3D Printing -Bambu P1S + AMS

Combining AI, FreeCAD & 3D printing

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Enhanced & edited by JMB
*(*** Thanks Shawn Garrett !!!)*

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Introduction to Bambu P1S + AMS

Overview and Key Capabilities

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Bambu P1S Overview



- Compact, 256 mm^3 build volume
- Dual-core 24 V stepper drivers for '*silent*' operation
- Print speeds up to 400 mm/s at 0.2 mm layer height
- Built-in filament detection & auto-leveling (Bambu Calibration)
- WiFi only; no Ethernet port
- Fully enclosed chamber with carbon filter and auxiliary cooling fans (designed for engineering filaments like ABS and ASA) [1]
- SD-Card for saved prints and WiFi SSID/pswd file. (permits staying offline)

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Automatic Material System (AMS)

- Supports up to 4 filaments simultaneously
- On-board filament storage with color-coded channels
- Automatic filament change during a single print job
- Built-in filament filament sensors for error detection
- Reduced print downtime – no manual filament swaps
- Increased print reliability with auto-leveling & filament sensing
- Simplified workflow for beginners and professionals
- Support for high-speed, high-quality prints across materials

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Slicing with Bambu Studio & Orca Slicer

- Bambu Studio optimized profiles for AMS
- Orca Slicer supports advanced multi-material settings
- Both tools integrate with Bambu API for real-time status
- User-friendly interface for parameter tuning (Bambu Studio offers more help, but has a horrible bug in Ubuntu Mate or Gnome desktops)
  - Mate: hovering (even accidentally) on any parameter locks up the entire GUI desktop, requiring a ‘sudo systemctl restart lightdm’ command!
  - Gnome: hovering (even accidentally) on any parameter locks up Bambu Studio!
- Orca Slicer has a less helpful popup menu text, but may complain at startup about incompatible or unsupported parameters, but does not lockup on anything.

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Getting Started with Bambu Studio

Bambu P1S with AMS

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1️⃣ Bambu Studio Installation & Initial Setup

- Download the latest Bambu Studio installer from the official Bambu Lab website.
  - Currently BambuStudio_ubu24-v02.08.04.57-20260922164607.AppImage
- Install on Windows, macOS, or Linux (follow on-screen prompts).
- Launch the program (optional: sign in with your Bambu account).
  - To avoid creating an account, you can configure the P1S to work offline.
  - Requires creating a text file in the SD-Card of the P1S, etc.
  - Keeps one disconnected from the Bambu ‘cloud’.
  - Don’t run remotely (ssh, X2Go, VNC, etc), performance is horrible or dis-functional.
- Connect to the Bambu P1S by entering the printer’s IP address & access code shown on the P1S display screen.
- https://wiki.bambulab.com/en/knowledge-sharing/access-code-connect

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2️⃣ Basic Workflow & Slicing

- Import your STL/OBJ model by dragging it into the workspace (or File → Import).
- Choose an material profile (PLA, PETG, ABS, etc.) from the Presets panel.
- Select a print quality preset or manually set layer height, infill, & support options.
- Use Auto-Orient to position the model optimally on the build plate.
- Click [Slice] to generate a preview; review tool-paths and adjust settings if needed.
- Save the resulting G-code to an SD card or send directly to the printer.

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3️⃣ AMS Management & Multi-Filament Tips

- Assign specific colors or materials to AMS slots in the filament settings panel.
- AMS ‘automatically’ detects loaded filament spools if assigned to the correct slots.
- Filament swap is automatic during a print to change colors or materials without stopping the machine.
- Monitor filament usage and remaining length directly from Bambu Studio’s dashboard.
- Common troubleshooting: clear filament jams, verify spool alignment, and recalibrate filament weight if the count is off.

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Advanced Slicing in Bambu Studio

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Some Advanced Settings for Bambu P1S

- Layer height 0.1-0.2 mm: 0.1 mm for fine detail, 0.2 mm for speed
- Nozzle temperature 210–300 °C (PLA 210, PETG 240, ABS 240)
- Shells 2-3, perimeters 4, infill 20-30 % (adjust for strength)
- Print speed 60-80 mm/s (top/bottom 30 mm/s for surface quality)
- Retraction 4–5 mm @ 25 mm/s, wipe enabled
- Cooling fan 100 % for PLA, 70 % for PETG, off for ABS

- Swap the stock components to Bambu's Hardened Steel nozzle and extruder gear assembly for carbon fiber or glass fiber reinforced filaments (like PA-CF or PET-CF), the stock stainless steel nozzle and extruder gears will wear out quickly.

