

Multi-Planar 3D Printer



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Group 1

<https://multiplanar3dprinter.github.io/>



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Background

Small desktop 3D printers, particularly FFF (fused filament fabrication) printers have been gaining traction for rapid manufacturing because they are able to produce parts using a low-cost machine without extensive infrastructure or physical space. This allows users to create various geometries that would have taken much more time and effort or would simply be impossible to fabricate with conventional subtractive manufacturing.

Motivation

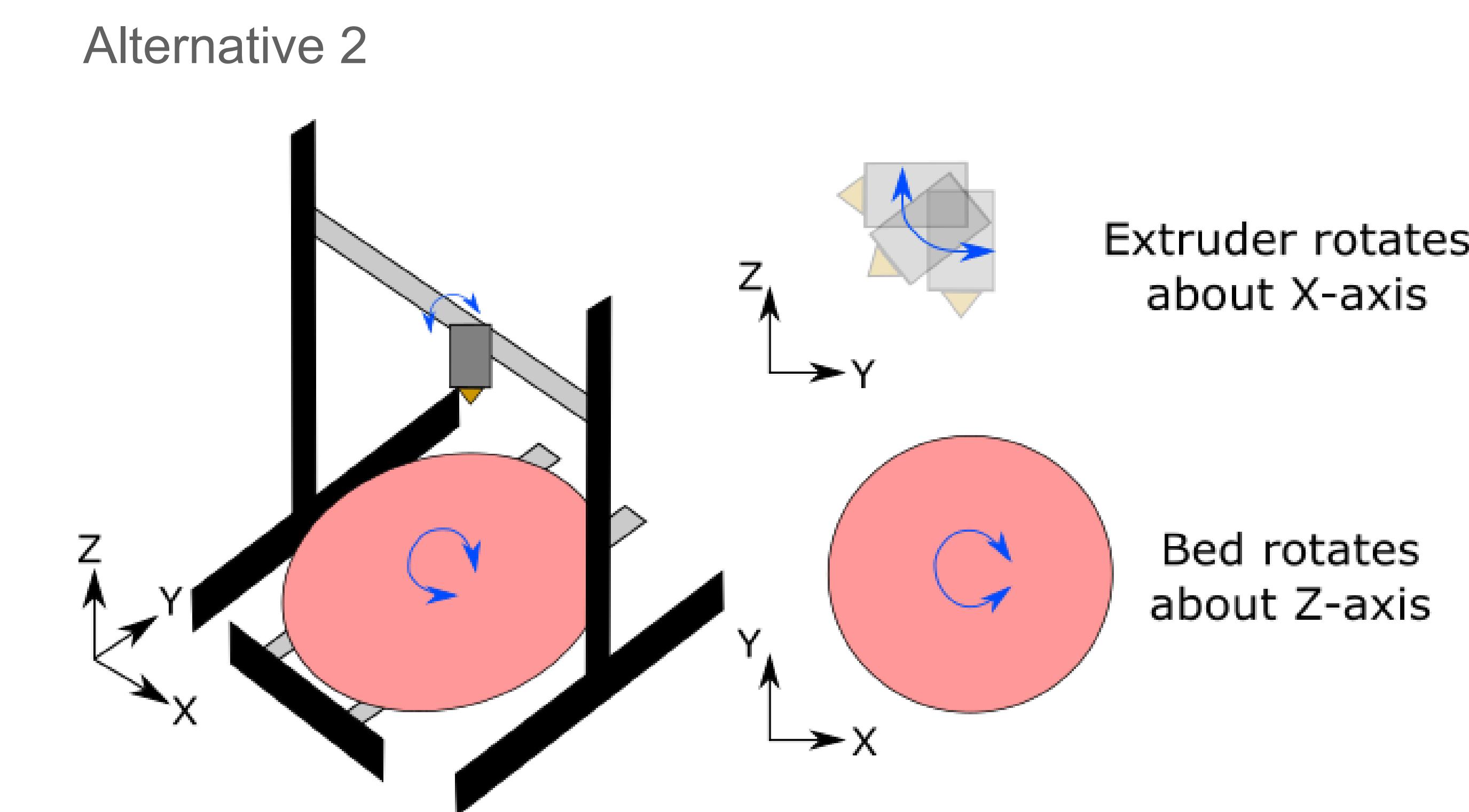
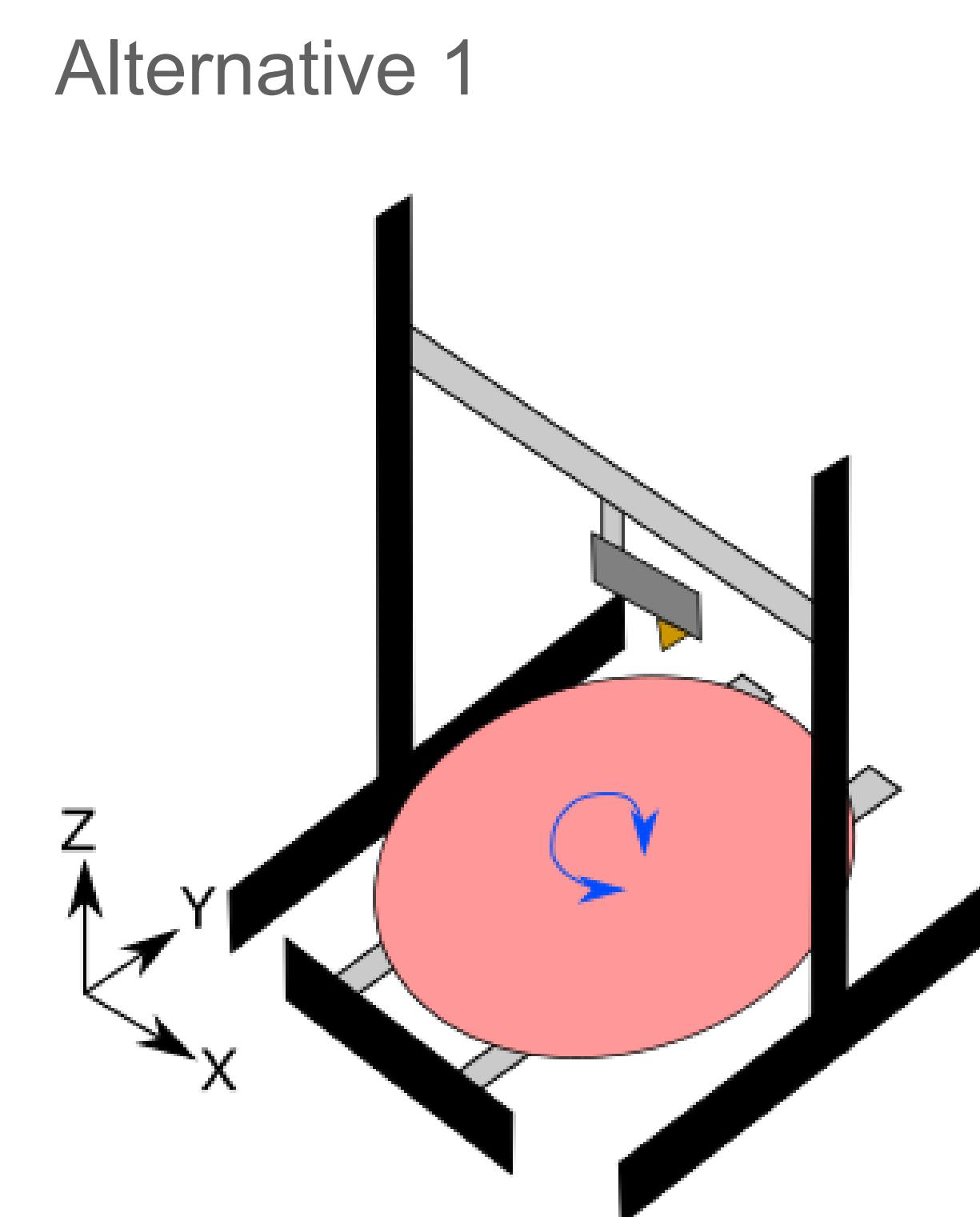
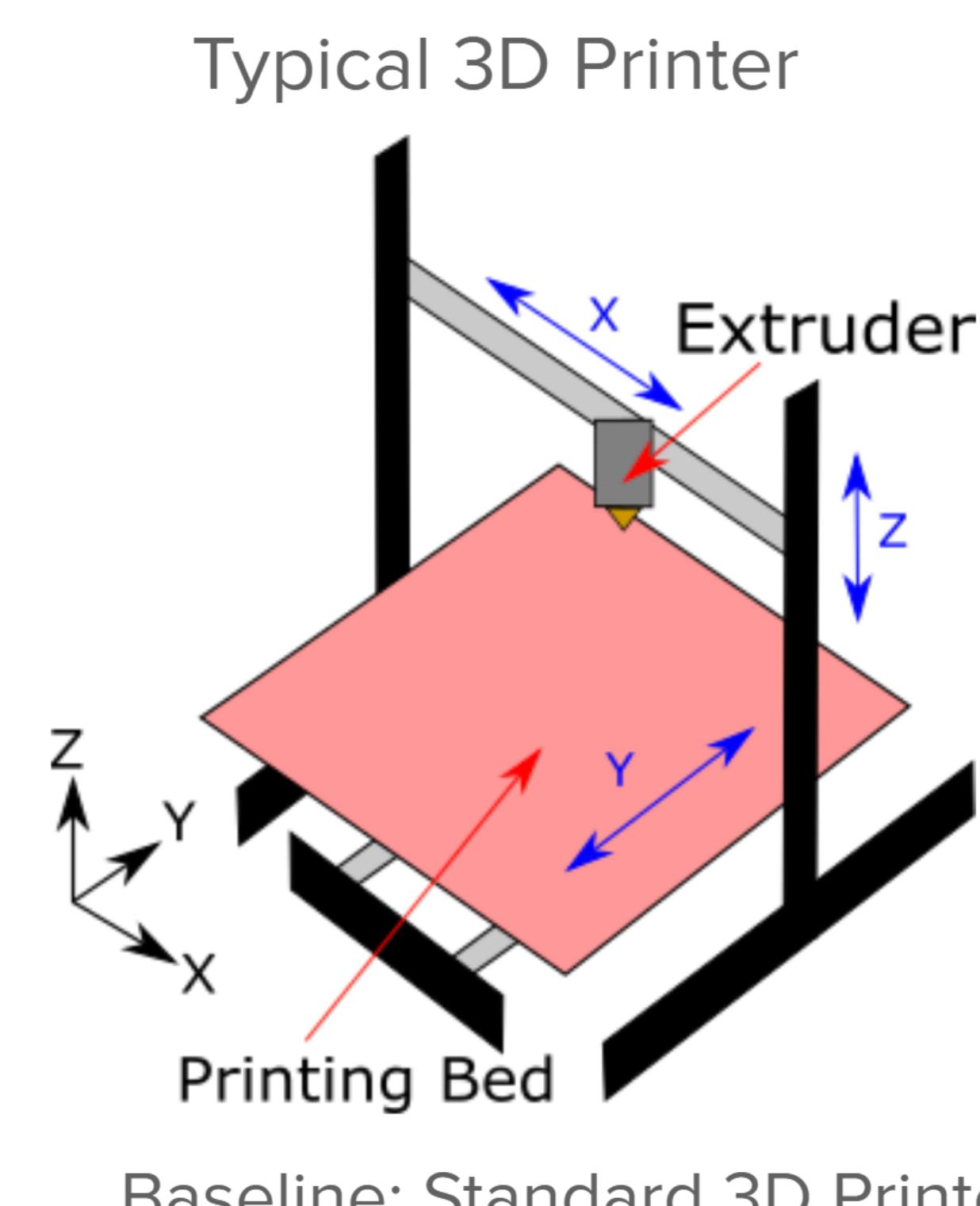
Current FFF 3D printers are designed to print parts in stacked horizontal layers, building the part from the bottom-up. To print sharp overhangs and other features without material below them, sacrificial support material is required. Meaning:

