AGENDA

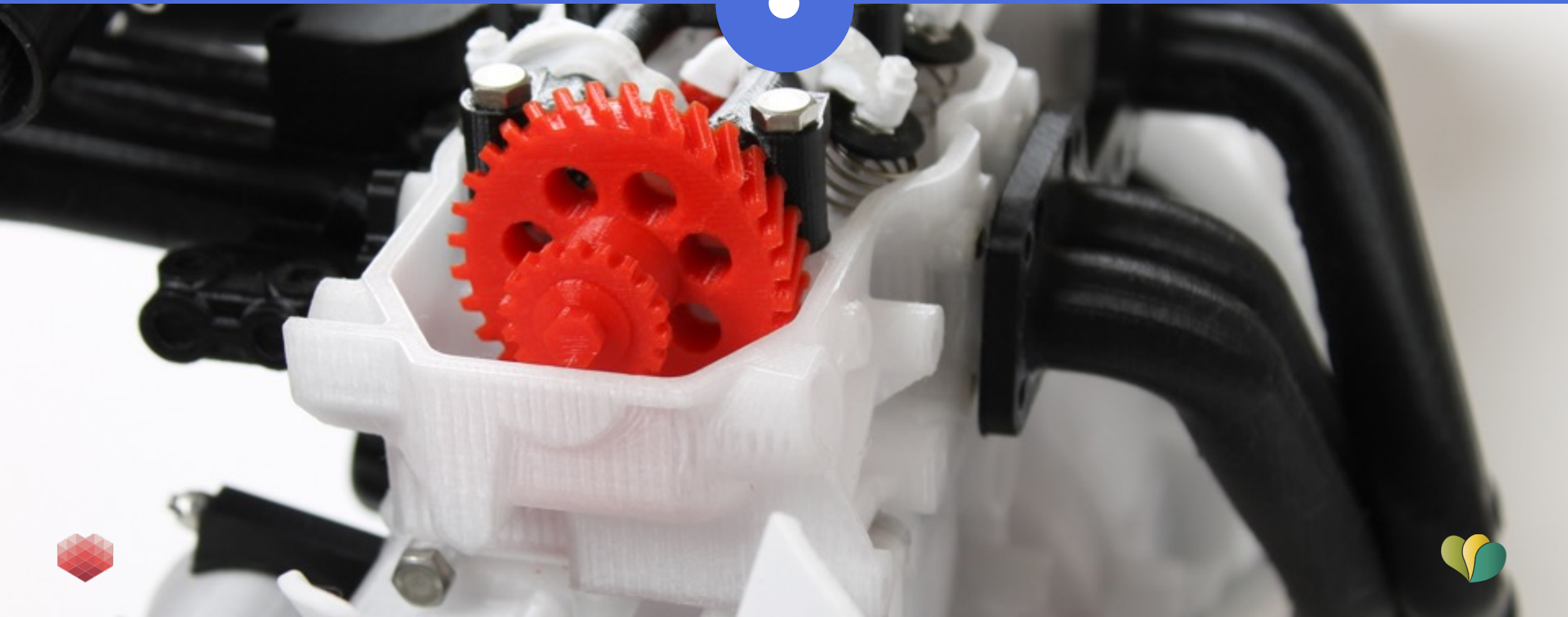
19.00 - 19.30:
Walk-in, drinks & snacks

19.30 - 20.30:
Presentation Workshop

20.30 - 21.00:
Discuss, drinks & snacks

CO-POLYESTER FOR 3D PRINTING

3D Hubs & Colorfabb Workshop



MATERIAL FOCUS

GUIDELINES

USEFUL RESOURCES

Choosing the right material

Fairphone
case

Print+

3DLabprint

Why you should offer Co-Polyester to your customers

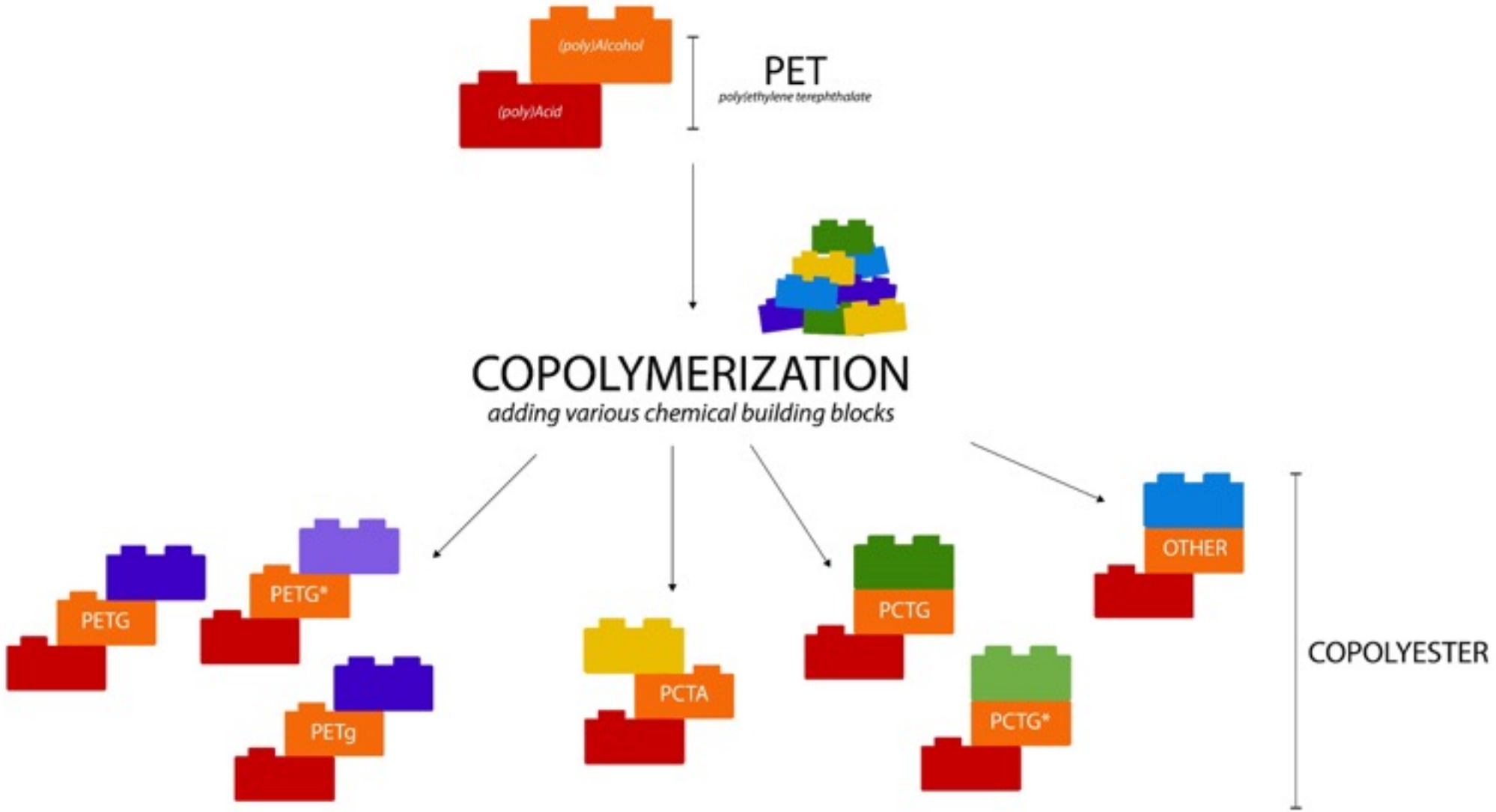
- Tough & durable printed parts
- Heat resistance temperature starting at 75C up to 110C
- Complies with certain FDA food contact regulations
- Chemically resistant

Why you should print in Co-Polyester

- Odor neutral printing, no funny smells in your maker space
- Low fine particle emissions
- Traceable source, Amphora 3D Polymer
- Range of co-polyesters to choose from, mechanical properties and temperature resistance (75C to 110C)

What's a Co-Polyester?

Co-Polyester ≠ PET


(poly)Alcohol
(poly)Acid
PET
polyjethylene terephthalate
COPOLYMERIZATION
adding various chemical building blocks
PETG
PETG*
PETg
PCTA
PCTG
PCTG*
OTHER
COPOLYESTER

What's a Co-Polyester?

- PET is a crystalline material mostly dedicated to Injection Stretch Blow Molding (*ISBM) to produce bottles (soft drink and water)*

- PET copolymerization gives a wide range of transparent materials suitable for:
  - *Injection*
  - *Extrusion blow molding*
  - *Injection blow molding*
  - *Sheet extrusion*
  - *Glass Polymer*

What's a Co-Polyester?

Number of grades is virtually infinite
EASTMAN & colorFabb select and tweak the
best ones for FFF 3D printing.

MATERIAL FOCUS

Sample Pack

colorFabb nGen

Eastman Amphora 3300

Alround

MATERIAL FOCUS

Sample Pack

colorFabb XT

Eastman Amphora 1800

Tough

MATERIAL FOCUS

Sample Pack

beta

colorFabb 910A

Eastman

Temperature Resistant

	colorFabb nGen	colorFabb XT	colorFabb 910A beta
Processing Temperature	220/240C	240/260C	250/280C
Bed Temperature	70/80C	65/75C	100/110C
Temperature Resistance	80/85C	70/75C	105/110C
Toughness	■	■ ■	■ ■ ■
Ease of printing	■ ■ ■	■	■ (Warping)

	colorFabb nGen	colorFabb XT	colorFabb 910A beta
Visual prototyping	■ ■ ■	■ ■	■
Functional prototyping	■	■ ■ ■	■ ■ ■
	Typical Alternative to PLA	Typical Alternative to ABS	Typical alternative to ABS and other high temperature resistant filaments

What's a Co-Polyester?

What's a Co-Polyester?

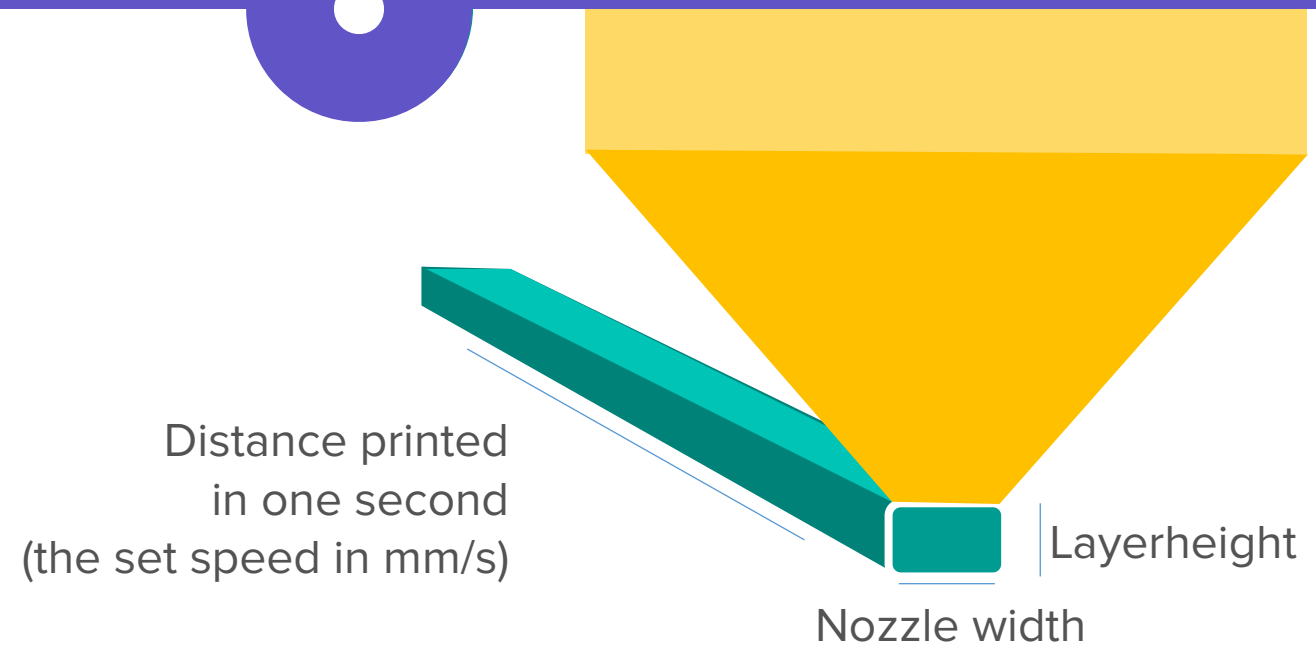
When to use Co-Polyester?

- Applications which need heat resistance.
- Creep resistance
  Parts under constant load
- Durable applications
- Chemical resistance, acids, base, oils etc.
- Toughness, impact resistant.

