

Bear Lab

Extrusion multiplier and filament diameter

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INTRODUCTION

This guide has been inspired by the [Extruder Calibration](#) article from Matt Harisson.

Step 1 — Preparation



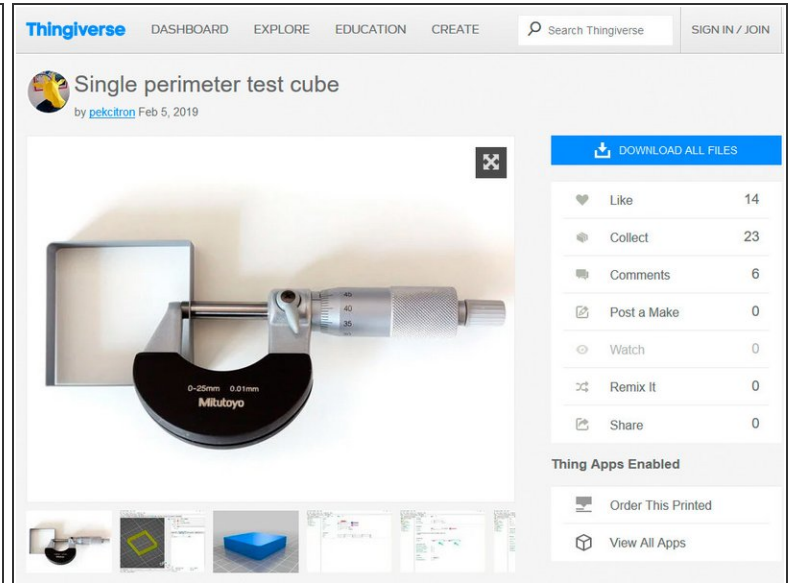
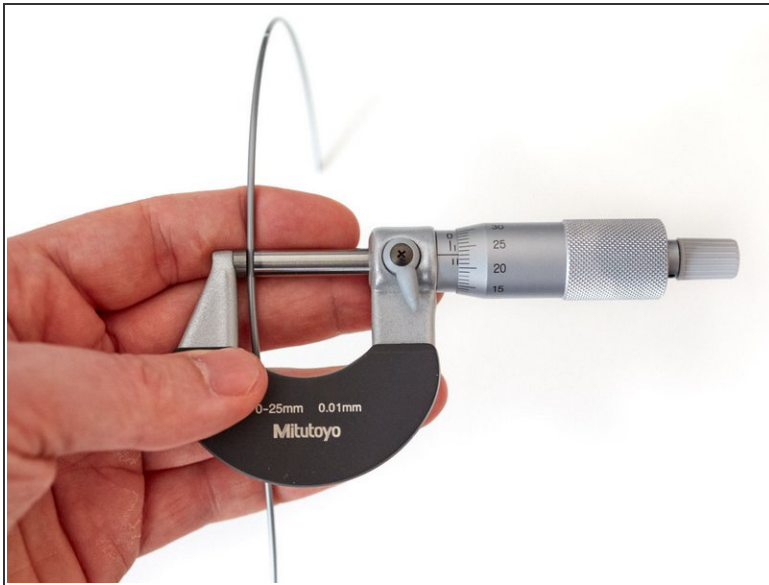
! If you have set up a different extruder steps/mm value than stock in the past I recommend resetting it to its default.

i We recommend a micrometer instead of calipers for the following steps. Calipers are not precise enough to measure such small values and a micrometer has a ratchet system made to apply same pressure for all measures.

★ If you need to buy a micrometer, choose a quality one. Digital micrometers are not necessarily more accurate and precise. In most cases, no-name digital micrometers are worse than quality analog ones. Some recommended brands are Tesa, Mitutoyo, Etalon, Mahr.

