



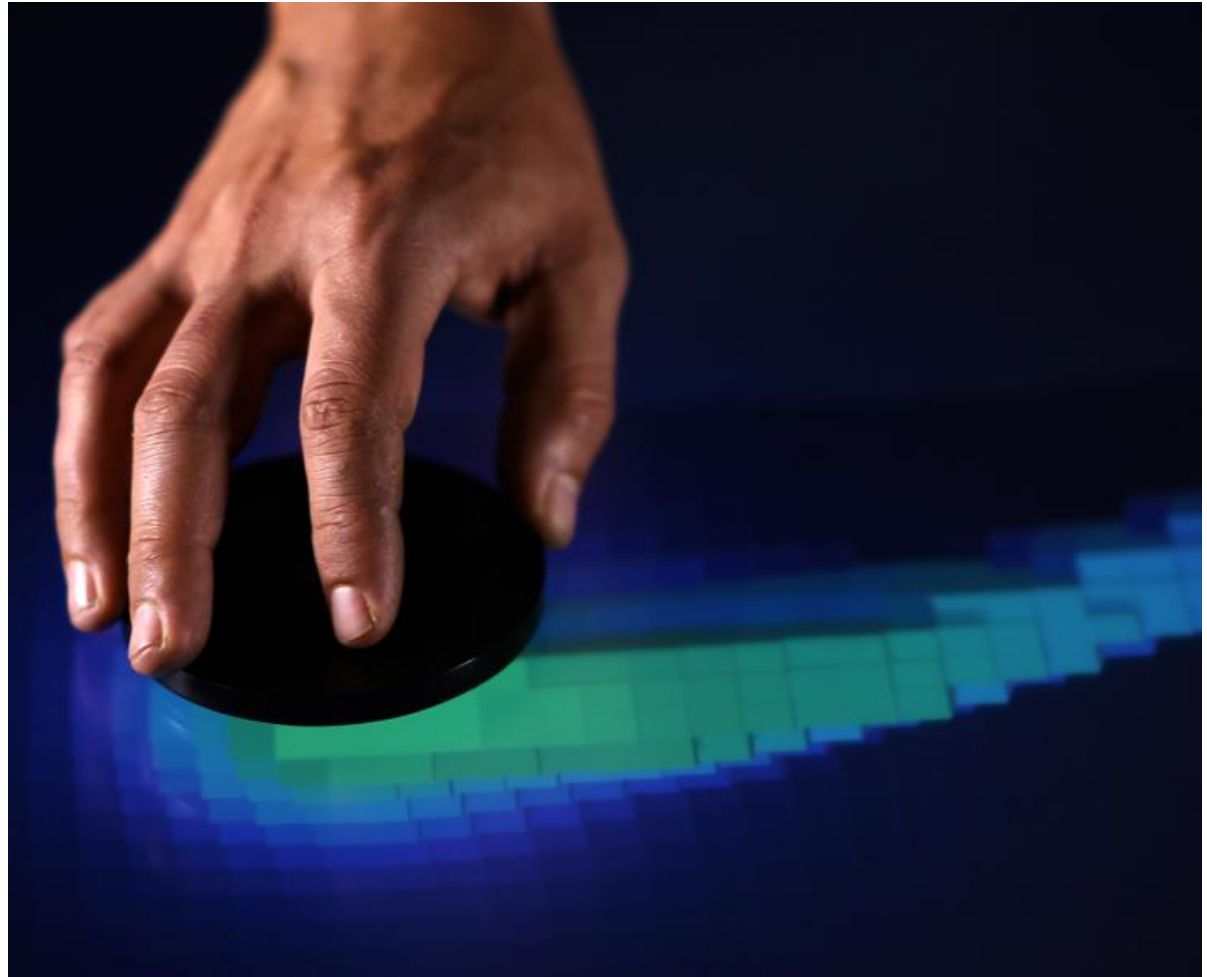
Tangible 3D Printing

User Guide v2.01

Need Help?

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About

Tangible Engine allows users to take advantage of specially engineered physical objects that can be recognized by Ideum touch-enabled products. These objects, often called *tangibles*, are made of conductive material that mimics fingertip touches on the surface of a projected-capacitive (or p-cap) display.

Tangible Engine ships with a set of tangible objects. This document includes instructions for 3D-printing your own objects, including 3D print-ready files and a list of conductive printing materials.

For more information regarding your Ideum Touch Display model, please refer to your Specifications Sheet (provided separately).

Ideum assumes no liability for the performance of tangibles not purchased directly from Ideum or the results of their use.

