

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 (`e_step`) than stock in the past we recommend resetting it to its default.

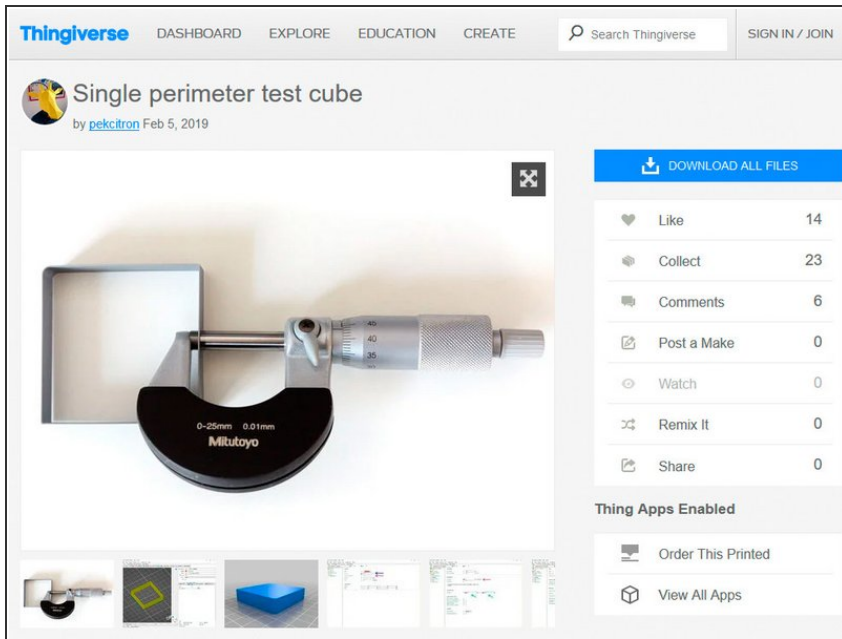
ⓘ E step calibration isn't a reliable way to calibrate your extrusion because you are not measuring where it matters (what goes out of the nozzle). It is also a painful process to adjust `e_step` per type of filaments, the extrusion multiplier in PrusaSlicer is a lot easier to handle.

- We recommend a micrometer instead of a caliper 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 still want to use caliper, make sure to always use the same pressure when you measure and don't press too strongly.

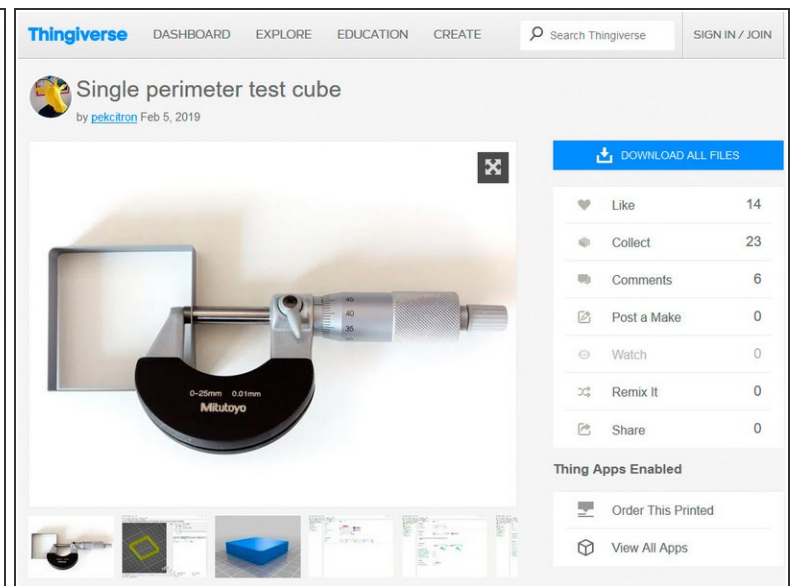
★ **Tip:** If you like to buy a micrometer, choose a quality one. We can recommend Mitutoyo 102-301 for its low price and quality. You can also check second hands market. Some recommended brands: Etalon, Mahr, Mitutoyo, Tesa, Starrett.