Settings to use

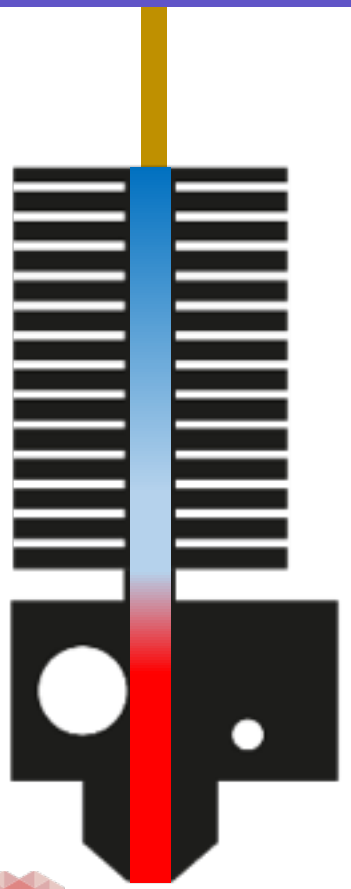
- 1. Speed | temperature | layerheight
- 2. Bridging
- 3. Retraction
- 4. Part cooling
- 5. Warping

Speed, Temperature, Layerheight



Layerheight x nozzle width x print speed
=
Volume per second

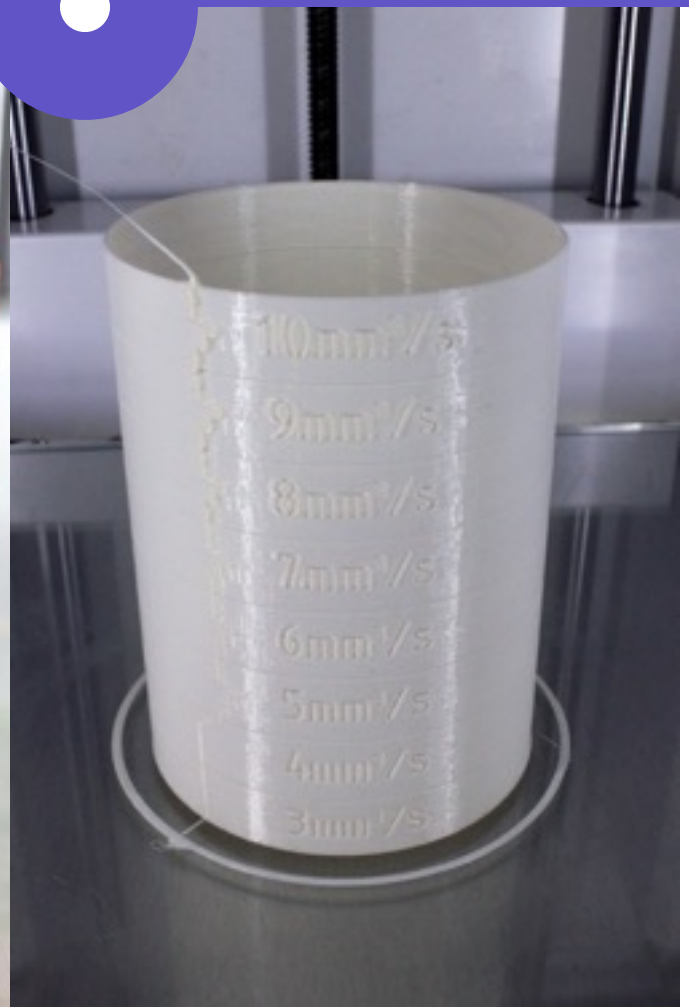
Speed, Temperature, Layerheight



0.05mm x 0.4mm x 50 mm/s = 1 mm^3 / s

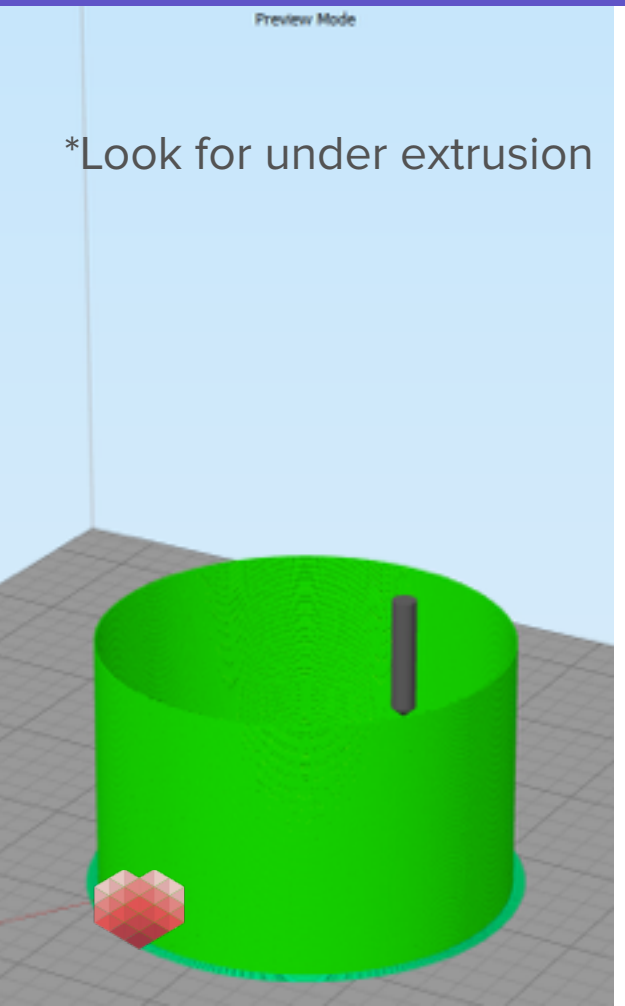
0.2mm x 0.4mm x 100mm/s = 8 mm^3 / s

Speed, Temperature, Layerheight

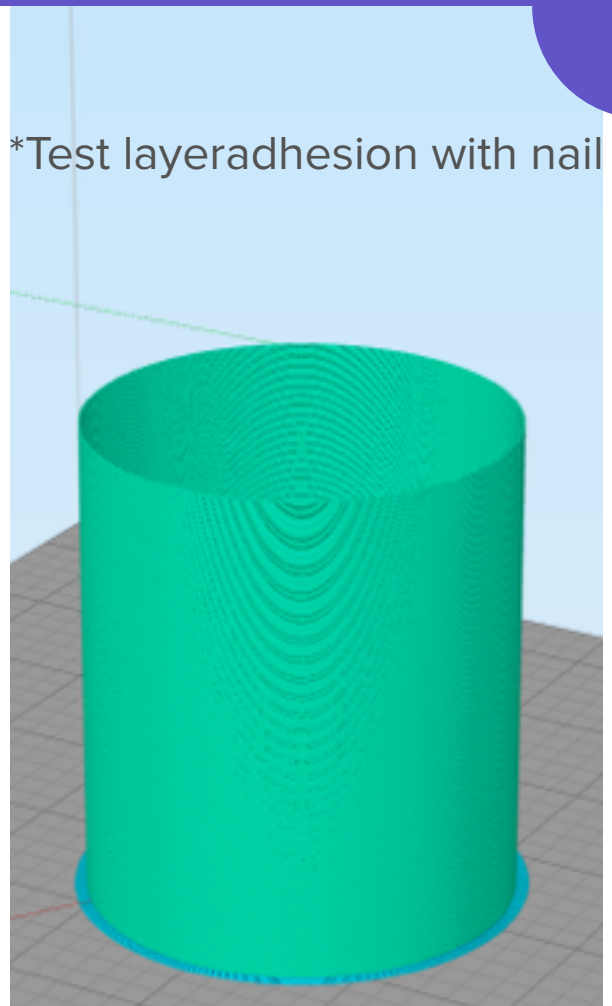


https://www.youmagine.com/designs/test-print-for-ultimaker--2

Speed, Temperature, Layerheight



*Look for under extrusion

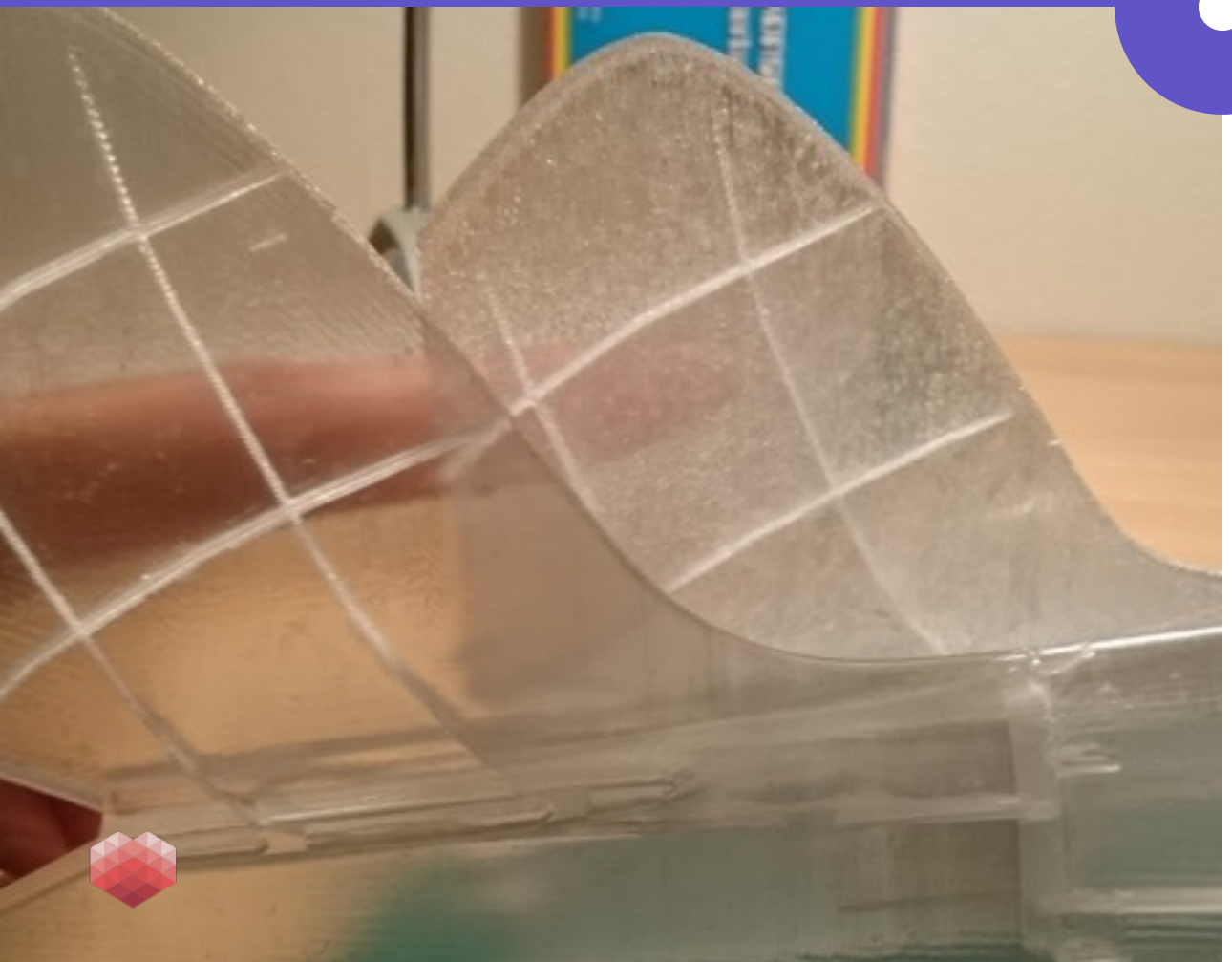


*Test layeradhesion with nail

Make your own speed test
Solid cylinder

- No infill
- Spiralize mode (vase)
- No top / bottom
- Disable speed overrides, layer time, slow down for outer perimeters etc.
- Set speed
- Set temperature
- Set layerheight
- Set nozzle width