- ⌚ Additional printing time
- 🗑 Waste
- 🔧 Post-processing

Objective

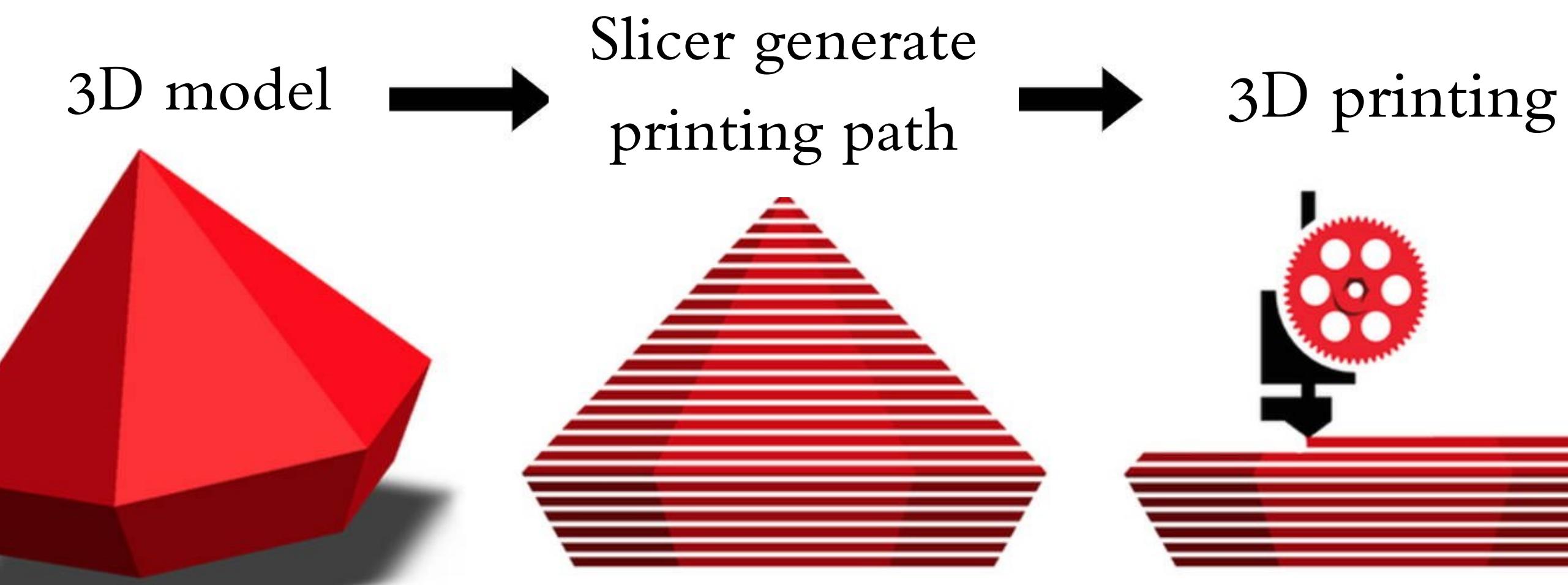
Print along additional axes to reduce or eliminate support material without compromising on part complexity.