Step 2 — Download the calibration model



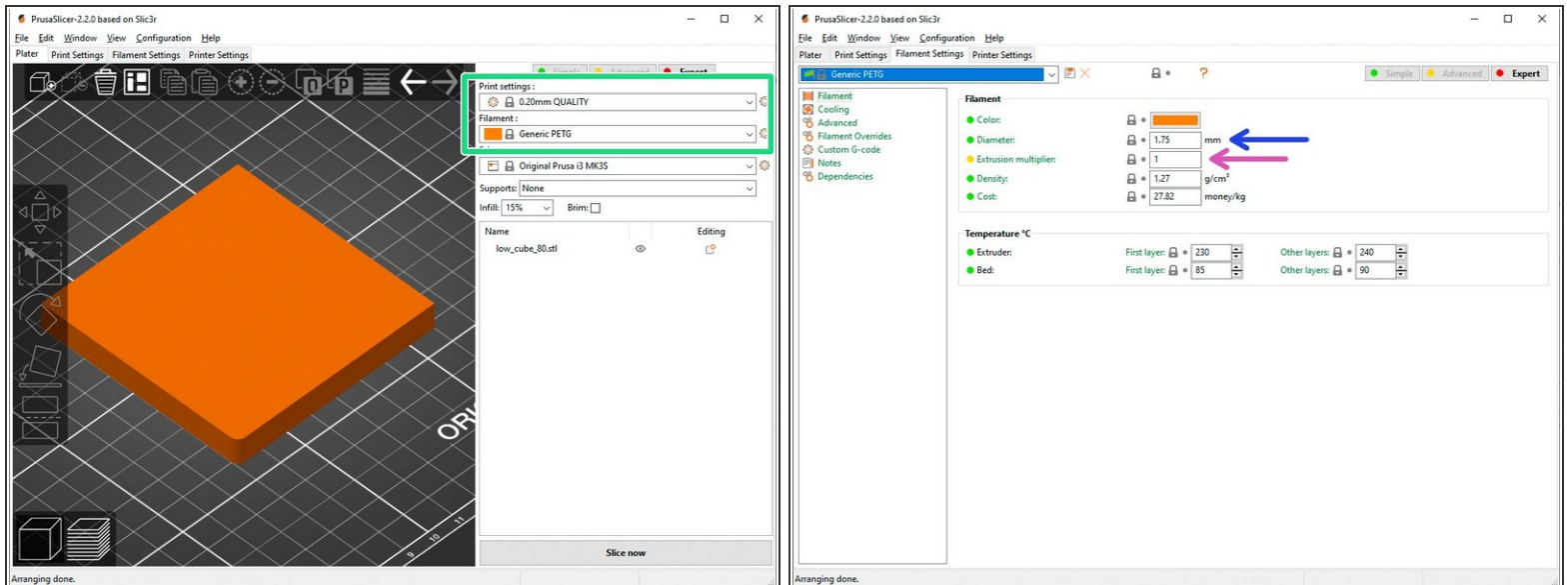
- Download the calibration model from thingiverse.com/thing:3405991 or from github.com/gregsaun/.../test/cube