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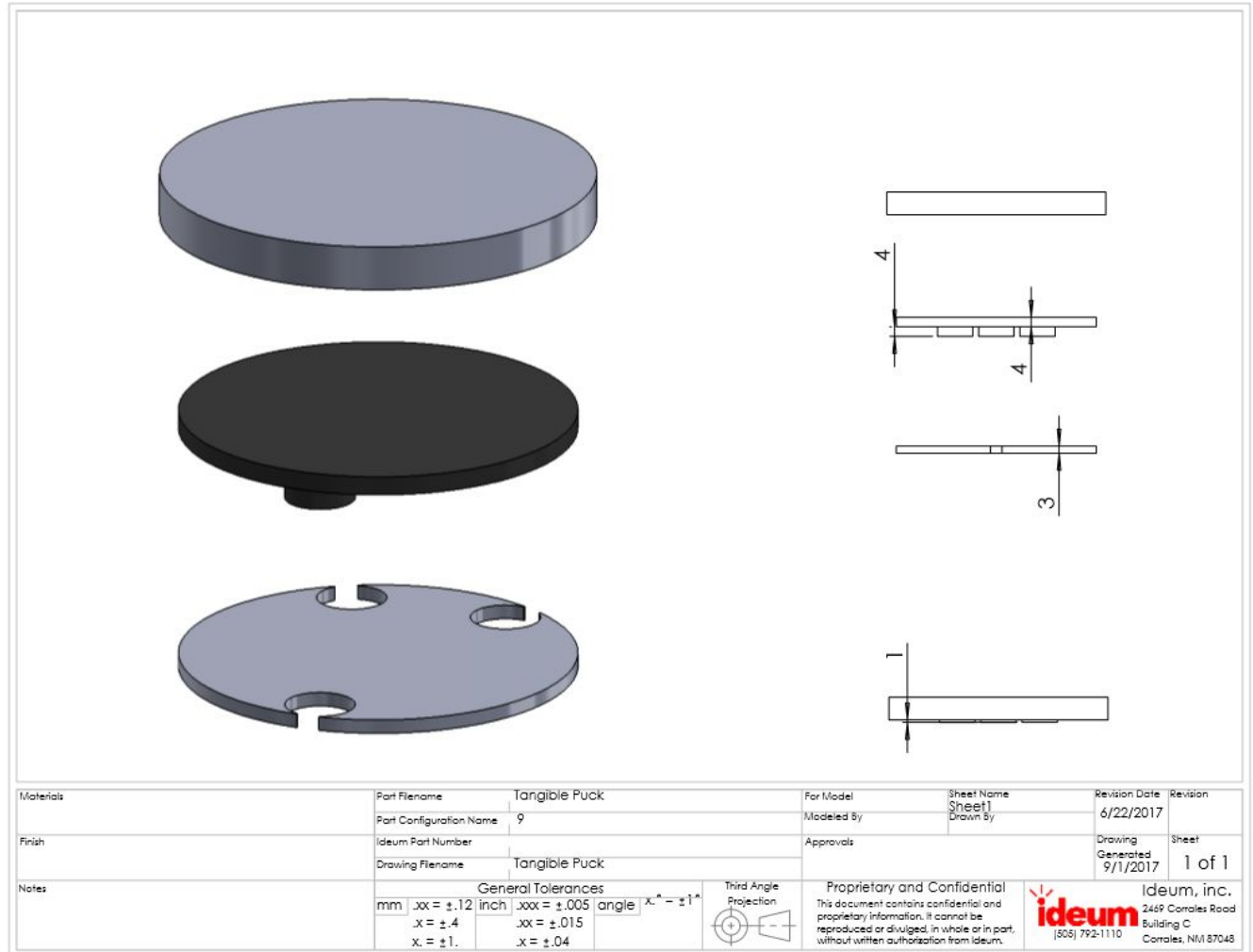
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Requirements

Materials Needed

You'll need these materials and tools to get started:

- 3D Printer (Creator Pro) with 0.5mm nozzle
- Software to create G-code (Simplify 3D)
- Conductive filament (PI-ETPU 95-250 Carbon Black)
- Non-conductive filament



Getting Started

The process of creating tangible objects through 3D printing can vary depending on your environment and tools. This document details the process employed with the tools used at Ideum. The 3D printer settings here are provided for the Flashforge Creator Pro model 3D printer. If you use a different printer, these settings will need to be adjusted. We advise using Ideum's settings as a baseline and adjusting for the best result as needed.