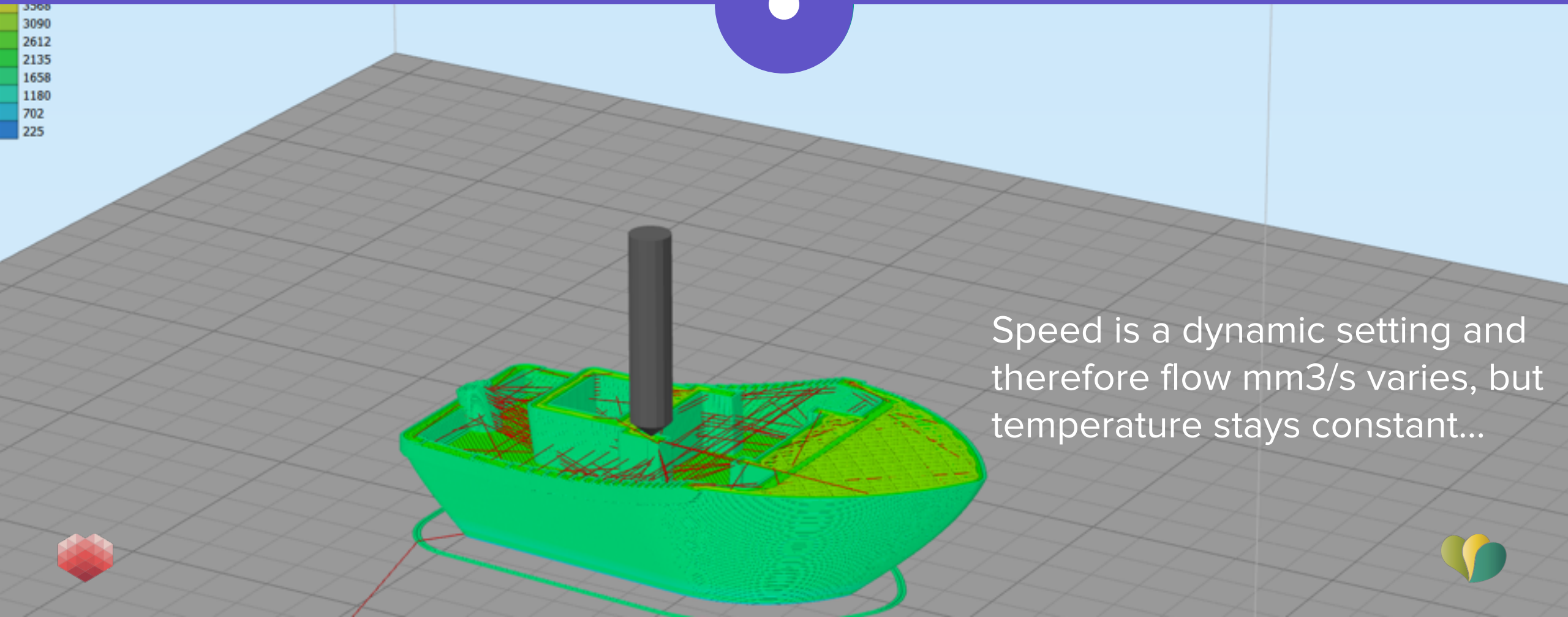
Speed, Temperature, Layerheight



Too fast printing: under extrusion, material collecting on the nozzle instead of the layer, bad layer adhesion, not connecting perimeter lines

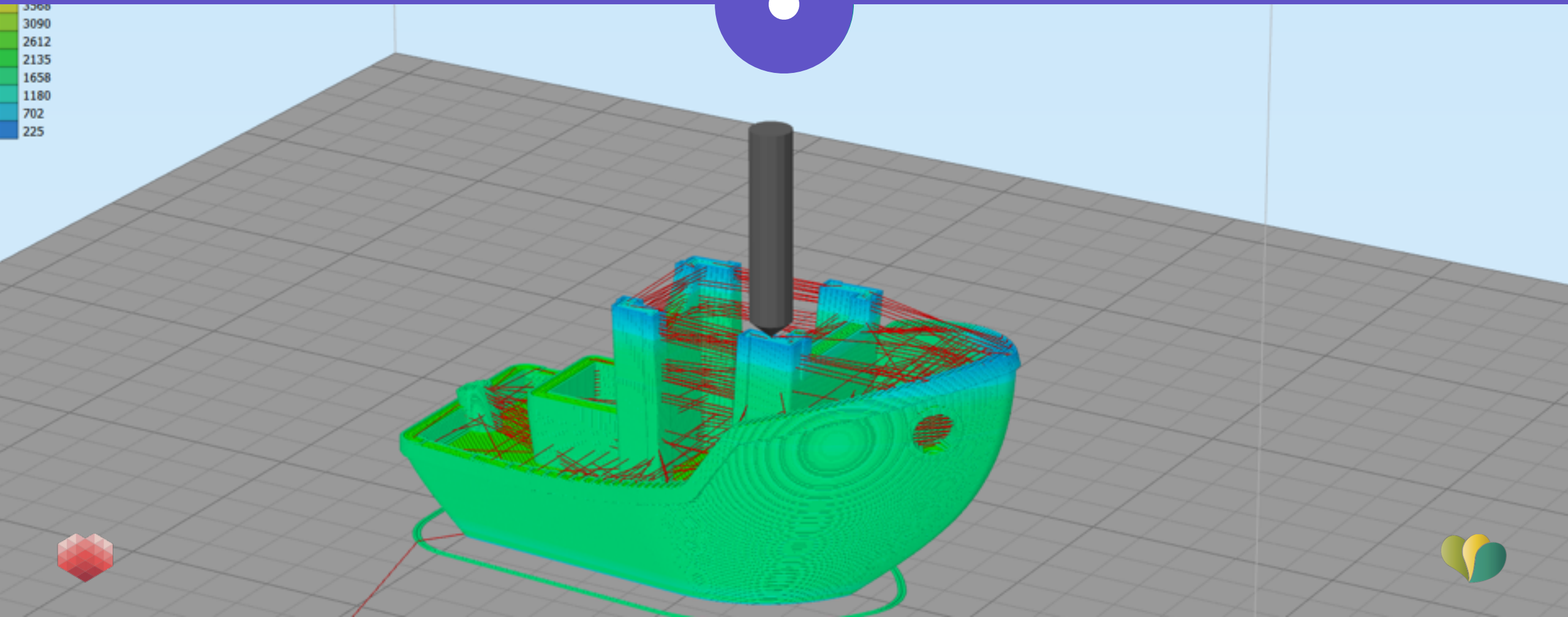
Too slow printing: residence time too long, bubbly effect

Speed, Temperature, Layerheight

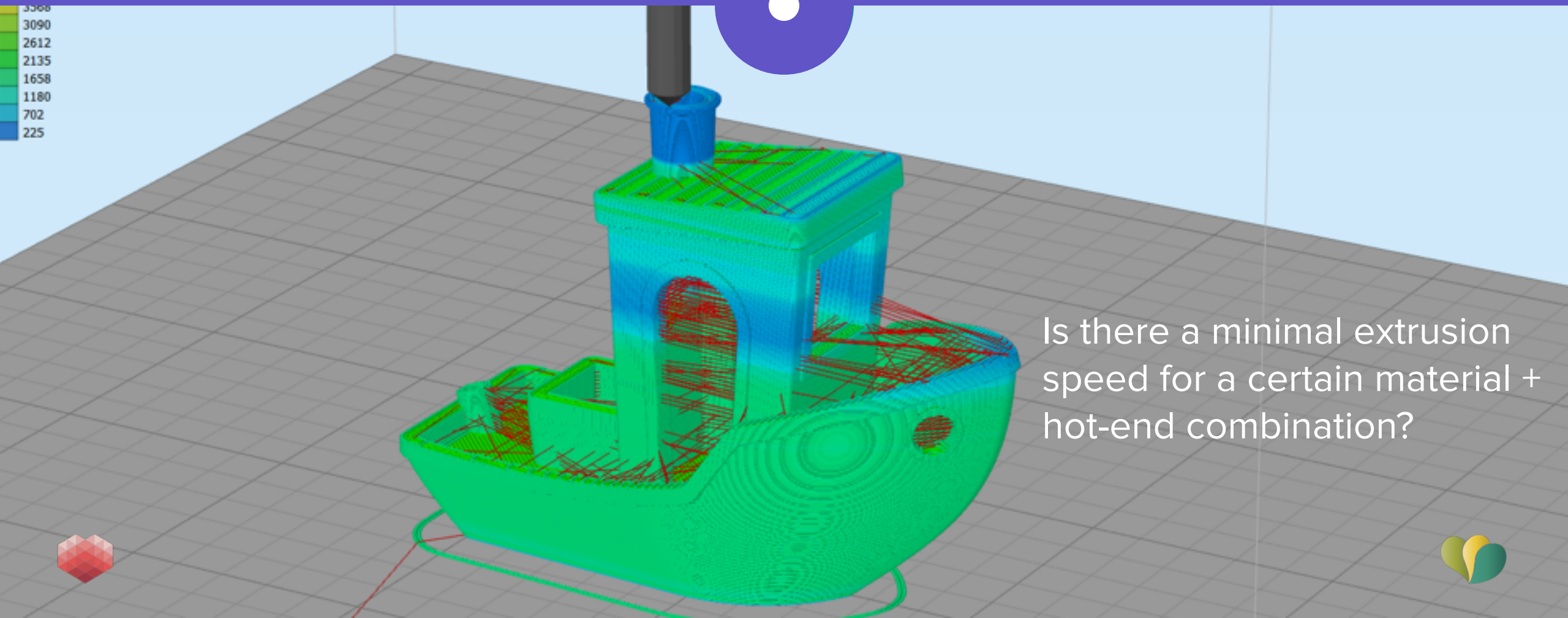


Speed is a dynamic setting and therefore flow mm3/s varies, but temperature stays constant...

Speed, Temperature, Layerheight

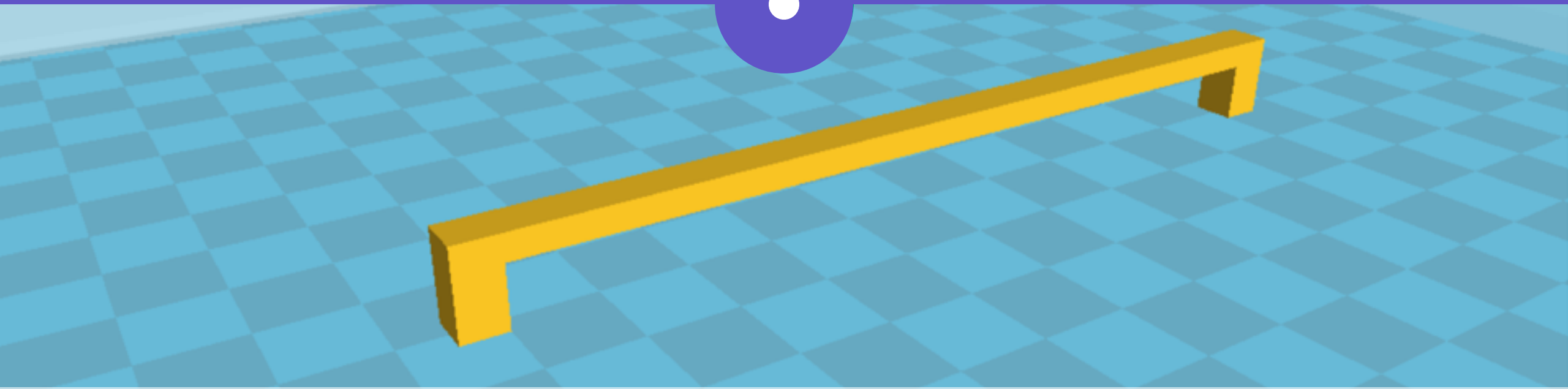


Speed, Temperature, Layerheight



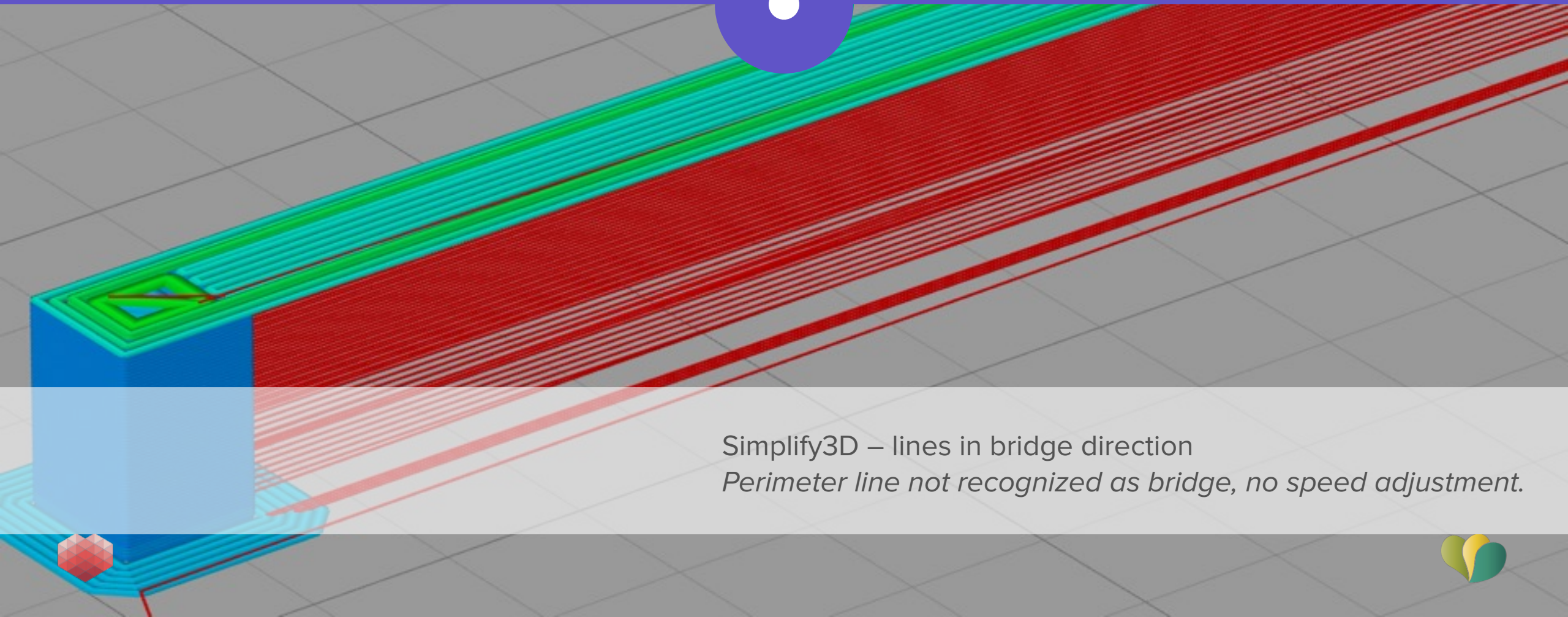
Is there a minimal extrusion speed for a certain material + hot-end combination?