Alternative Designs



Baseline: Standard 3D Printer
- 3 linear axes of motion

Process

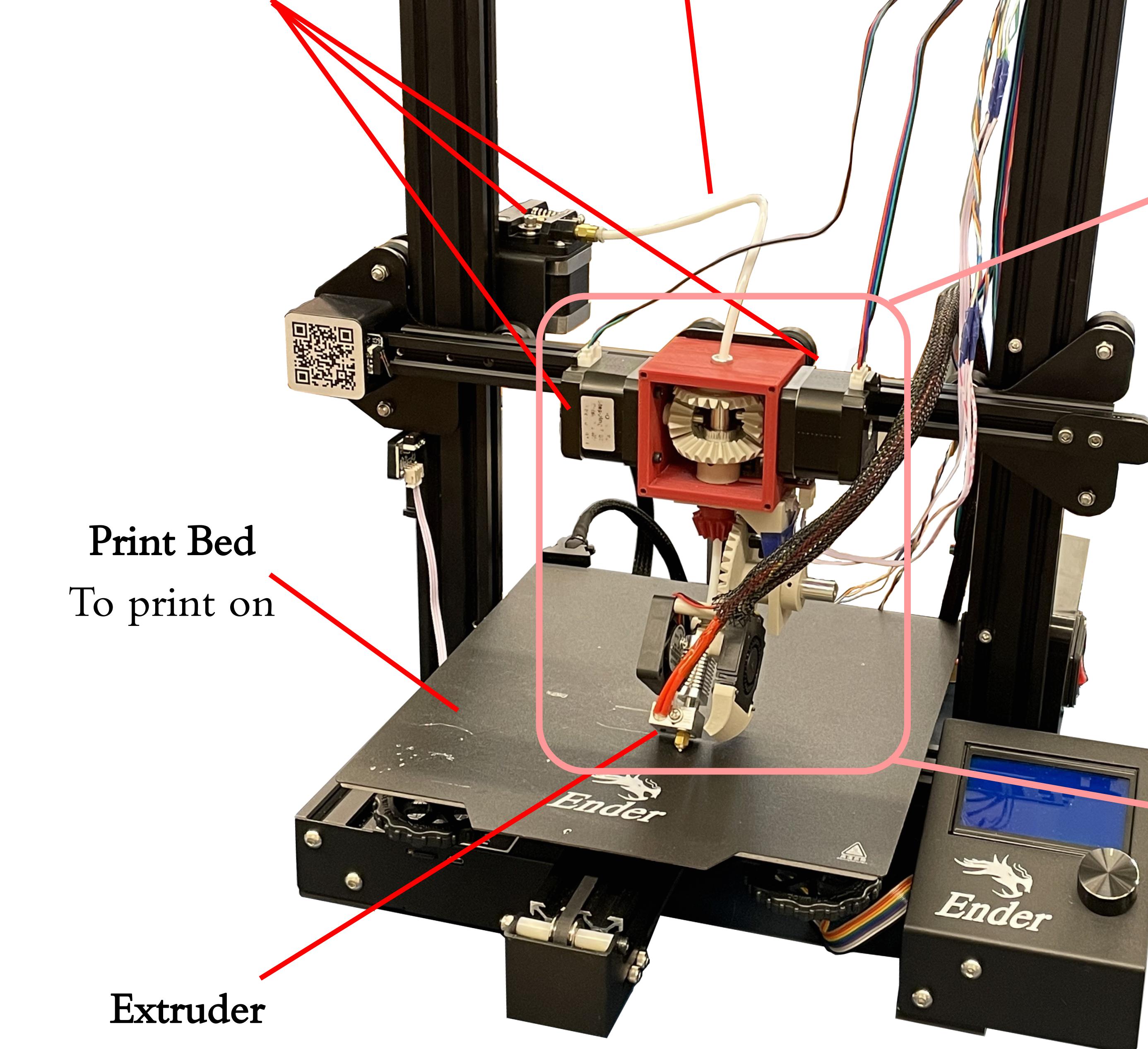


Filament Tube
Feed in printing material

Motors