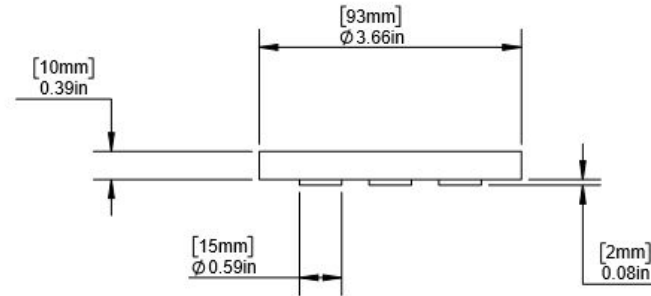
Included with the Tangible Engine bundles are four STL files that can be used as reference when building tangible objects. Throughout this guide, we refer to the 3-point STL files as an example.

The tangibles created by Ideum for use with Tangible Engine are three separate prints that are combined to form a complete tangible. The pieces are a non-conductive support piece (the "Base"), a conducting piece (the "Core") that has the touch points Tangible Engine tracks, and a non-conductive top (the "Cap").

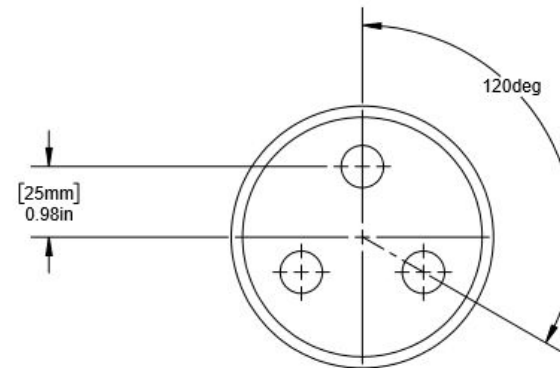


TANGIBLES
patent pending

93mm Dimensions



THESE DIMENSIONS APPLY TO ALL 93mm TANGIBLES



THESE DIMENSIONS VARY WITHIN 93MM TANGIBLES AND ARE DEFINED AS THE "PATTERN"

The Core

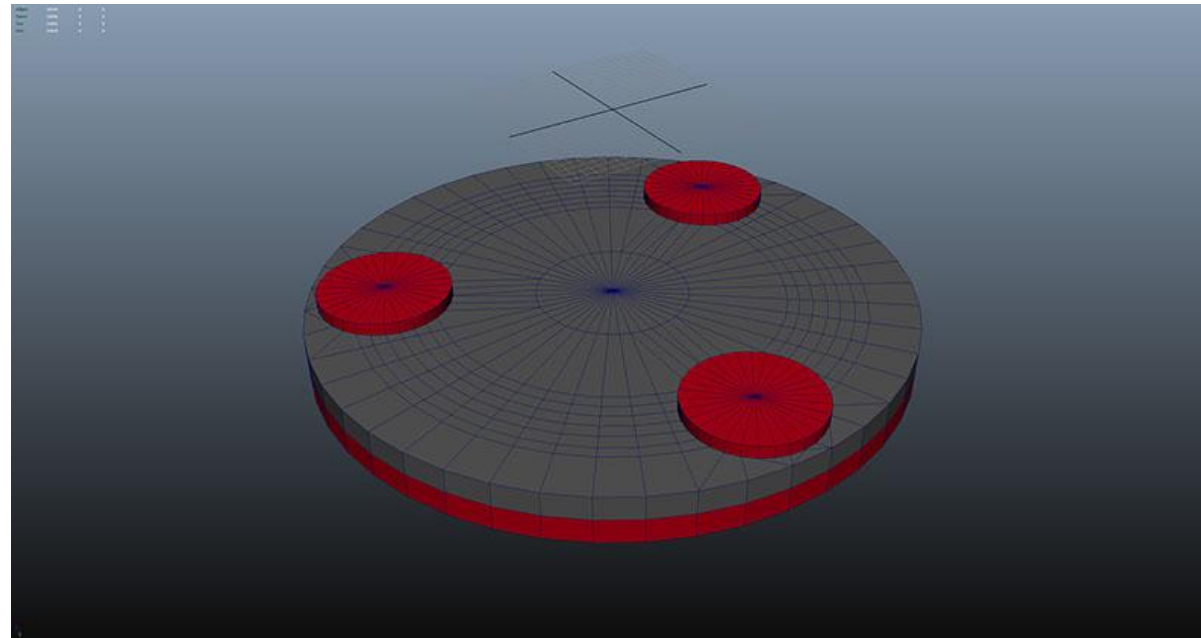
Design

Through Ideum's extensive research and development and continued improvement of physical tangibles, we have established the following design guidelines:

- The Core is 3D printed from a carbon infused conductive filament. ***We recommend PI-ETPU 95-250 Carbon Black.***
- Cores must have sufficient capacitive mass. ***The tangible core should weigh a minimum of 25 grams.***
- The shape & size of the Core can vary, but we have settled on a circular pattern with a 93 mm diameter for both ergonomic considerations and simplicity of printing.