Bridging with Co-Polyester



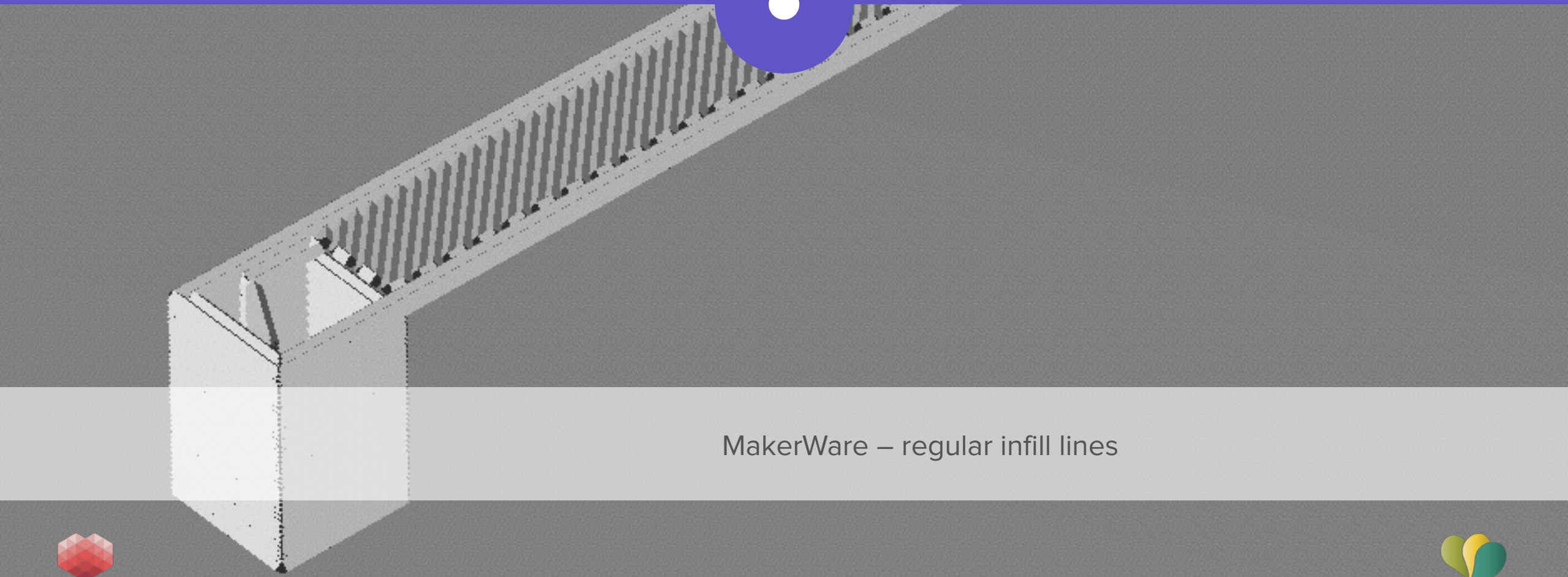
Slicers have different ways of handling bridges.

Bridging with Co-Polyester



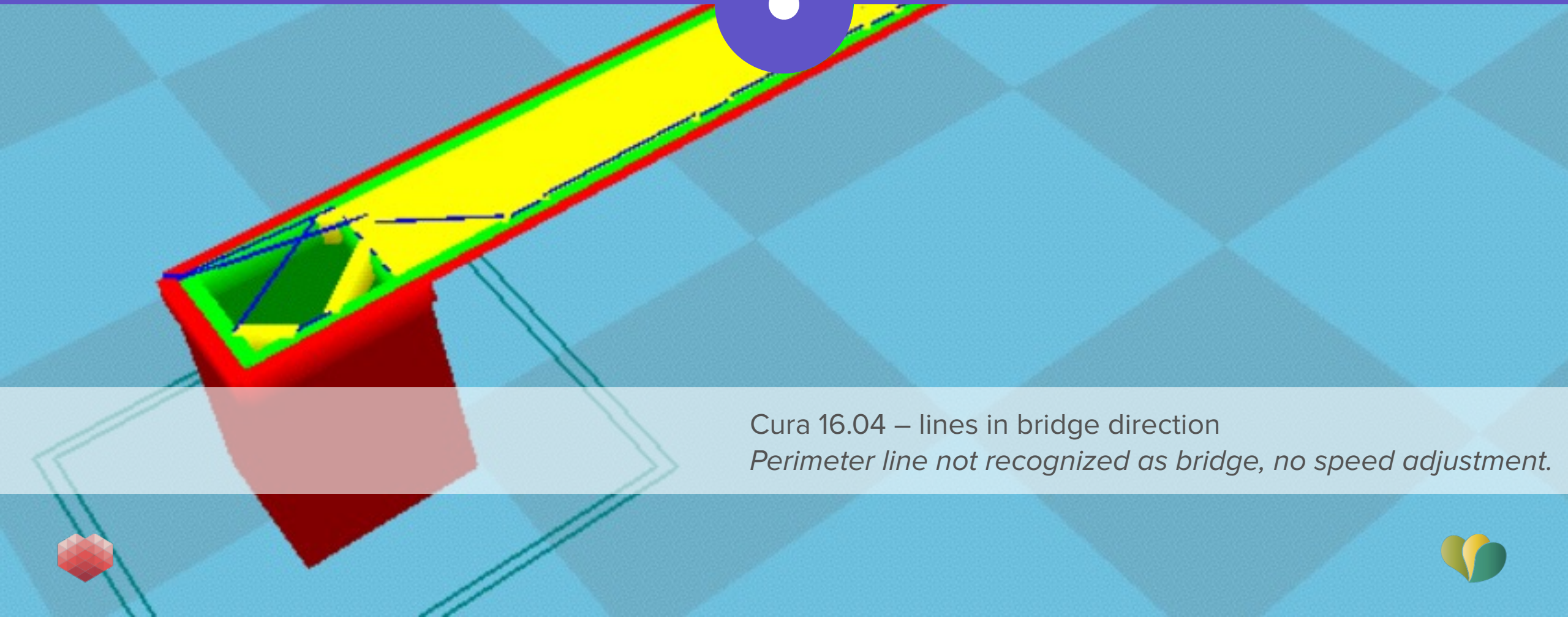
Simplify3D – lines in bridge direction
Perimeter line not recognized as bridge, no speed adjustment.

Bridging with Co-Polyester



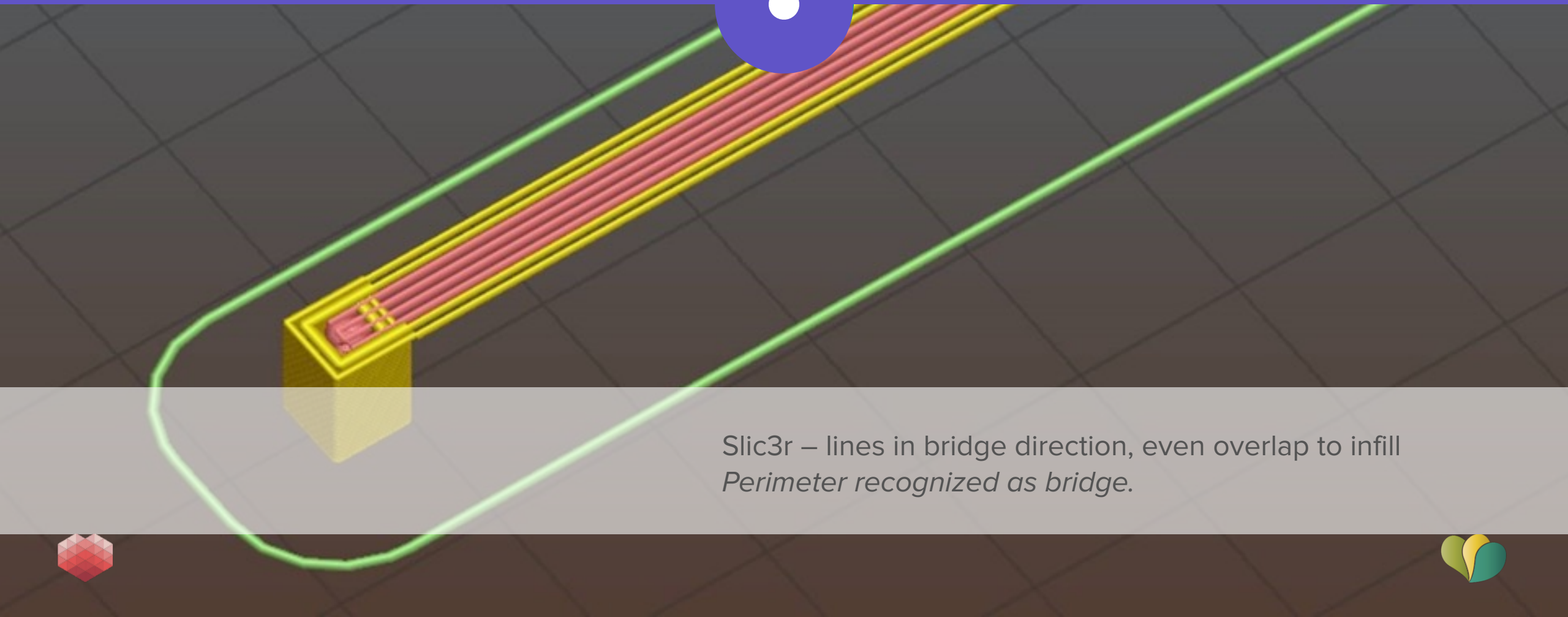
MakerWare – regular infill lines

Bridging with Co-Polyester



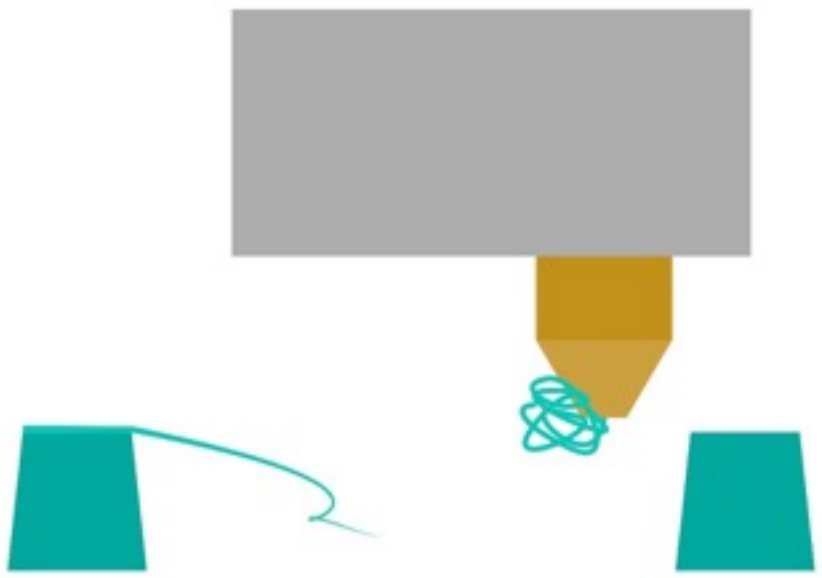
Cura 16.04 – lines in bridge direction
Perimeter line not recognized as bridge, no speed adjustment.

