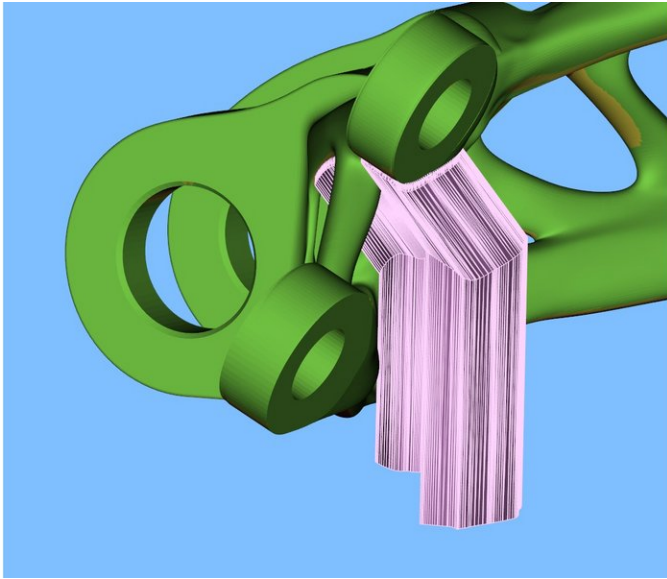
- In situations where the surface quality needs to be maximized or support would be difficult to remove due to it touching another portion of the part, support deformation may be employed to move the support out of the way.
- Select a support (it becomes brighter), right click it, mouse over 'Deform support' and select 'Free deformation'
- Once in deformation mode, the support will become transparent and a thin grey column will appear at some point in the midst of the support.
- Mouse over near the top of the column until the mouse changes from a pointer to a hand.
- Grab the top of the column and move it in some direction away from the part if it is hidden.

Step 13 — Support Deformation



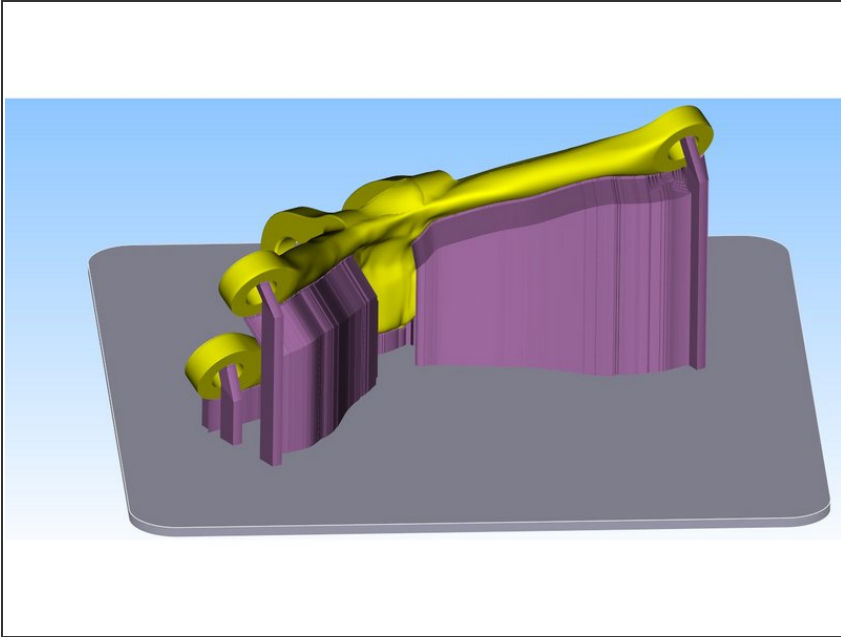
- The way that you move this cross-hair will affect how the support is deformed.
- To guess what will happen when you validate the deformation, imagine it as if every vertical support line will follow the same trajectory as the column shows.
- Generally you would want to move the crosshair so that it is above flat ground and not above the part.
- Do not move the crosshair vertically too much as you want to minimize the amount of angled support.
- Do not move the crosshair too far horizontally as that may result in unstable support. One way to notice this is if fins appear under the supports.

Step 14 — Support Deformation



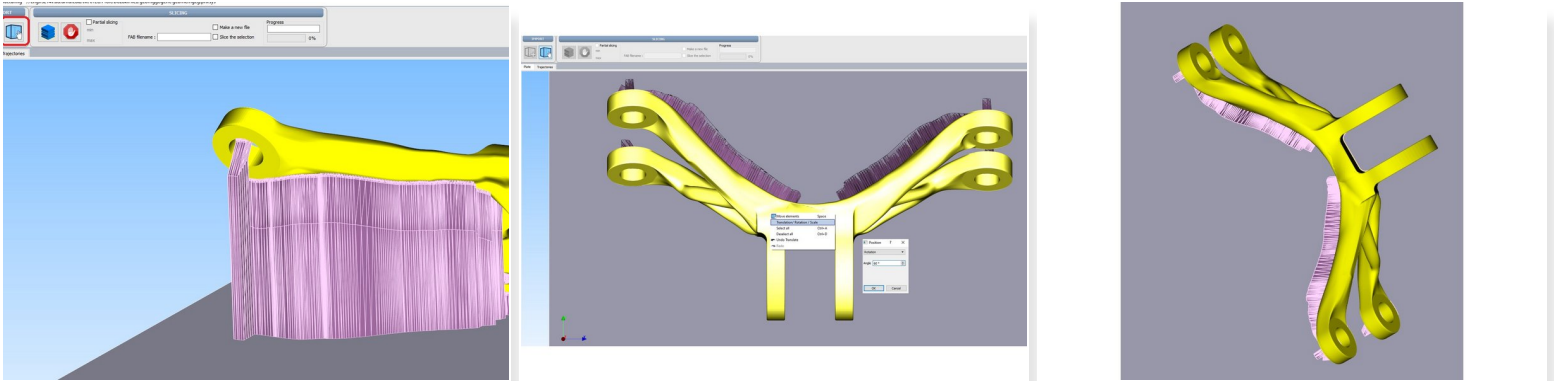
- Example of a good deformed support
- Does not intersect part, no fins, no overhangs.
- If deforming an entire support is problematic, break it into sub-sections by building the support in several steps.