Material

The material used to create the Core is extremely important. The selected material must be conductive, but note that hard materials may scratch the surface of the touch table over time. As noted, we recommend PI-ETPU 95-250 Carbon Black.



The Core is the red section shown above.

The Core

Design

- Tangibles with 3 feet perform best, because all 3 feet will be in contact with the sensor at all times. Fewer feet will be unstable, and more feet may provide false positives.
- Each of the tangible feet should be circular in profile, with a minimum 15 mm diameter and a maximum 20 mm.
- Tangible feet should be a minimum of 2x the diameter of a foot apart (center to center) to be recognized as unique touch points.
- For best performance, please refer to the 93 mm patterns shown here. After extensive testing, we rely on these as our standard patterns.
- Adhesion of a *soft, conductive fabric material* to the feet can in some cases improve performance. These cases include applications where motion or rotation of the tangible is integral to the UX. This material can be sourced from Ideum should your application require it.



TANGIBLES
patent pending

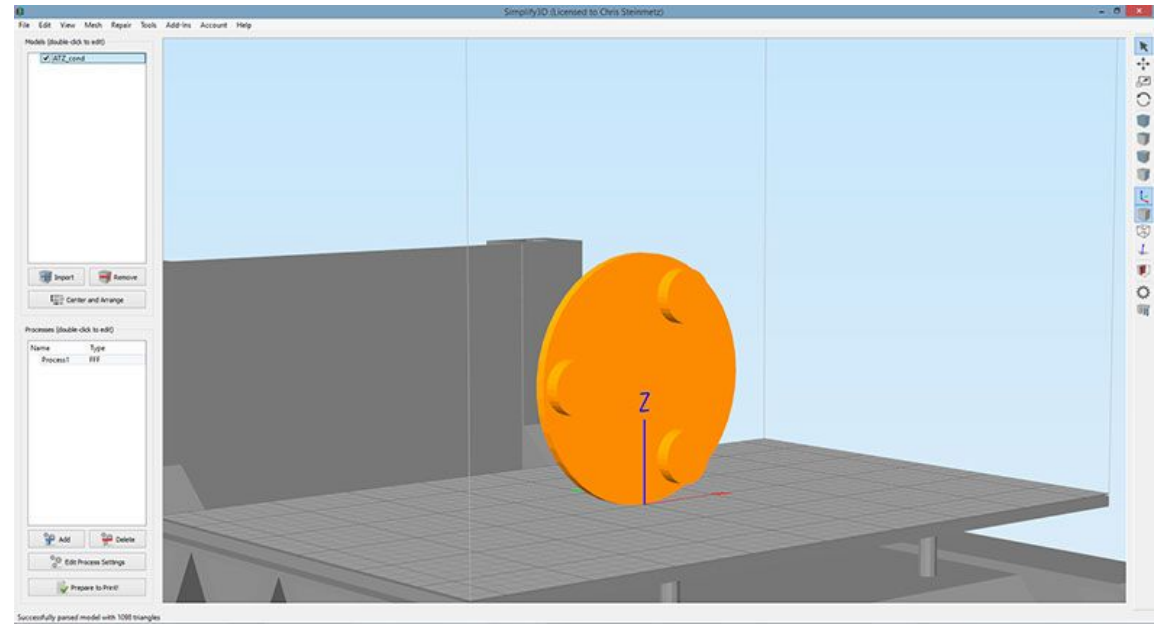
93mm Patterns

	25MM SPACING	30MM SPACING	35MM SPACING
120° ANGLE			
135° ANGLE			
150° ANGLE			

The Core

Setup

To begin the process of printing the Core, first import the necessary 3D model into Simplify 3D. Next, decide the orientation required for the piece being printed. For Core pieces, *it is imperative that the feet face upward*. Check the coordinate system of your software to be sure the piece is aligned properly.