Bridging with Co-Polyester



Slic3r – lines in bridge direction, even overlap to infill
Perimeter recognized as bridge.

Bridging with Co-Polyester

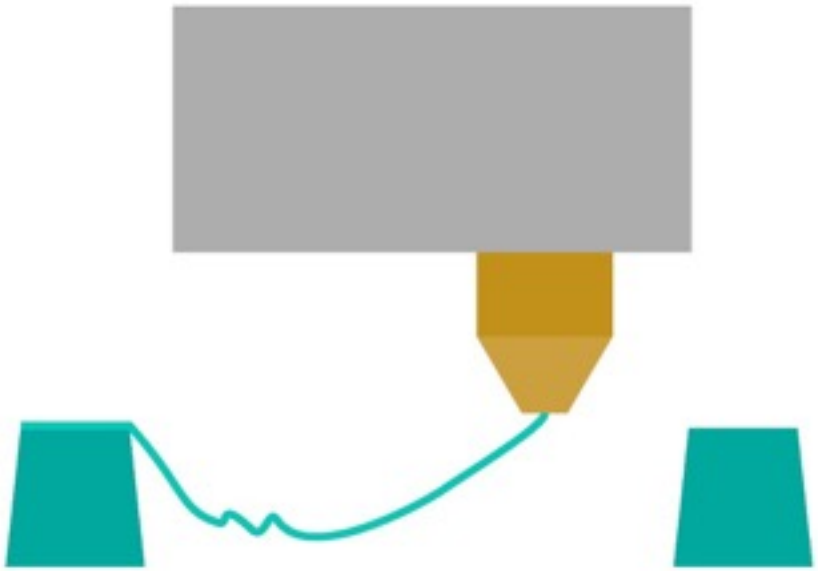


Bridging too fast: break the melt, material collects on the nozzle

Bridge material multiplier too low can give similar result.

Parameters to tweak: bridging speed and bridge flow multiplier

Bridging with Co-Polyester



Bridging too slow: material tends to drool and drop in loops

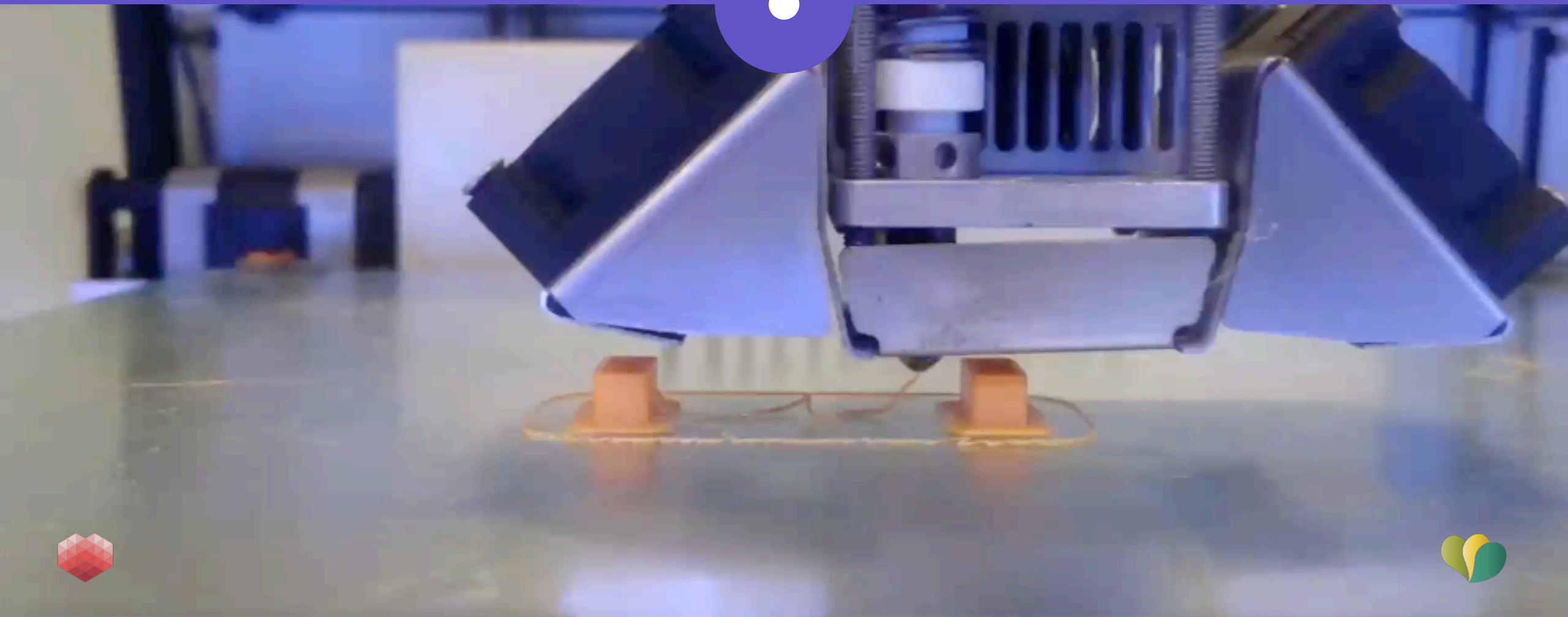
Too much material gives the same result.

Parameters to tweak: bridging speed and flow multiplier

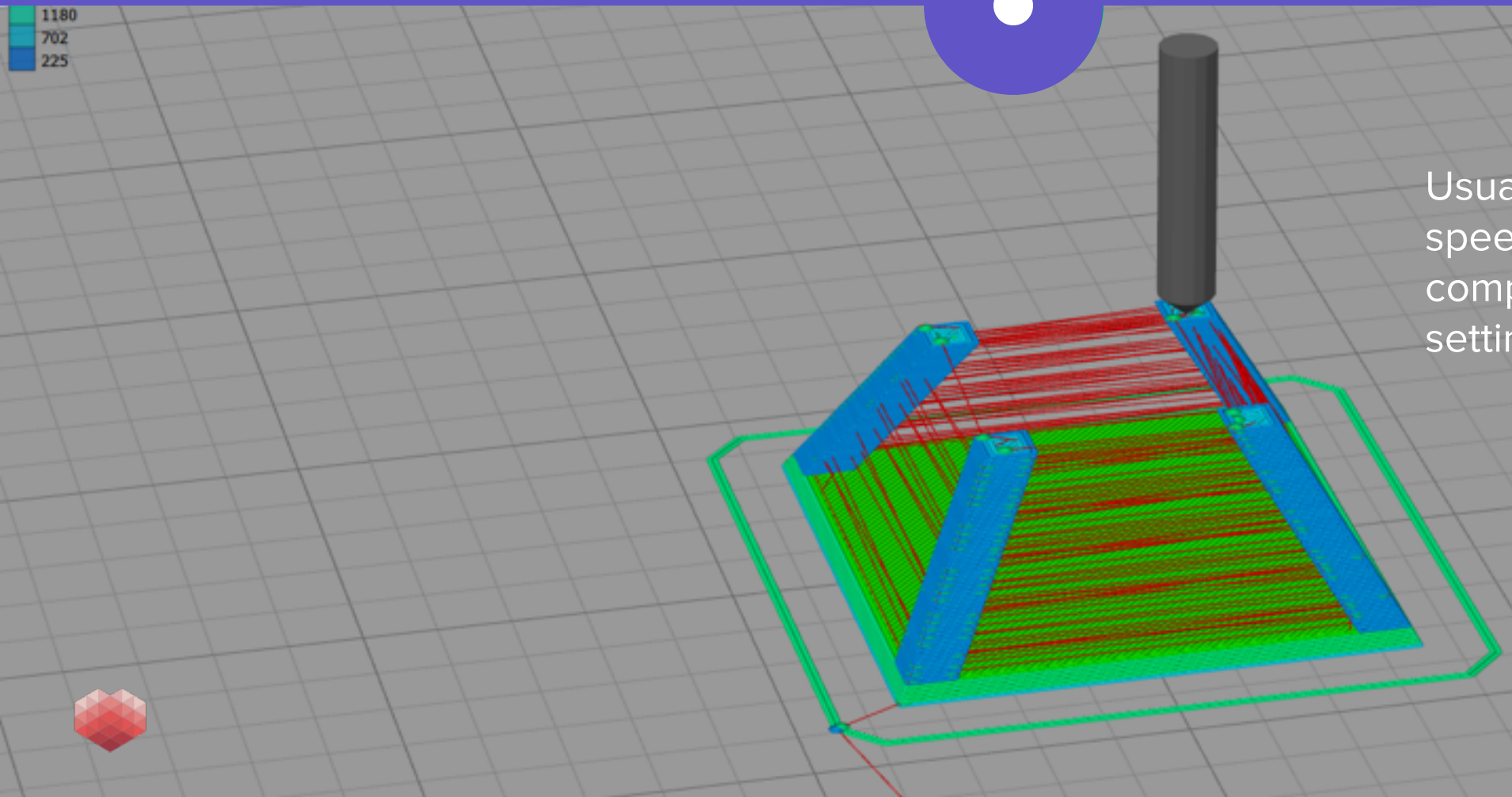
Bridging with Co-Polyester

- **Tip** – use extra bottom / top layers to make sure bridge is fully closed.
- **Tip** – check cooling settings, 100% cooling for bridging usually helps.
- **Tip** – Play with bridge multiplier / speed

Bridging with Co-Polyester

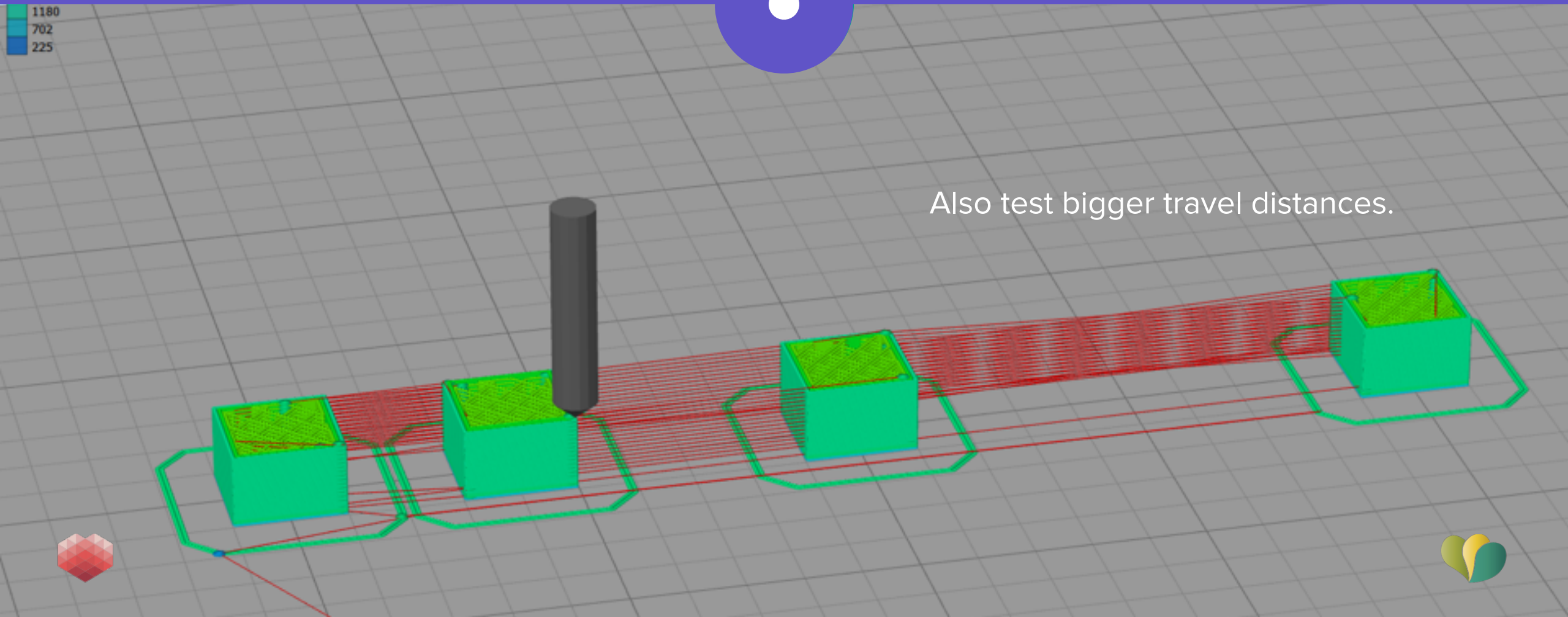


Retraction



Usually higher retraction speed and distance compared to regular PLA settings.