Control movements

Print Bed
To print on

Extruder
Melt & push out filament



Design

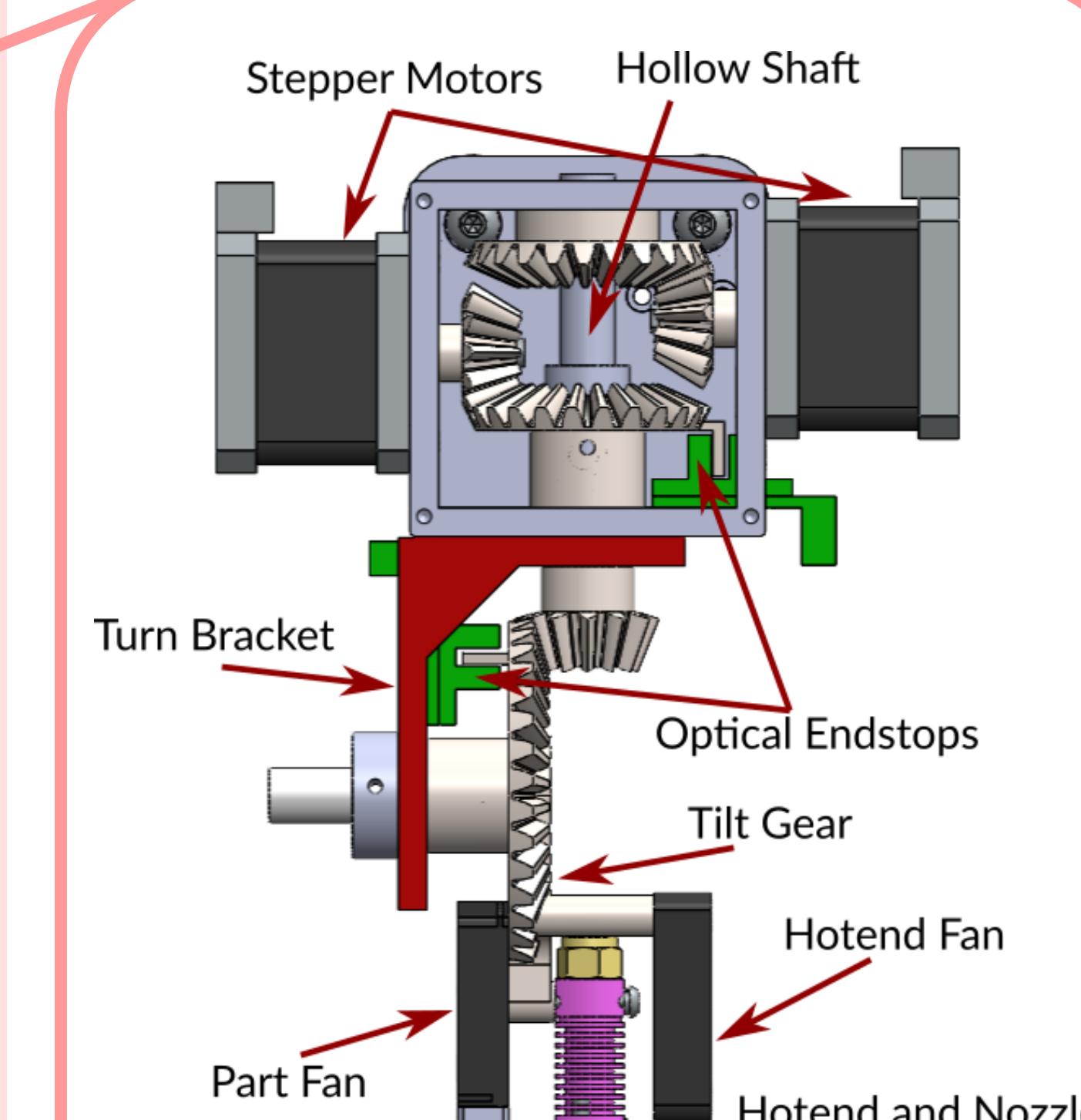
Goal: Add two rotational axes to standard 3D printer