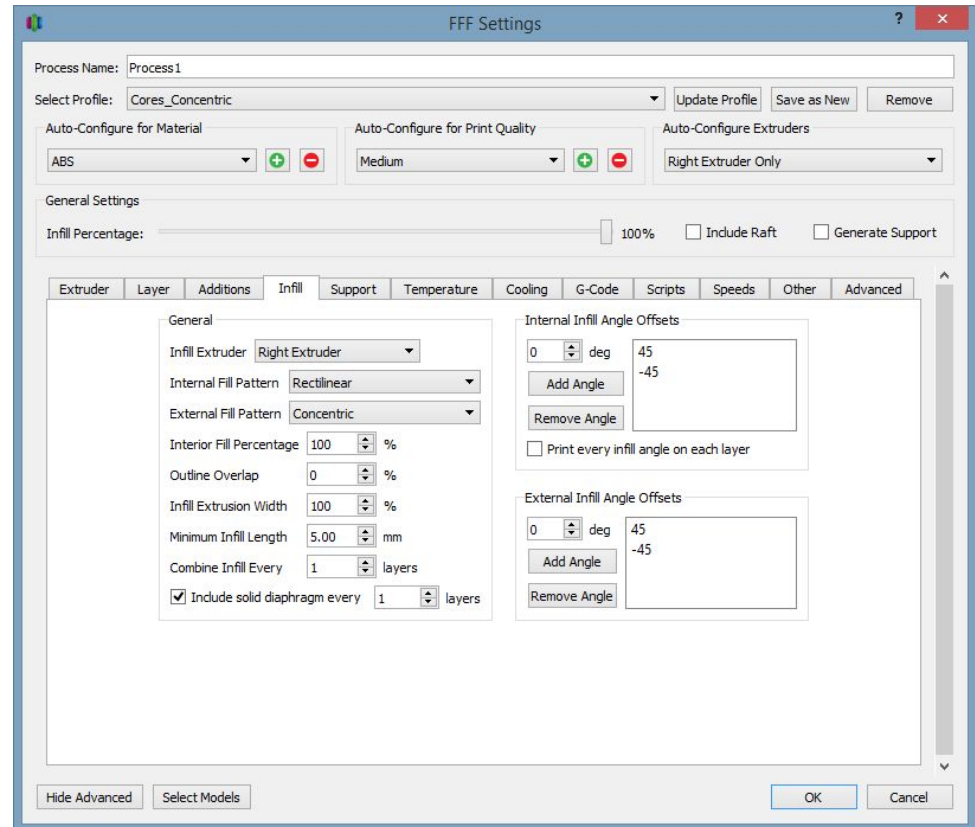
The Core

Printing

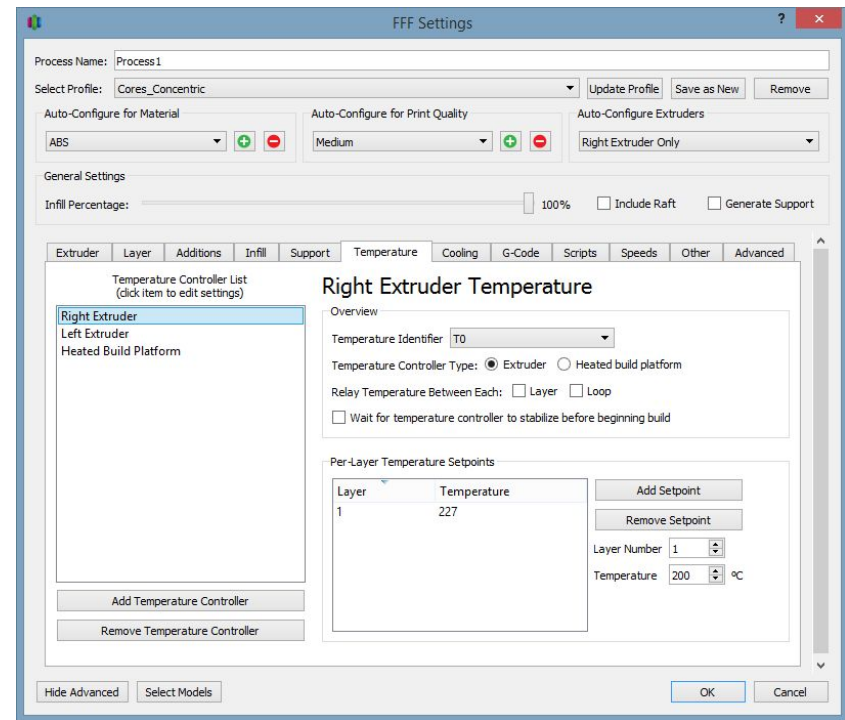
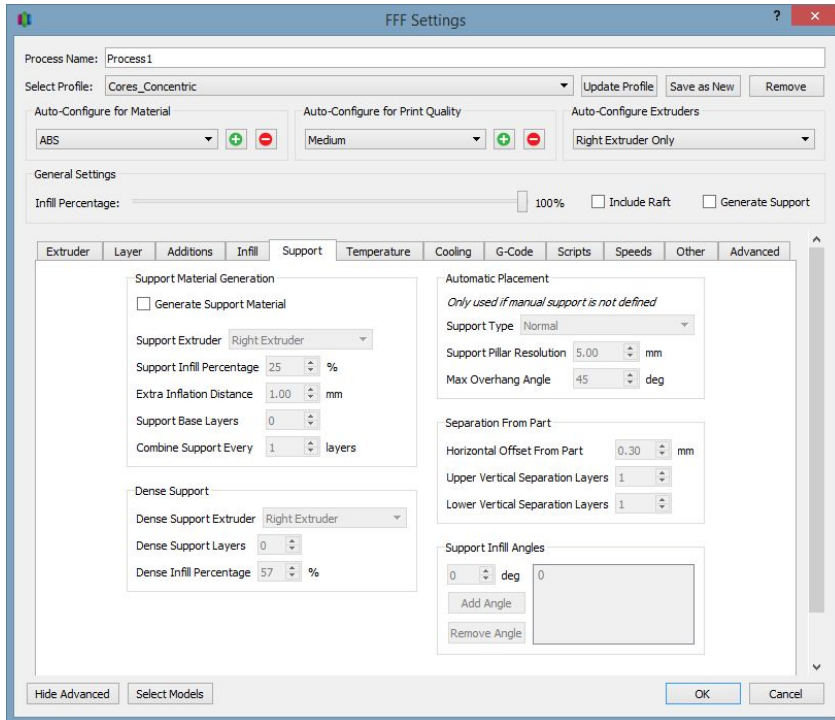
Once the critical settings are set and the appropriate filament is placed in the 3D printer, the Core is ready to be printed. When creating your own Core pieces, there are several things to consider. Please refer to the Design section of this document for guidance. Placing feet in the center of the Core is not advised, as this can lead to a poor connection. The centroid of the resulting tangible will be calculated as the center point of the printed feet.