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AMS & Multi-Material Print Workflow

- Select ‘AMS’ material library in Bambu Studio
- Map each AMS slot to desired filament (e.g., 1: PLA, 2: PETG)
- Use ‘Material Change’ command in the slicer for color or property switches
- Automatic AMS load/unload triggers based on ‘Z-level’ or ‘object’ changes
- Monitor material usage via real-time AMS dashboard
- Plan print sequence: start with support material, then primary, finish with support removal

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Optimizing Performance with OrcaSlicer Features

- Adaptive layer height – finer layers for top surfaces, coarser elsewhere
- Dynamic retraction – adjust per print speed changes
- Support structure: ‘Z-level’ support placement & sparse support pattern
- ‘Print at different speeds per layer’ – slower top/bottom for finish
- Advanced cooling: fan speed curves tied to layer height
- Custom G-code: insert pre/post-print scripts, temperature ramps
- Real-time preview & simulation to catch overhangs early

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Best Practices & Troubleshooting

- Calibrate bed level once per month or after hardware changes
- Use a brim or raft for first-layer adhesion on P1S
- Monitor temperature drift – adjust fan or heater on long prints
- Inspect AMS for filament jams – clear with the AMS removal tool
- Keep firmware & slicer updated to latest Bambu releases
- Log prints in the slicer’s ‘Print History’ for future reference

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Introduction to OrcaSlicer

Optimized for Bambu P1S with AMS

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Key Features & Capabilities

- Open-source and community driven
- Built on the robust Slic3r core
- Pre-configured Bambu P1S and AMS presets
- Advanced filament management and real-time status
- High-resolution 3-D preview with adaptive slicing

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Benefits for Bambu P1S Users

- Optimized print quality for dual-extruder AMS
- Reduced retractions and stringing thanks to Bambu-specific tuning
- Seamless multi-material workflow without manual resets
- Rich visualization for troubleshooting
- Active community forum and frequent updates

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Installation & Quick Start

- Download latest release from GitHub (releases page)
- Unzip to a convenient folder
- Launch OrcaSlicer.exe (Windows) or run binary (Linux/Mac)
- Import Bambu P1S preset library (available in settings)
- Connect to the printer via USB or Wi-Fi
- Slice a model – enjoy the AMS-aware workflow

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Optimizing Prints with OrcaSlicer on Bambu P1S

Leveraging AMS and Advanced Slicing for Peak Performance

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AMS Integration & Material Management

- AMS auto-detects filament types—ensure correct profile loaded in OrcaSlicer
- Use "Material Palette" to assign colors and infill settings per AMS slot
- Enable "Automatic Material Change" for seamless multi-filament builds
- Calibrate AMS weight sensor once per printer to avoid over-extrusion

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Print Parameter Tuning

- Layer height: 0.1 mm for fine detail, 0.2 mm for speed
- Extrusion multiplier: 0.98–1.02 based on test prints
- Print temperature: 210 °C (PLA) – 235 °C (PETG)
- Build plate temp: 60 °C for PLA, 80 °C for PETG

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Support & Retraction Strategies

- Enable "Adaptive Supports" for minimal contact and easy removal
- Retraction distance: 4.5 mm (single-extruder), 6.0 mm (dual-extruder)
- Retraction speed: 45–60 mm/s to reduce stringing
- Coasting: 0.2 mm to prevent oozing on long moves

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Best Practices & Common Pitfalls

- Run a 20 mm test cube after any settings change
- Use "Print Preview" to check overhangs before printing
- Disable "Prime Tower" if not using multi-material builds
- Monitor first layer adhesion with the AMS “Print Monitoring” panel

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Comparison: Bambu Studio vs. OrcaSlicer

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Core Feature Comparison

- User Interface: Bambu Studio drag-and-drop, native Windows/Linux; OrcaSlicer clean 3-view layout
- AMS Integration: Built-in with auto filament tracking vs. manual configuration
- Advanced Settings: Bambu Studio presets, limited tweaks; OrcaSlicer full manual control and custom profiles
- GPU Acceleration: Optional in Bambu Studio (CUDA/OpenCL); built-in in OrcaSlicer for faster slicing
- Community & Updates: Official Bambu support, firmware-aligned releases vs. open-source community, frequent PRs
- Cost: Both free, bundled with printer or open source

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Workflow & Practical Considerations