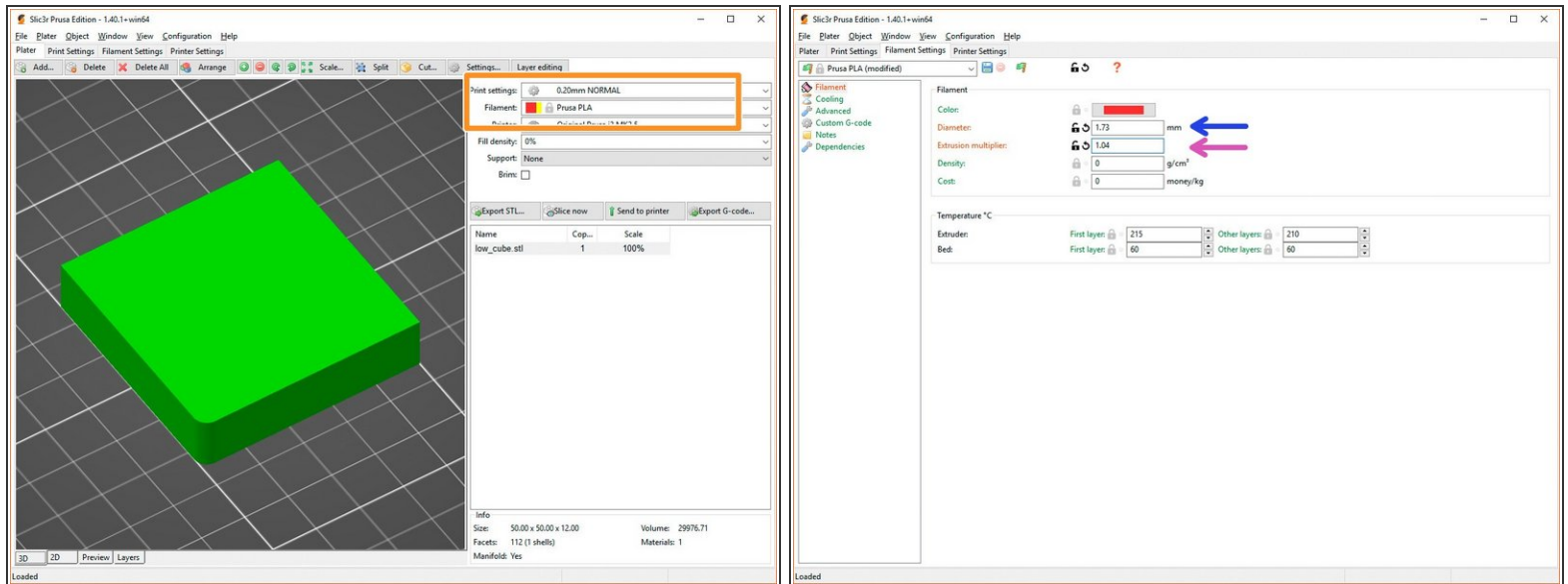
! Make sure to use the temperature you are using for printing the filament. Do not change the temperature during these steps. Temperature might change the flow and therefore the extrusion multiplier.