Setup

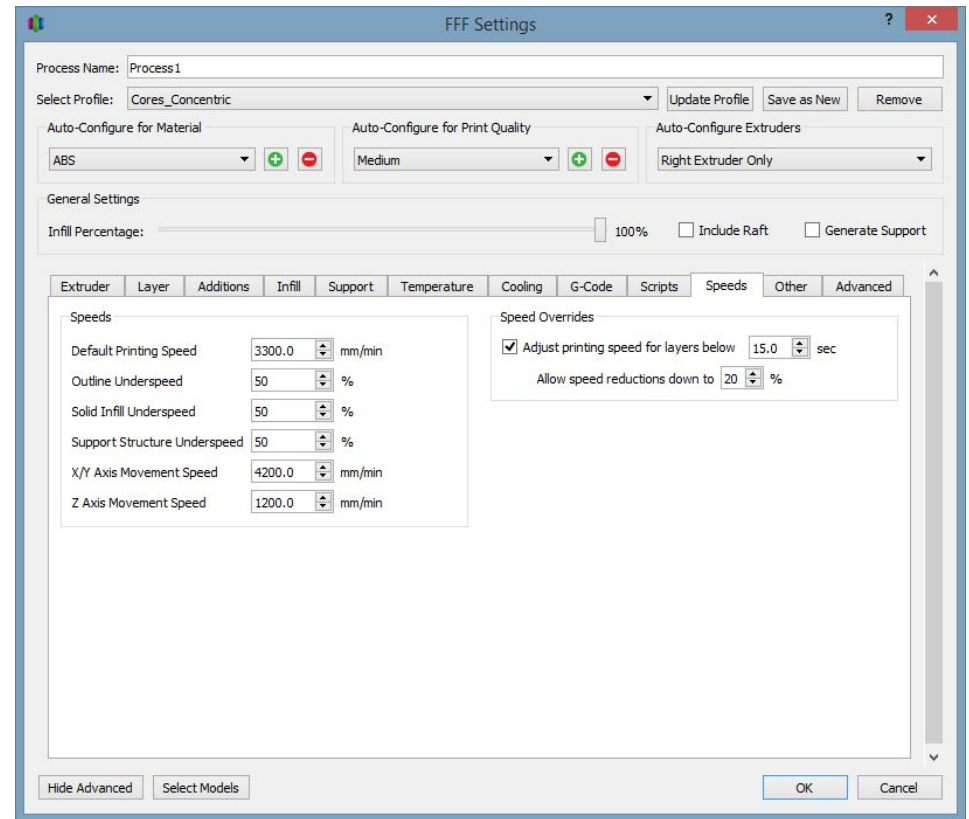
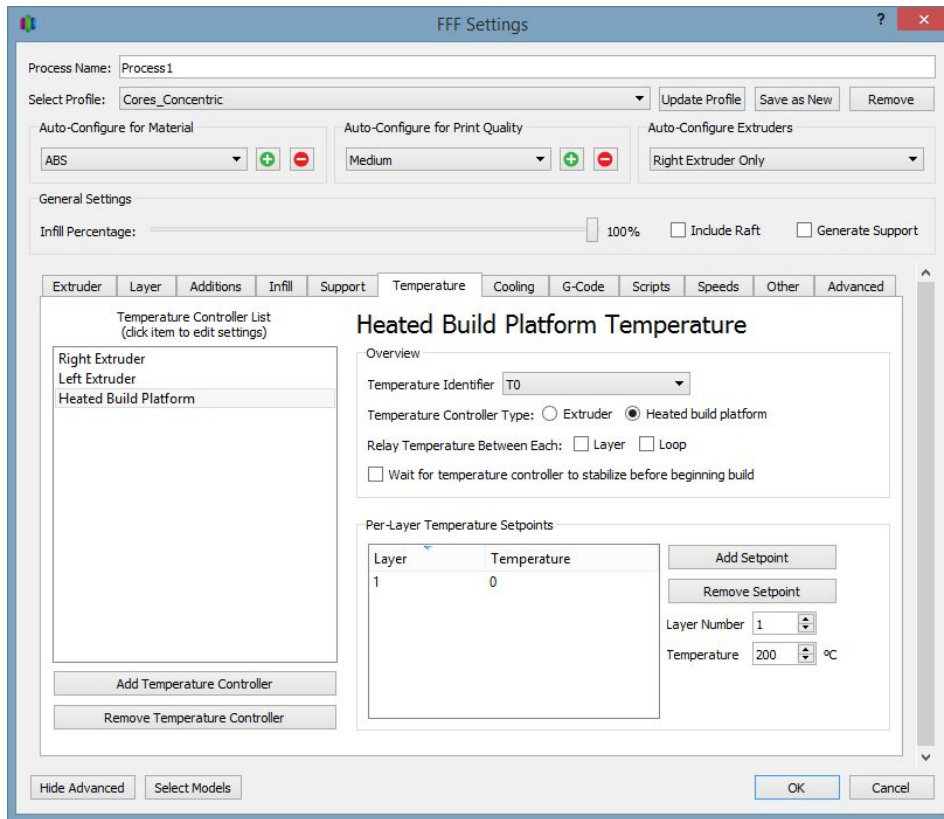
In order for the core to be printed properly, the critical settings shown here must be configured directly on the 3D printer.