Mechanical: Swerve/differential drive inspired gear system

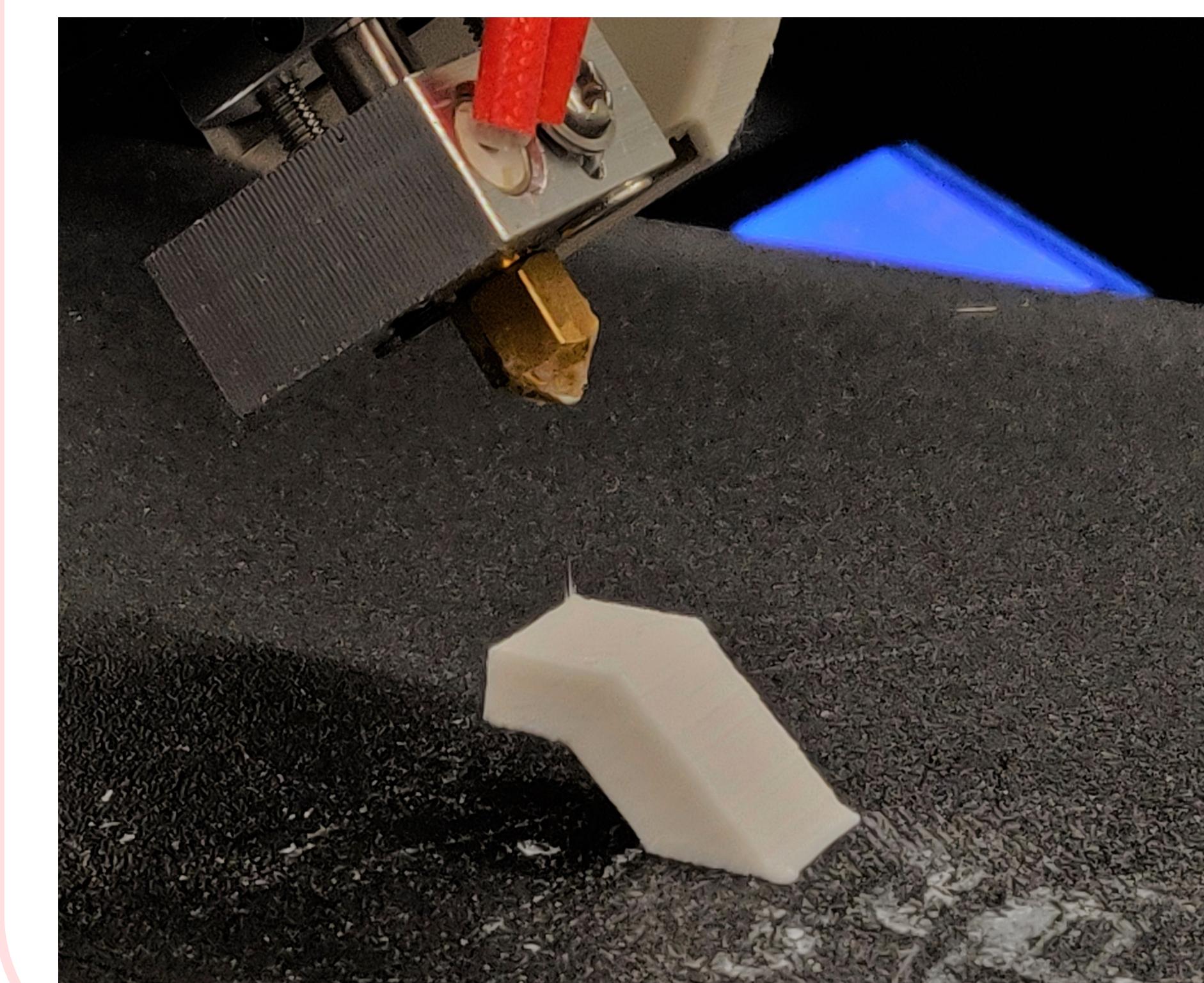
Electrical: Custom controller board for existing peripherals and two new axes