Step 2 — Measure and get calibration cube



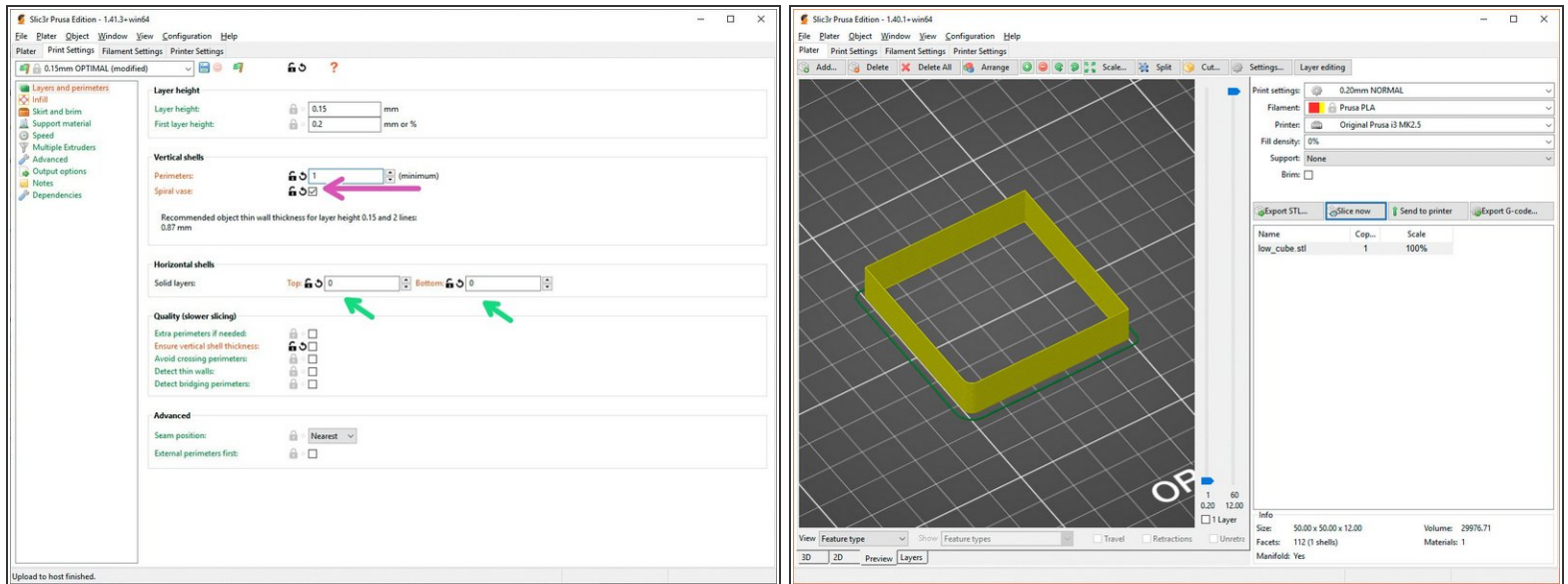
- Measure your filament diameter with a micrometer. Write it on a piece of paper.
- 📌 You could measure the filament at several places and calculate the average.
- Download the calibration model from thingiverse.com/thing:3405991 or from github.com/gregsaun/.../test/cube

Step 3 — Extrusion multiplier and filament diameter settings



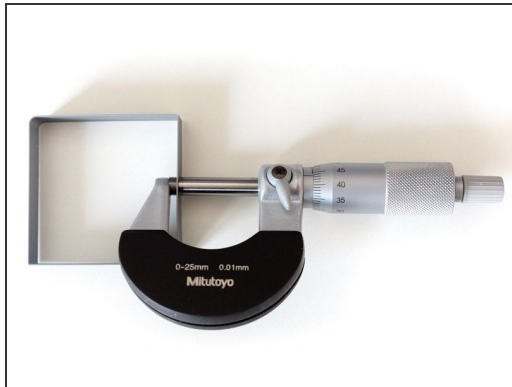
- Start Prusa Slicer and load the calibration model. On the main page, select the following parameters:
 - Print settings: 0.20mm Normal
 - Filament: Prusa PLA
- Enter your filament diameter into the corresponding input under filament settings.
- Reset "Extrusion multiplier" to 0.95.

Step 4 — Print extruder calibration cube

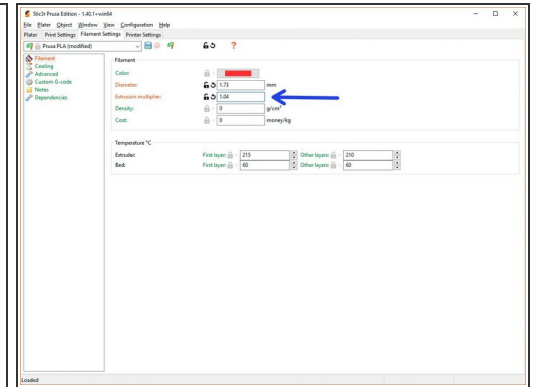


- Set the following print settings:
 - Vase mode
 - Solid layers top and bottom: 0
- Slice and print your cube.