The Core



The Core



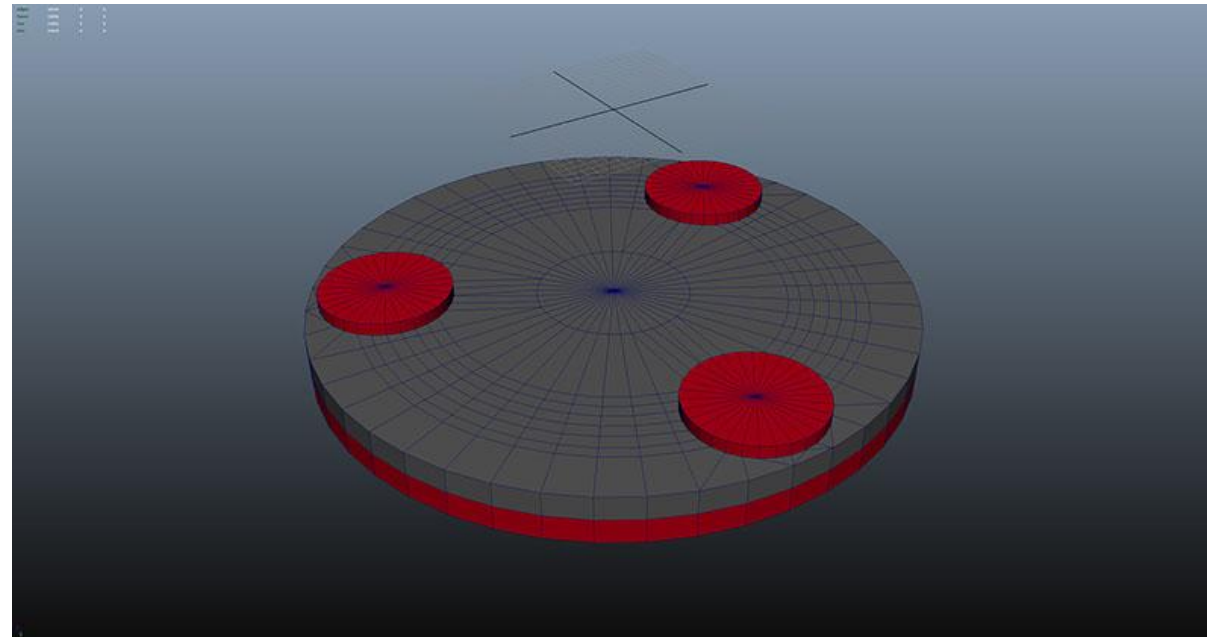
The Base

Material

The Base serves as support for the rubberized feet of the Core. The material used to create the Base should be both hard (to provide support and keep the tangible rigid) and non-conductive.