Slicer: Modified Slicer4RTN software to generate 5-axis specific toolpath

Firmware: Custom code (added to open-source controller) to control rotational axes

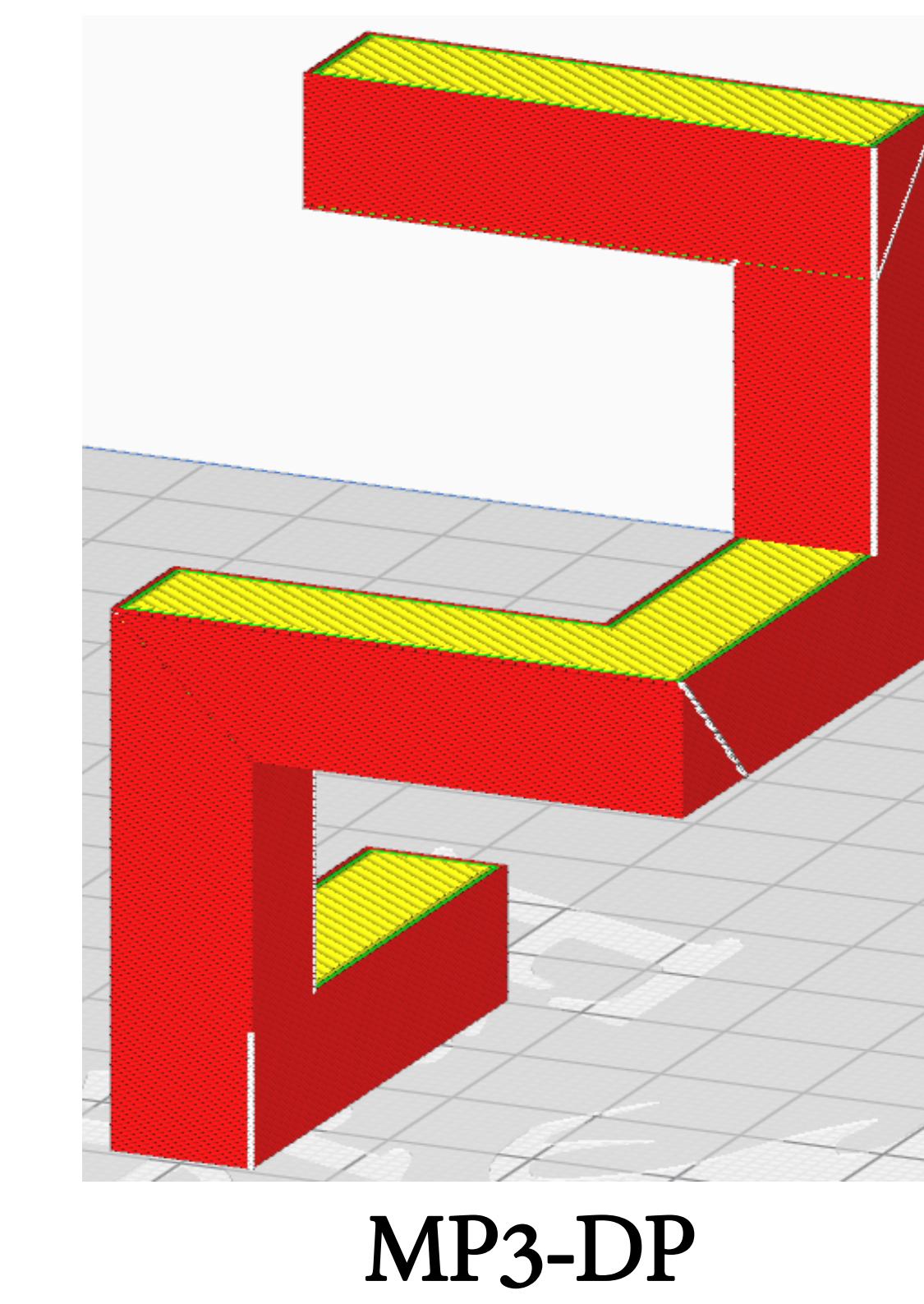