Step 3 — Measure filament diameter



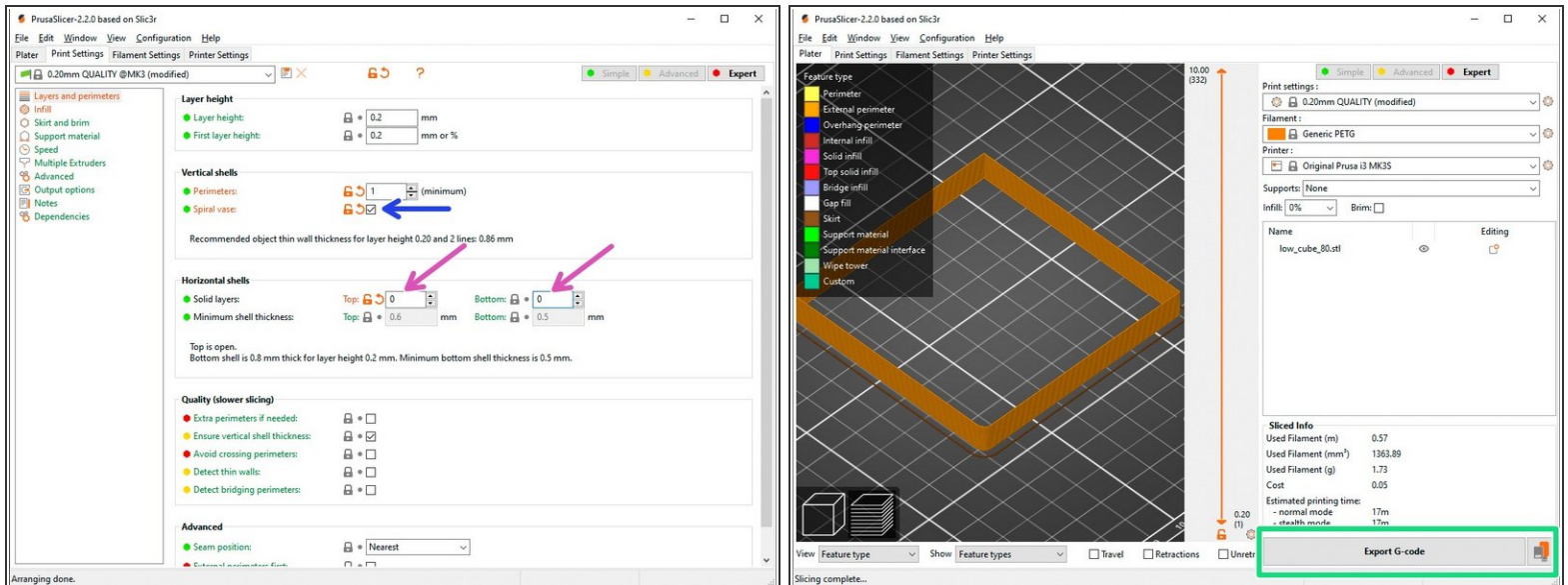
- Measure your filament diameter with a micrometer. Write it on a piece of paper.
- You could un-spool a little the filament, measure at several places and calculate the average.

Step 4 — Filament settings



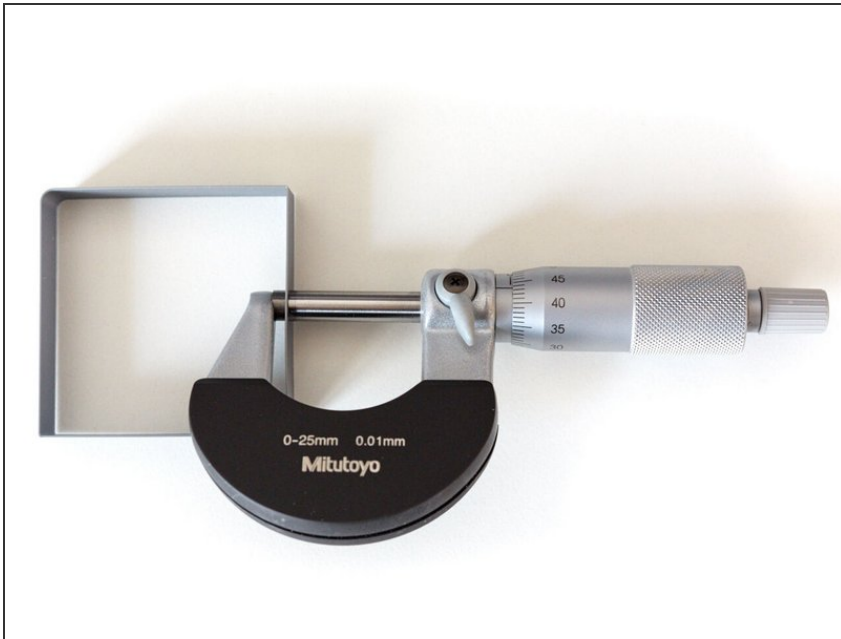
- Start PrusaSlicer and load the calibration model. On the main page, select the following parameters:
 - Print settings: 0.20mm QUALITY
 - Filament: choose the filament profile corresponding to the filament you want to calibrate.
- Enter your measured filament diameter into the corresponding input under filament settings.
- Set your extrusion multiplier to 1.00

Step 5 — Print settings and printing



- Set the following print settings:
 - Spiral vase mode (and accept dialog to auto-configure settings accordingly)
 - Solid layers Top and Bottom: 0
- Slice the model and start the print.