Retraction



Also test bigger travel distances.

Retraction

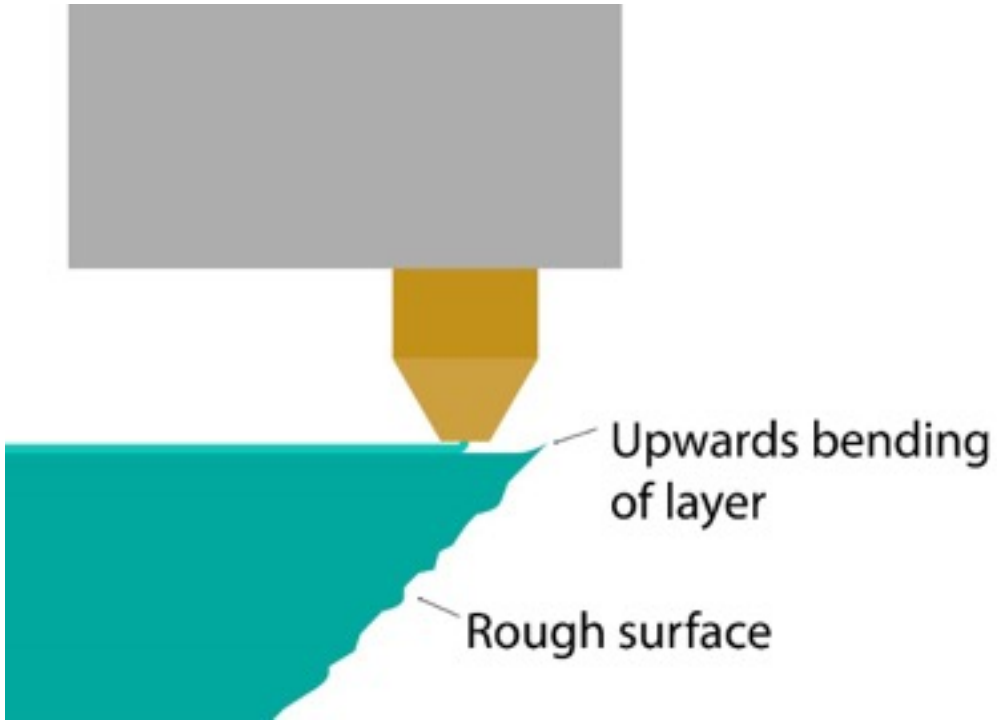
Are the stringing a result of retraction settings or other reasons?

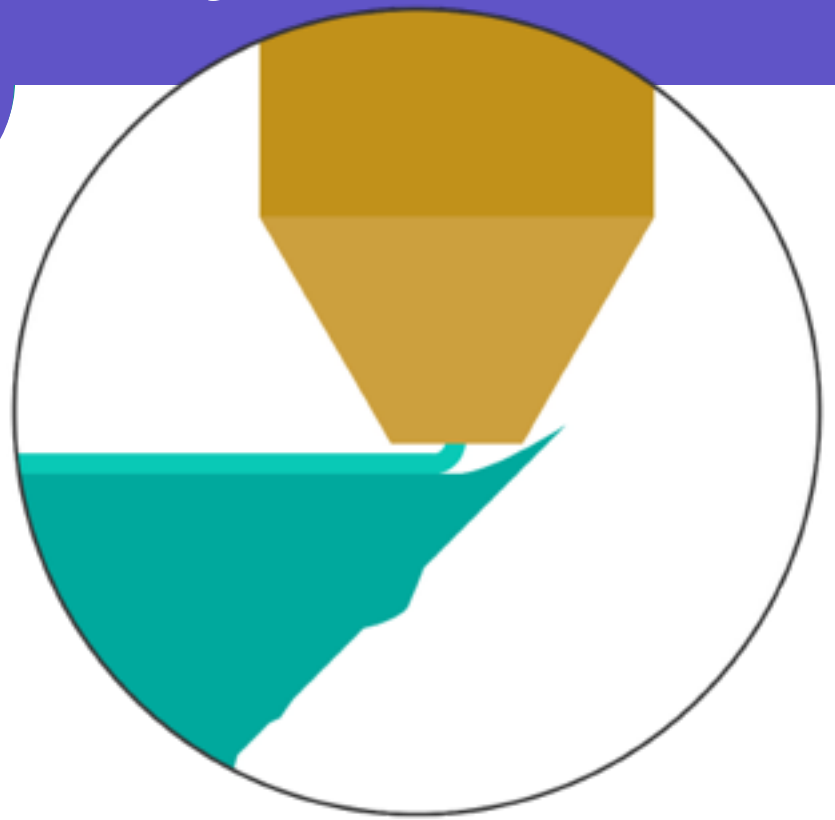
- Not enough cooling leads to upwards smearing leads to stringing.
- Travel moves over print can cause stringing.
- Failed bridges can result in stringing.

Parameters to tweak:

- Travel speed – speed of movement without extruding
- Retraction distance
- Retraction length
- Temperature

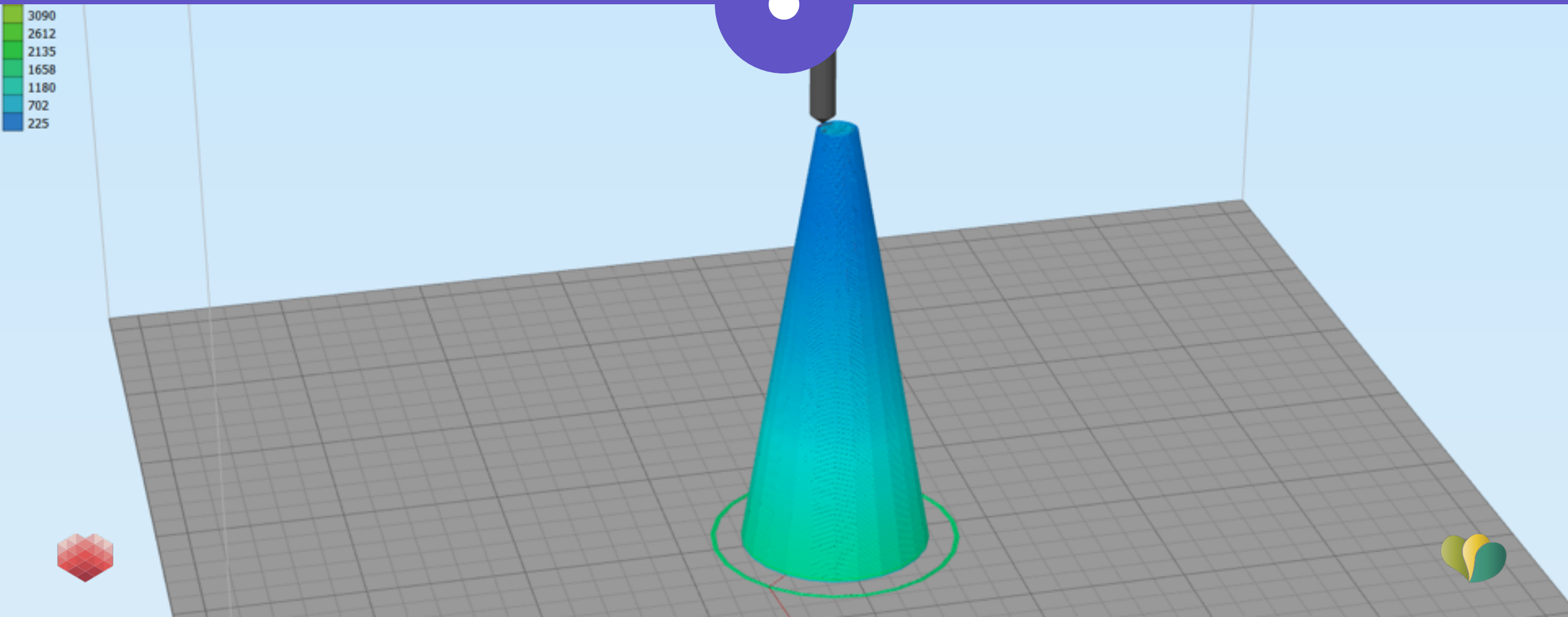
Part Cooling / Minimal Layertime



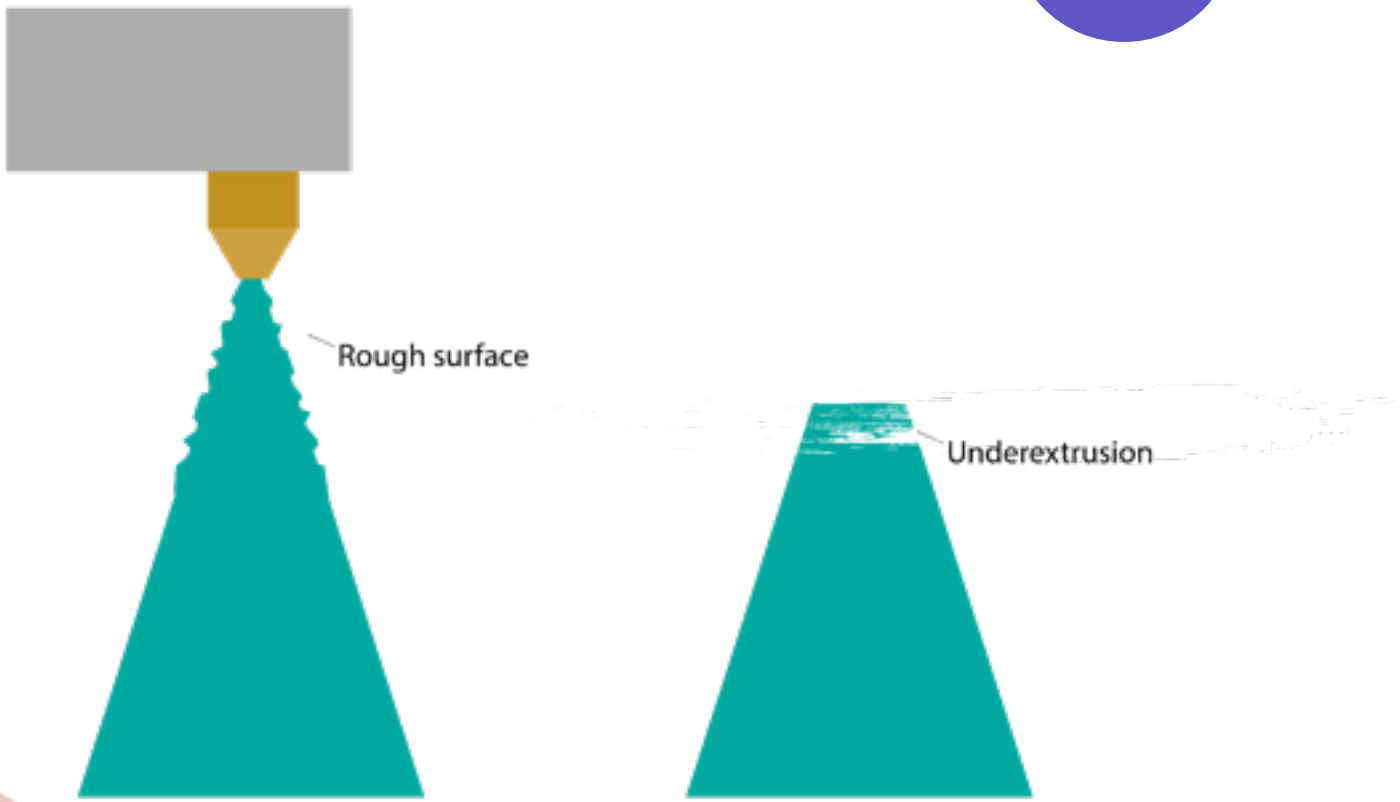


Cooling down below heat resistance temperature from processing temperature.

Part Cooling / Minimal Layertime



Part Cooling / Minimal Layertime



- Minimal Layertime too short / cooling to little?
- Minimal layer time too long / minimum print speed too slow
- Too much cooling? -> bad layeradhesion.

Part Cooling / Minimal Layertime

Too much cooling? -> bad layeradhesion -> usually noticeable after printing, not during.