Printing

To begin the process of printing the Base, first import the necessary 3D model into Simplify 3D. The Base's pattern must match its counterpart as perfectly as possible. It may be beneficial to use a lower infill for the Base; Ideum recommends infill at 37%.



The Base is the gray section shown above.

The Cap

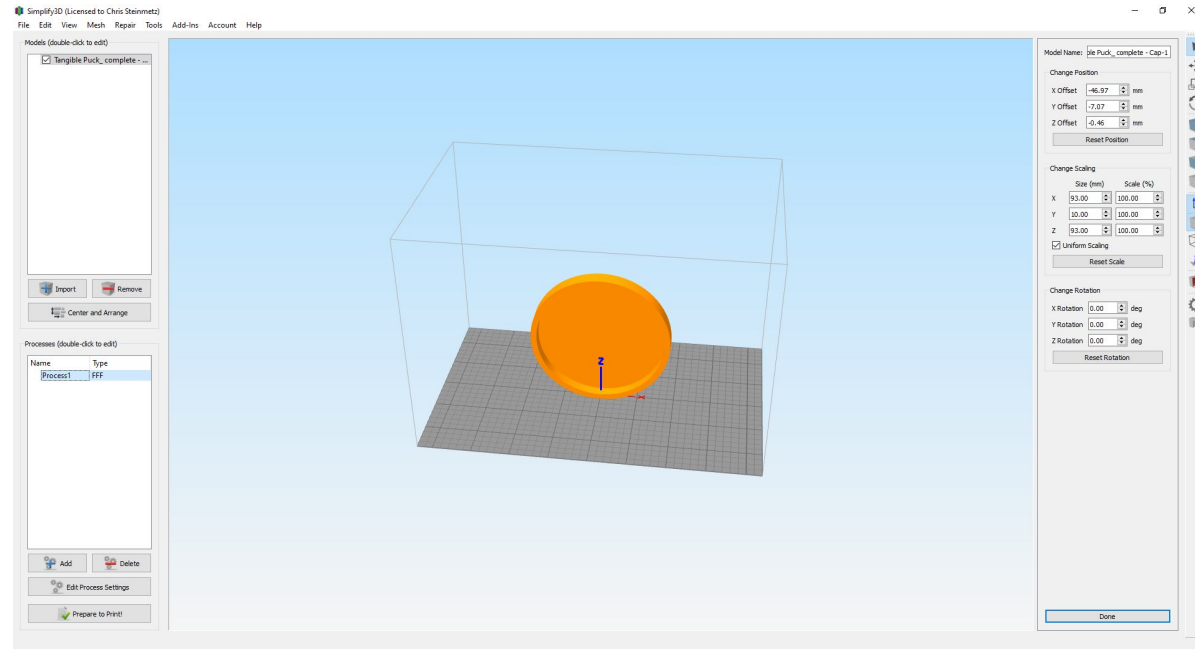
Material

The Cap serves as support for the stacked assembly of the Core & Base. The material used to create the Cap should be both hard (to provide support and keep the tangible rigid) and non-conductive.

Printing

To begin the process of printing the Cap, first import the necessary 3D model into Simplify 3D. Because the Cap also serves as the aesthetic portion of the tangible, it may be printed from a different color material; it can also be painted, cast, or machined from any other suitable materials. If 3D printed, it may be beneficial to use a lower infill for the Cap; Ideum recommends infill at 37%.

If you use a custom “totem” or “topper” object to which the Core & Base assembly is attached, the Cap will not be necessary as the totem will serve both support and aesthetic functions.



Recommendations

The preceding instructions for creating custom tangibles have been distilled from extensive testing. However, numerous variables can create issues with the final product. These additional recommendations may help increase the performance of your tangibles.

Add weight to the tangible.

- Consider increasing the infill of the Base.
- Consider designing a custom tangible totem or topper with an internal area to hold a small weight, such as washers or lead shot.

Ensure areas of contact are smooth and all feet are level.

- Use fine-grit sandpaper to ensure the tangible's feet have full contact with the touch table.
- If the rubberized Core feet have small holes, either adjust your printing settings or consider finding a way to fill the holes. It may save time to melt material manually onto the Core's surface.

Adjust your settings.

- Factors such as ambient temperature and humidity can affect printing with the conductive rubber material. Consider adjusting attributes such as speed and temperature to get a stable print.