Step 6 — Measure your perimeter thickness

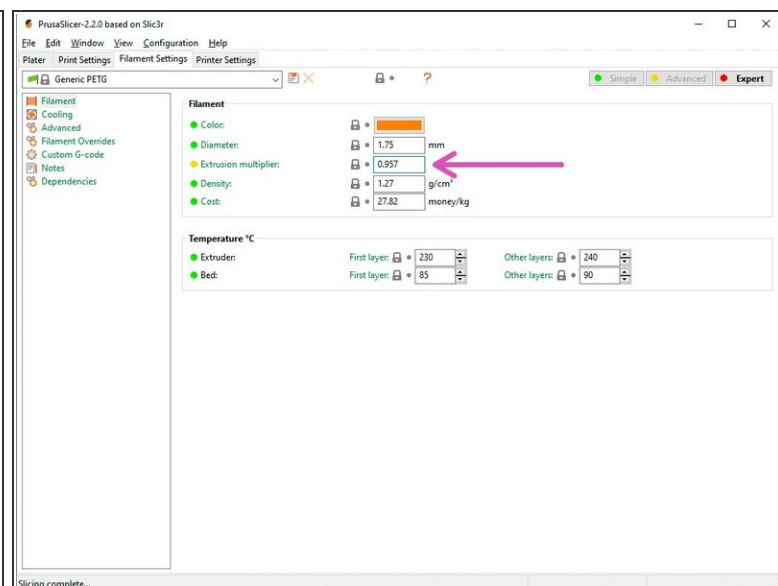


- Measure thickness of all the perimeters and calculate the average.
- ❗ The most reliable measure is on the center of each walls as shown on the image.

Step 7 — Calculate the new extrusion multiplier

$$\text{new_multiplier} =$$

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



- Calculate your new extrusion multiplier using the formula on the 1st image. Here is an example:
 - Your original extrusion multiplier = 1.00 and your average perimeter thickness = 0.47mm.
 - You are using a 0.4mm nozzle, so your target/expected extrusion width is 0.45mm.
 - Your new extrusion multiplier = $(1.00 \cdot 0.45)/0.47 = 0.957$
- Enter the new extrusion multiplier value in the filament settings page of PrusaSlicer.

Step 8 — Verification

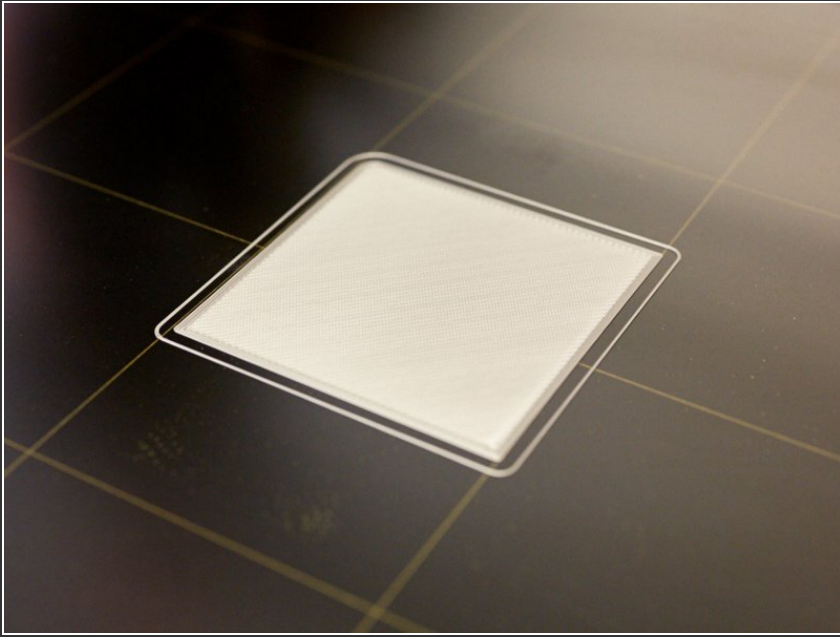


- Slice and print the calibration model again with the new extrusion multiplier value.
- Verify the wall thickness with your micrometer. Repeat the previous steps if refinement is needed.

⚠ Do not change the printing temperature during these steps. Temperature might change the flow and therefore the extrusion multiplier.

★ 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 PrusaSlicer.

Step 9 — First layer calibration



- You can now more finely recalibrate your first layer.
- ① You could print the first layer of the previous calibration model as a test.

Step 10 — Finished!



- Happy printing :)