Step 15 — Support Conclusion



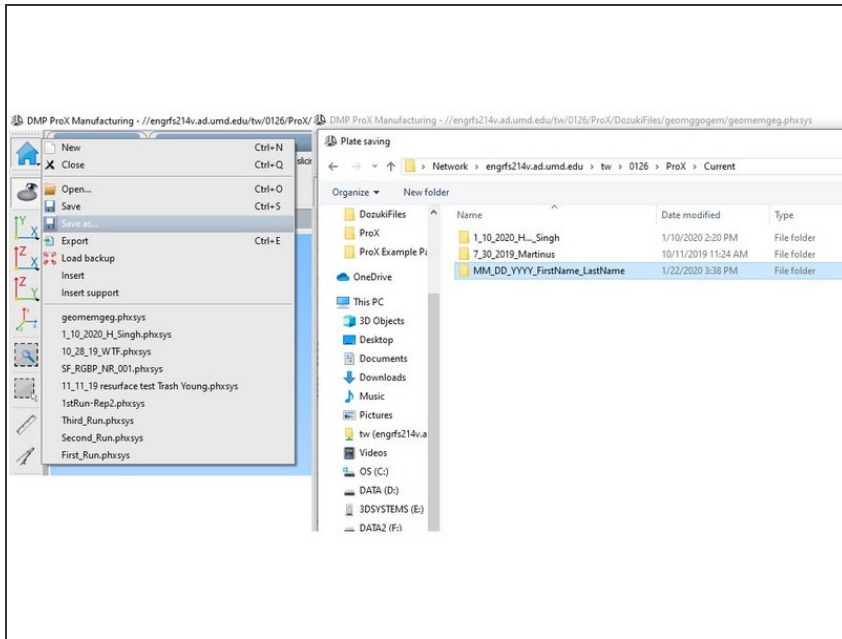
- This is an example of a fully supported part.
- Once you are ready for the next step, click import on the bottom right.

Step 16 — Part Orientation on Build Plate



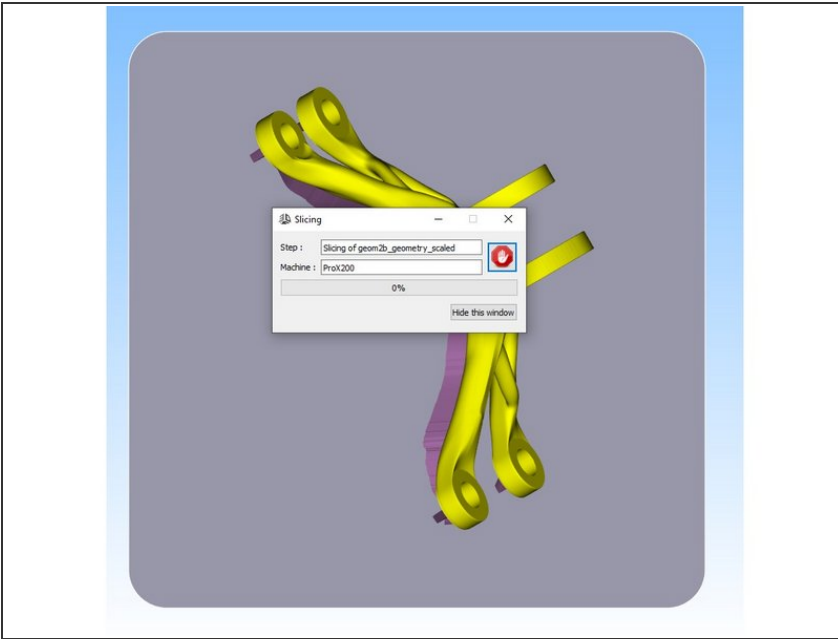
- Select the Cube with a hand in the top left to enter support mode.
- Select the part by left clicking on it. Right click on the part. Select Translation Rotation Scale.
- Select Rotation from drop down menu and set the angle to an appropriate amount.
- The goal is to orient the part in such a way that the roller would not catch on a flat face (on approach, it comes onto only a small portion of the part like a corner)
- See the third picture for an example of an orientation of the part that would not result in the roller catching on it.

Step 17 — Saving the part



- Before proceeding to slicing (which may crash), please save the part by clicking the home icon and then save as. This will save a physx file - the file that describes the model with supports and location on the build plate.
- Navigate to `\\engrfs214v.ad.umd.edu\tw\0126\ProX\Current`
- Create a new folder with the format as shown (MM_DD_YYYY_FirstName_LastName)
- Enter the folder, name the file with a descriptive name (what is the print?) and hit save.
- Copy the filepath for this folder so that you can use it in the next step.

Step 18 — Slicing



- To run the slicing process, click the blue stack in the top panel on the left.
- You will be prompted to save the part (this time as a FAB3 file), use the address you copied in step 17 to get to the right folder quickly.