Warping

Co-Polyesters need heated buildplate

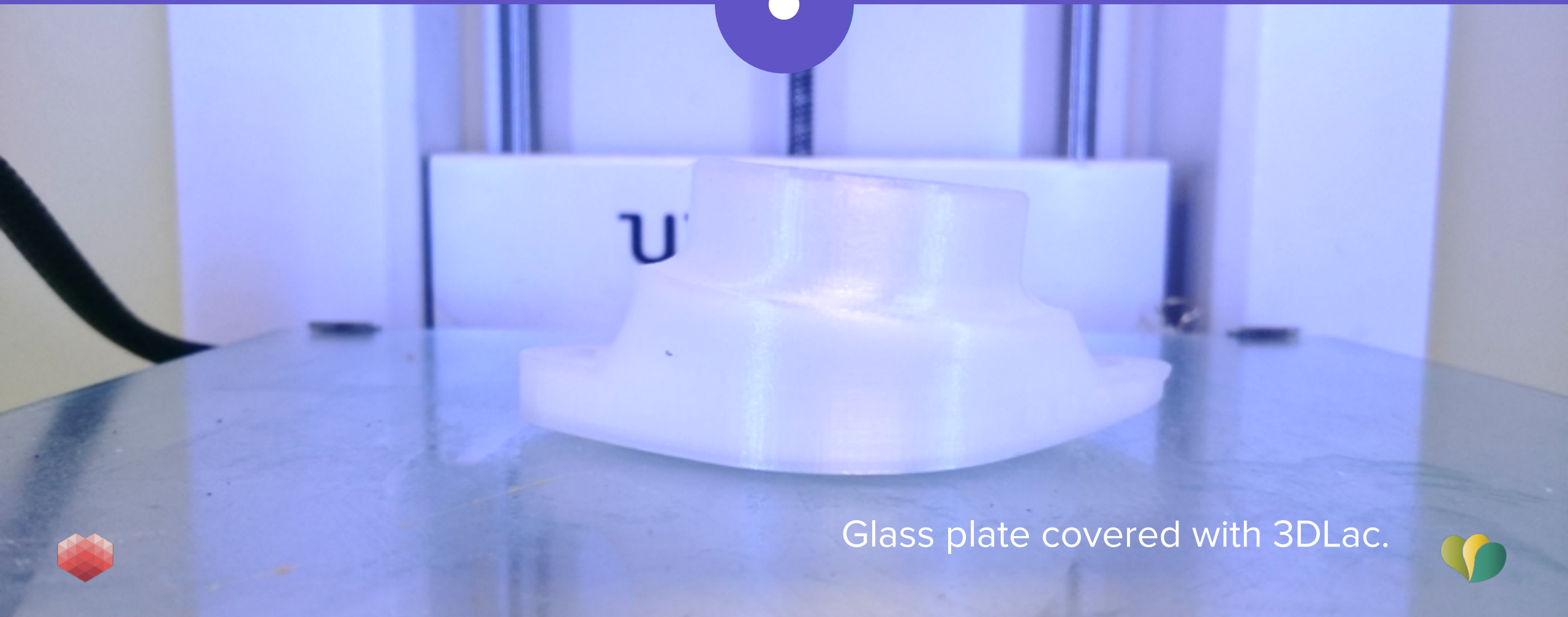
- Good start point Heated bed around TG of material.
- 5/10 C lower or higher
- Buildsurface; 3DLac, BuildTak
- Add a brim or raft.

- **Tip** - Carefully check if you're part needs cooling, if not leave it off.
- **Tip** - Check for airflow in the room, cold air makes it worse.
- **Tip** – more infill, more warping

colorFabb 910A

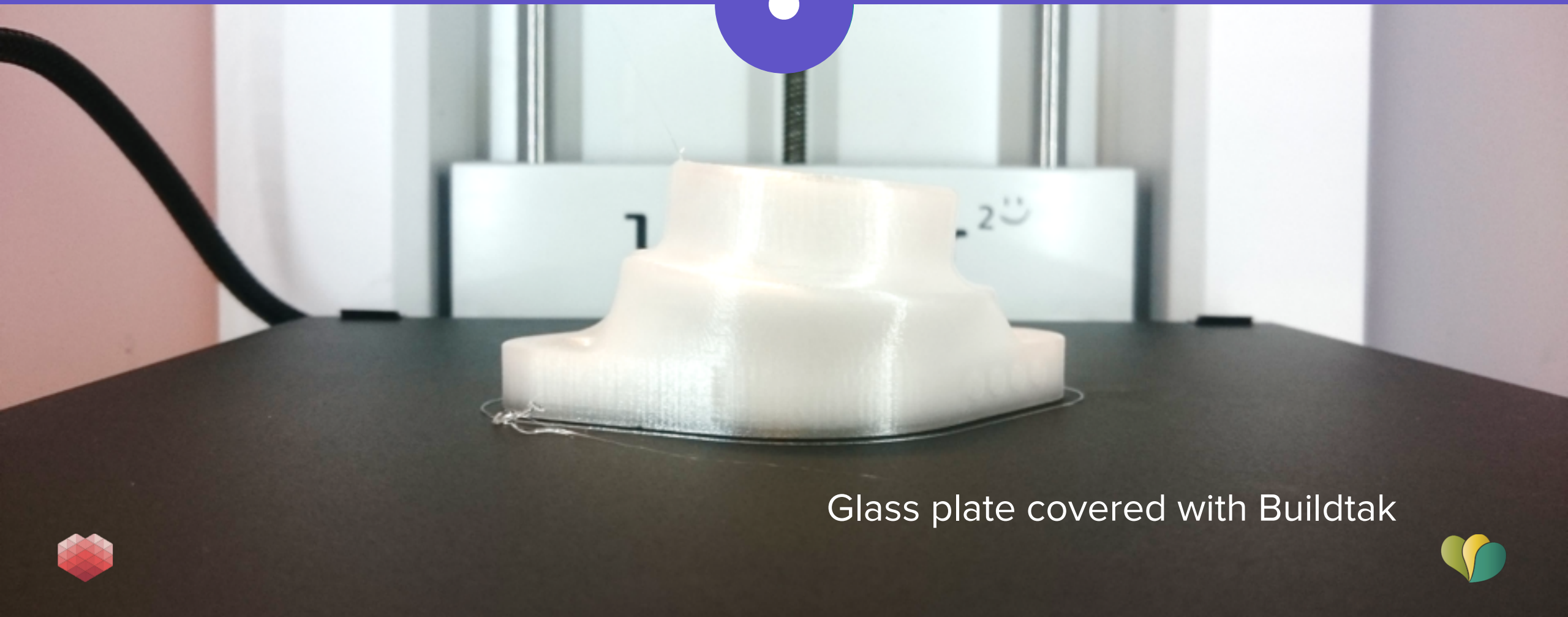
- high bed temperature 100/110C for glass
- 80/90C for PEI
- 100C /110C for BuildTak

Warping



Glass plate covered with 3DLac.

Part Cooling / Minimal Layertime



Glass plate covered with Buildtak

Part Cooling / Minimal Layertime

Sample Pack

colorFabb nGen

Eastman Amphora 3300

Alround

colorFabb XT

Eastman Amphora 1800

Tough

colorFabb 910A

Eastman

Temperature Resistant

beta

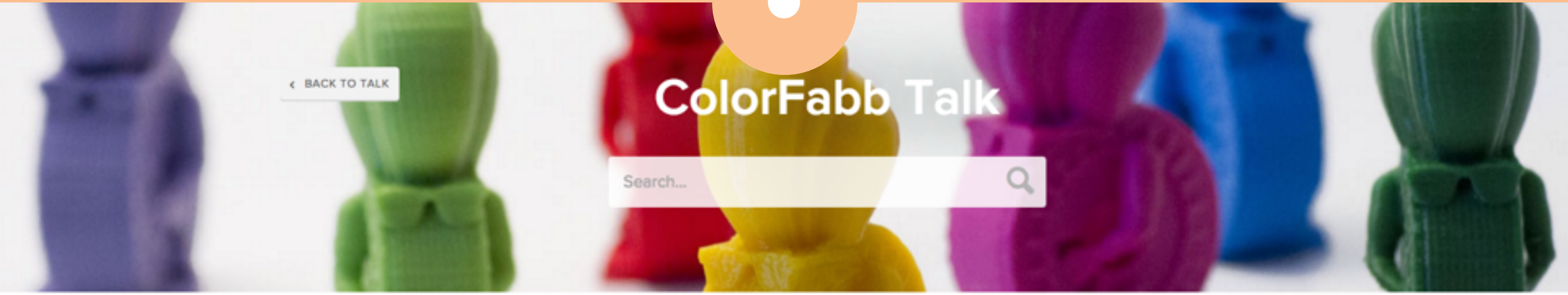
General Settings - Ultimaker 2

	colorFabb nGen	colorFabb XT	colorFabb 910A beta
Temperature Settings	230C	245C	260C
Bed Temperature	80C	75C	110C
Print Speed	50 mm/s	40 mm/s	50 mm/s
Layer Height	0.1 - 0.2 mm	0.1 - 0.2 mm	0.1 - 0.2 mm
Retraction Speed	25 - 45 mm/s	25 - 45 mm/s	25 - 45 mm/s

General Settings - Lulzbot Mini

	colorFabb nGen	colorFabb XT	colorFabb 910A beta
Temperature Settings	230C	240C	260C
Bed Temperature	70C	60 - 65C	90/100C
Print Speed	50 mm/s	40 mm/s	50 mm/s
Layer Height	0.1 - 0.2 mm	0.1 - 0.2 mm	0.1 - 0.2 mm
Retraction Speed	20 mm/s	10 mm/s	20 mm/s

Share settings and learn from others



POPULAR | NEW | MY TAGS

START A NEW /COLORFABB THREAD

18

Show me what you've gooooot !

Since I begin my internship at 3D Hubs I always wanted to learn how to use sculpting software like Z-Brush. Lucky I was to have a great sculptor working just next to me. After spending a few bucks in

victorp 6 days ago 14 comments (14 new)