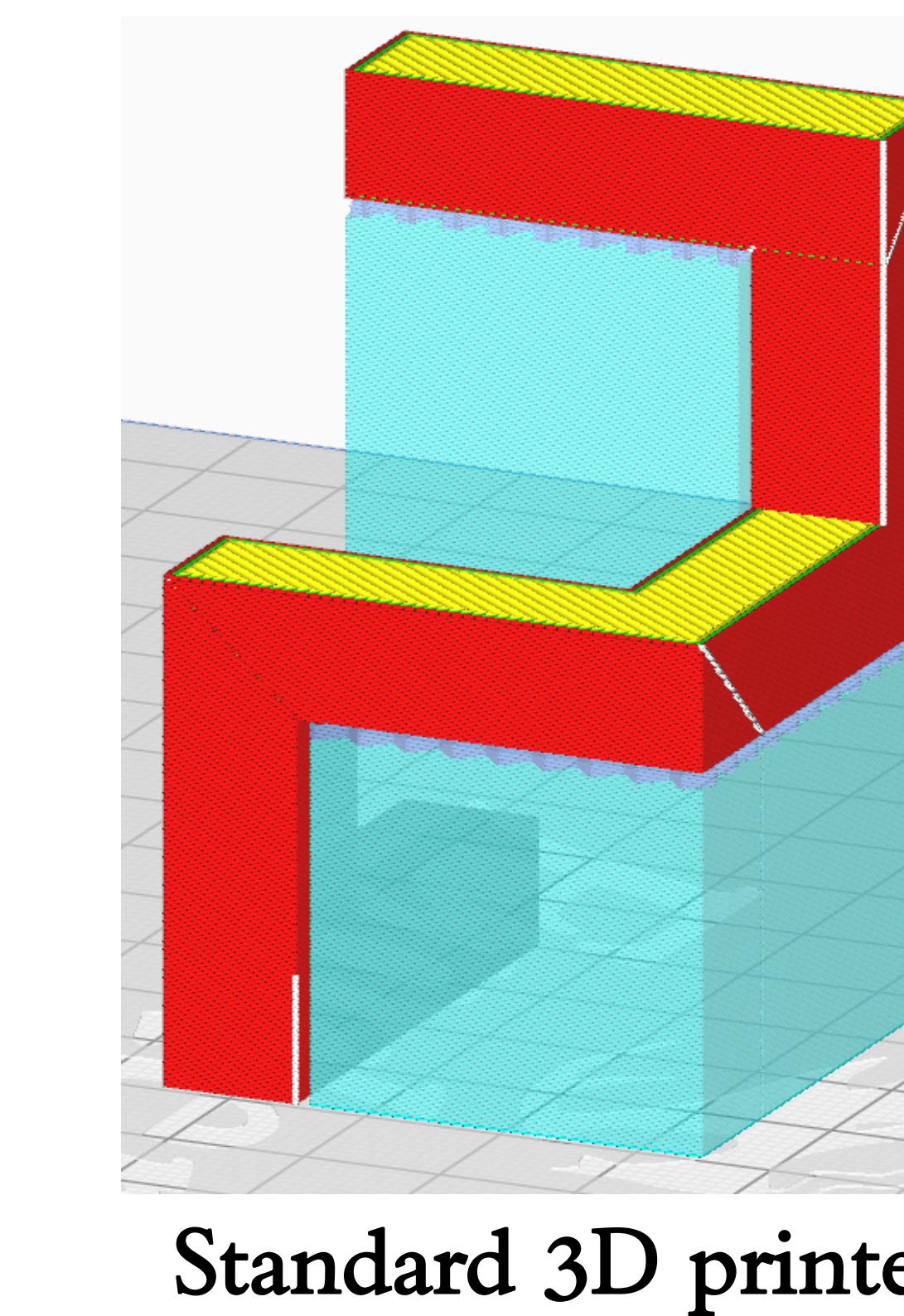


Test/Validation



Advantage

No support needed for 90° overhang



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