Step 5 — Calibrate extrusion multiplier

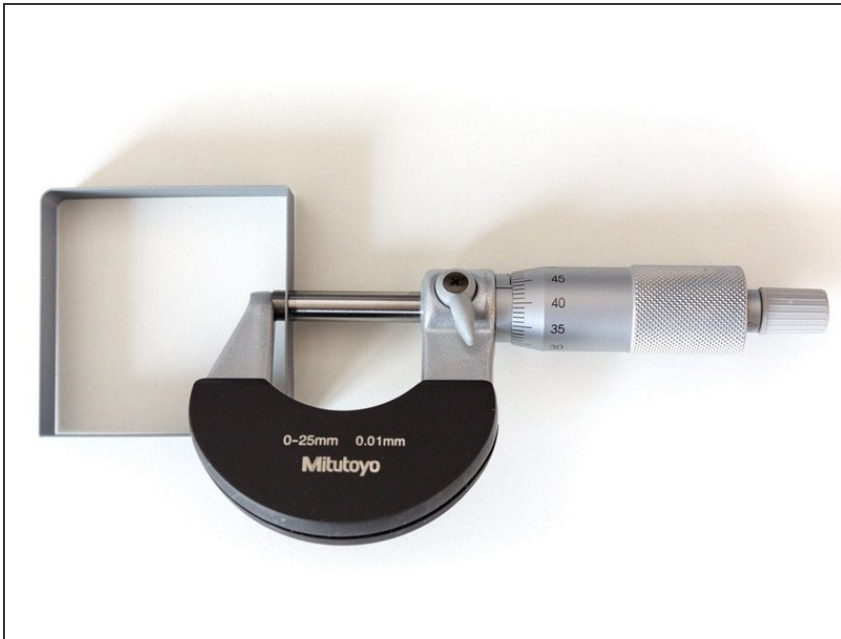


$$\text{new_multiplier} = \frac{\text{old_multiplier} \cdot \text{extrusion_width}}{\text{average_perimeters_thickness}}$$



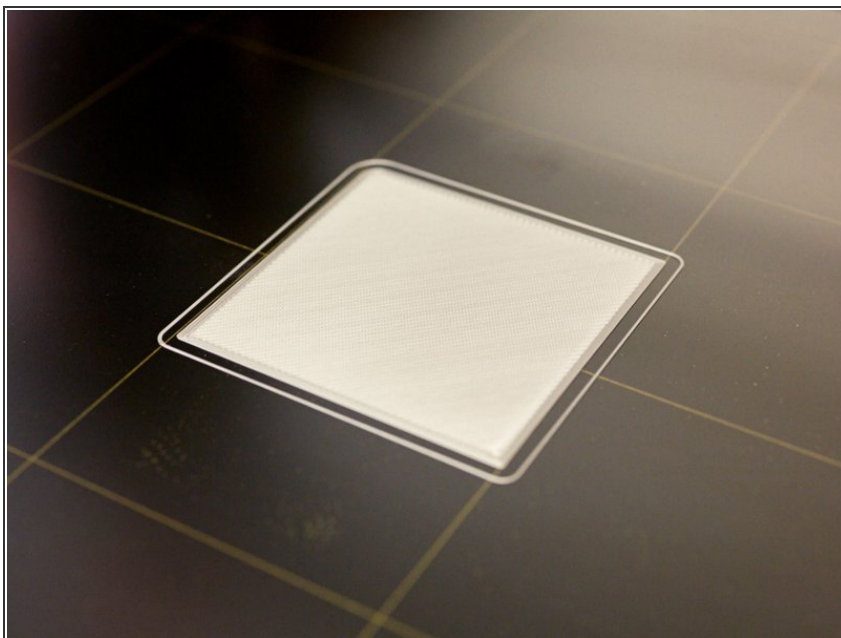
- Measure all the perimeters of your cube and calculate the average.
- Calculate your new extrusion multiplier using the formula on the second image. Here is an example:
 - Your old extrusion multiplier = 0.95 and your average perimeter thickness = 0.43mm.
 - You are using a 0.4mm nozzle, so your extrusion width is 0.45mm.
 - Your new extrusion multiplier = $(0.95 \cdot 0.45)/0.43 = 0.994$.
- Enter the new extrusion multiplier value in the filament settings page of Prusa Slicer
- ⚠ Print the part again to verify the value is correct. Repeat the previous steps if necessary.
- 📌 **Tip:** The extrusion multiplier is generally constant for a whole spool (if you do not change temperature) but the filament diameter will change. Therefore, before slicing a part, measure the filament diameter you are going to use and enter it into Prusa Slicer

Step 6 — Verification



- Print the calibration model again with these new settings.
- Verify the wall thickness with your micrometer. Repeat the previous steps one or two more times if refinement is needed.

Step 7 — First layer calibration



- You can now more finely recalibrate your first layer. You could print the first layer of the previous calibration model as a test.

Step 8 — Finished!



- Happy printing :)