/3D Hubs Team /bronzeFill /ColorFabb /Zbrush

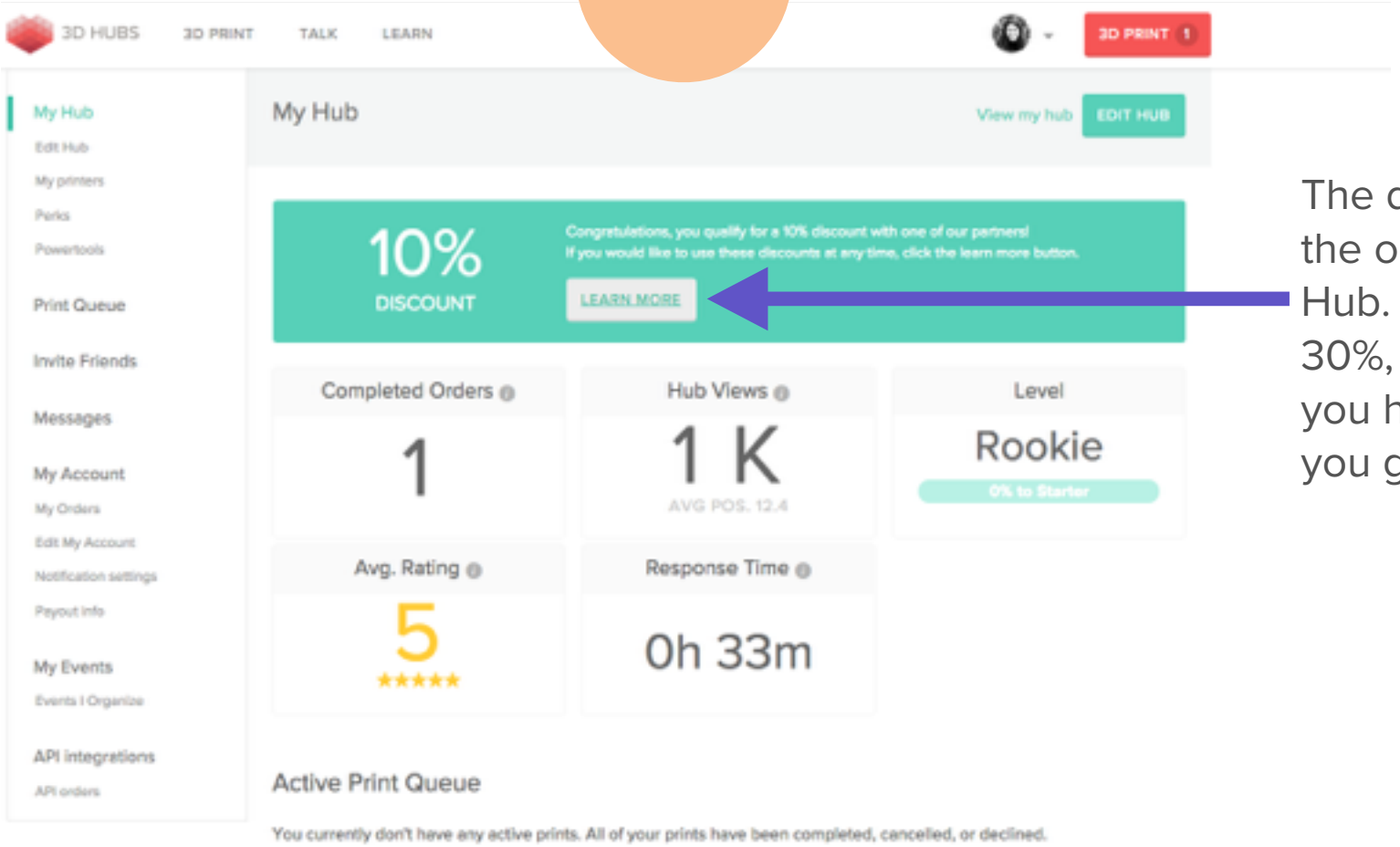
ColorFabb Talk

77 followers

UNFOLLOW /COLORFABB

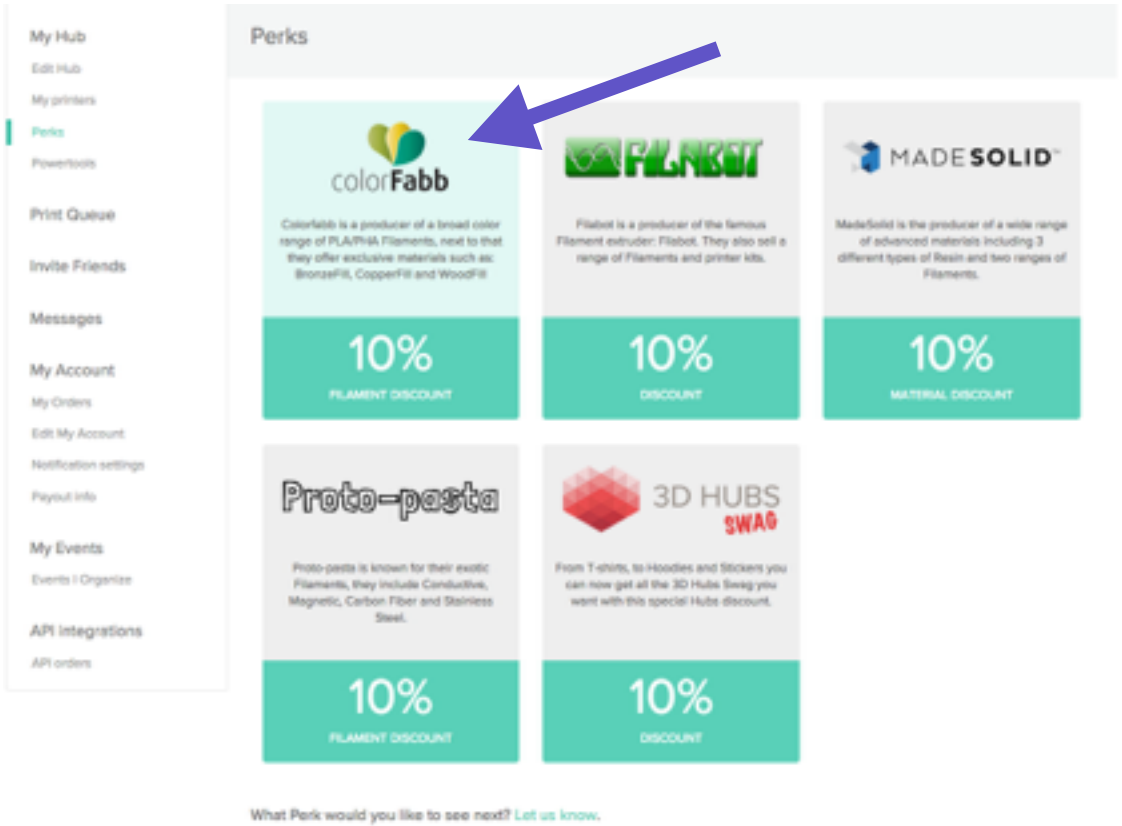
About ColorFabb

Hub Perks

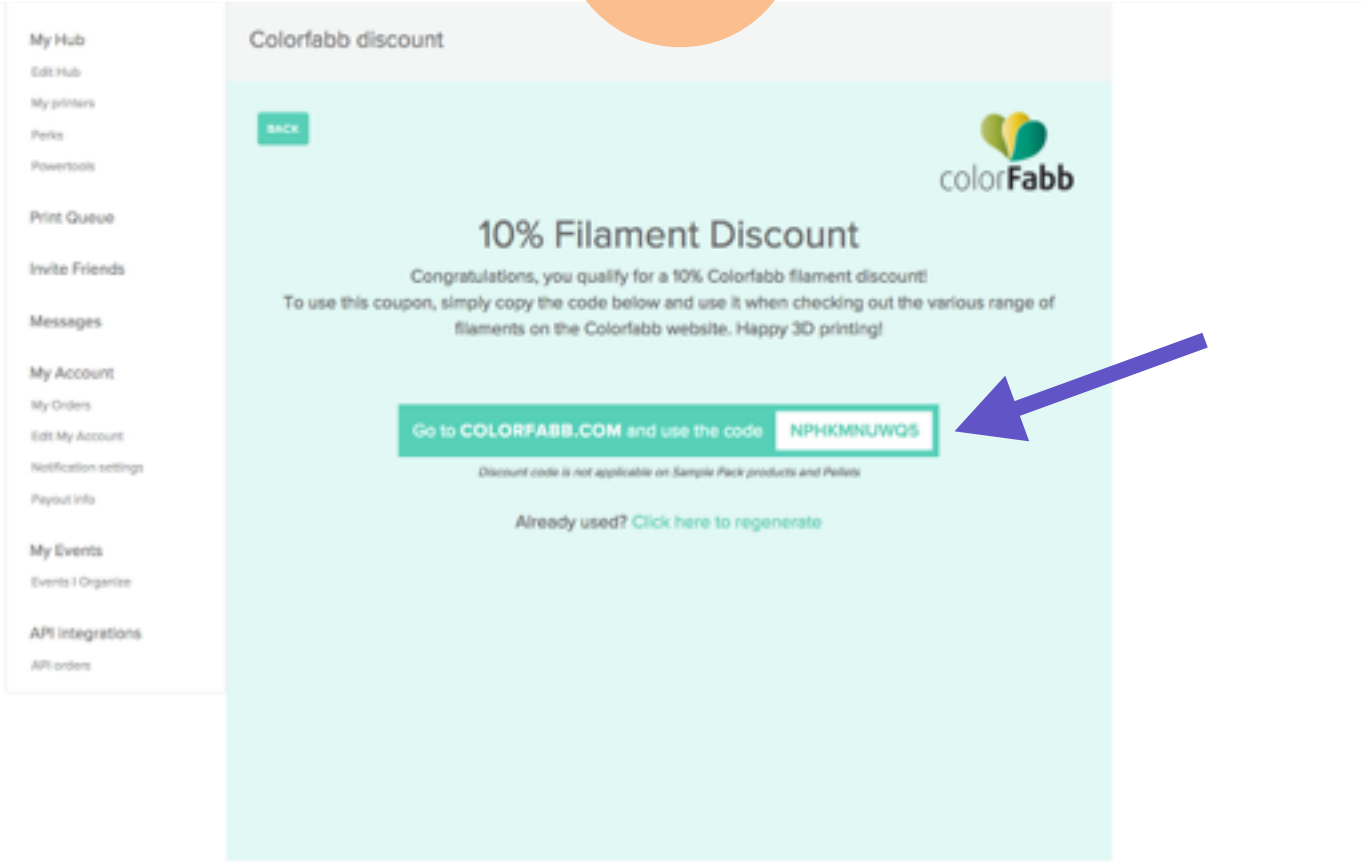


The discount is based on the order activity of your Hub. It goes from 10% to 30%, so the more orders you have the more discount you get!

Hub Perks


My Hub
Edit Hub
My printers
Perks
Powertools
Print Queue
Invite Friends
Messages
My Account
My Orders
Edit My Account
Notification settings
Payout info
My Events
Events I Organize
API integrations
API orders
Perks
colorFabb
10%
FILAMENT DISCOUNT
FILABOT
10%
DISCOUNT
MADESOLID
10%
MATERIAL DISCOUNT
Proto-pasta
10%
FILAMENT DISCOUNT
3D HUBS
SWAG
10%
DISCOUNT
What Perk would you like to see next? Let us know.

Hub Perks


My Hub
Edit Hub
My printers
Perks
Powertools
Print Queue
Invite Friends
Messages
My Account
My Orders
Edit My Account
Notification settings
Payout info
My Events
Events I Organize
API integrations
API orders
Colorfabb discount
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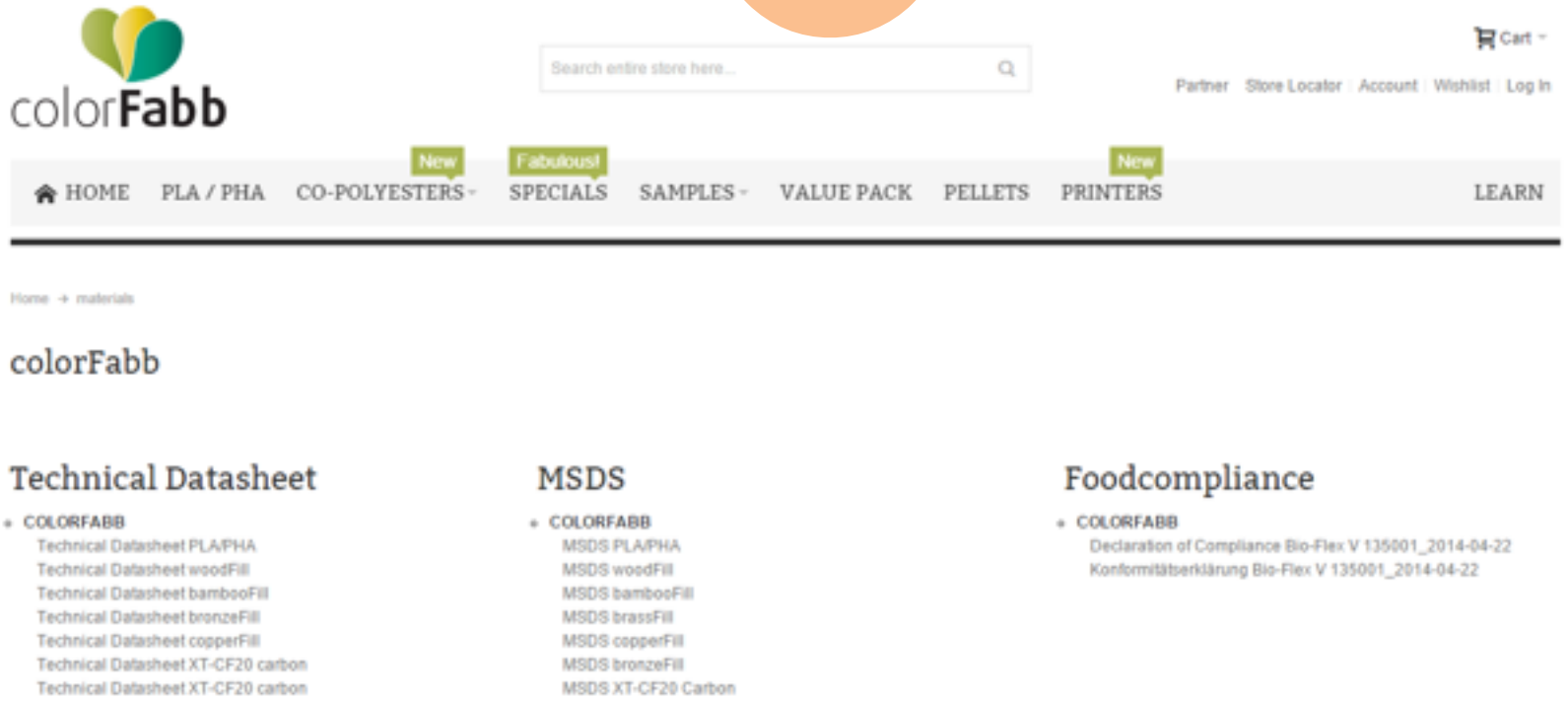
10% Filament Discount
Congratulations, you qualify for a 10% Colorfabb filament discount!
To use this coupon, simply copy the code below and use it when checking out the various range of filaments on the Colorfabb website. Happy 3D printing!
Go to COLORFABB.COM and use the code
NPHKMNUWQ5
Discount code is not applicable on Sample Pack products and Pellets
Already used? Click here to regenerate

Technical Datasheet

colorfabb.com/materials



Have fun experimenting!

support@colorfabb.com

3dhubs.com/talk