- Use Bambu Studio for plug-and-play printing with AMS, real-time filament stats
- Choose OrcaSlicer for complex multi-material or custom profile needs
- Both export G-code; Bambu Studio shows instant AMS preview curves
- Bambu Studio updates align with firmware releases; OrcaSlicer updates may lag behind firmware
- Open-source nature of OrcaSlicer allows community patches and faster feature addition

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Troubleshooting & Best Practices

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Common Troubleshooting Scenarios

- AMS filament jam – inspect sensors, clean nozzle, restart AMS
- Poor bed adhesion – verify level, use tape or glue stick, adjust first-layer height
- Nozzle clog/under-extrusion – check diameter, temperature, retraction
- Layer shifting or warping – secure print, increase bed temp, add brim
- Unexpected failures – review G-code logs, confirm slicer settings, update firmware

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Best Practices for AMS Operation

- Keep filaments dry – store in sealed bag with desiccant, preheat AMS to ~60 °C
- Use AMS-approved filaments (PLA, PETG, TPU) and avoid high-humidity types
- Clean filament path monthly – wipe extruder gear, check for worn teeth
- Maintain up-to-date AMS firmware – download from Bambu site, flash via Bambu Studio
- Monitor AMS health – use diagnostics panel in Bambu Studio, set alerts for jam or low filament

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Optimizing Slicer Settings: BambuStudio vs OrcaSlicer

- Layer height & speed – BambuStudio default 0.2 mm; OrcaSlicer allows finer adjustment for detail
- Support structures – BambuStudio auto-supports; OrcaSlicer offers custom overhang thresholds and support density
- Retraction – BambuStudio preset length/force; OrcaSlicer dynamic retraction based on travel distance
- AMS configuration – BambuStudio has dedicated AMS tab; OrcaSlicer integrates via custom profiles
- Post-processing – Bambu Studio outputs clean G-code; OrcaSlicer provides real-time preview of extrusion paths

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Conclusion

- BambuStudio and OrcaSlicer together unlock the full potential of the Bambu P1S with AMS
- AMS integration ensures seamless multi-material handling and reduced print failures
- Custom and community-shared print profiles speed up workflow and improve quality
- Performance optimizations and real-time diagnostics simplify troubleshooting

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Lessons Learned:

- Create 3D models to eliminate the need for supports.
- Check the FreeCAD solid for inconsistencies before creating the *.3mf file(s).
- Ensure layering orientation is conducive to the expected strength, or change the various slicing parameters to compensate.
- Print just a few layers (use a ‘Pause’ in the G-Code) to look for problems early.
- Batch process multiple (tested/proven) prints to reduce ‘poop’.
- A custom pre-print G-Code can be used to minimize the ‘poop’ but it causes problems, when it is not heavy enough to drop off!
- Vary the location where printing will occur for a test print. Spreads out the wear and tear on the toothed belts, perhaps the rod carbon & steel guide rods.
-

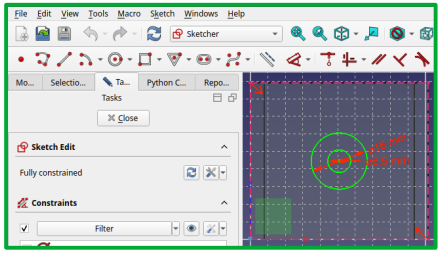
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Combining AI, FreeCAD & 3D Printing

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FreeCAD & AI (Public: Google Gemini)

Richard Wills

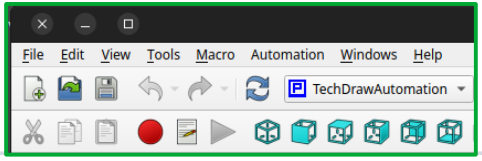


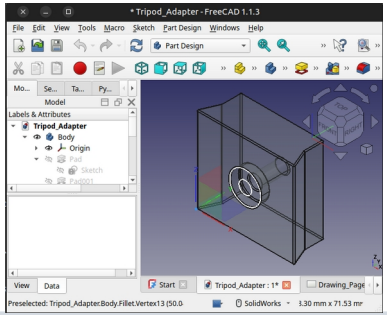
- Design in FreeCAD (sketch driven, parametric 3D solid → *.3mf file)
- Public AI (Google Gemini) to generate FreeCAD macro & new ToolBench to create ANSI B 2D Engineering ‘Blueprint’ with 3 orthogonal & isometric views.
  - Includes borders, pre-filled title block, etc.
  - Can be annotated with additional dimensions.

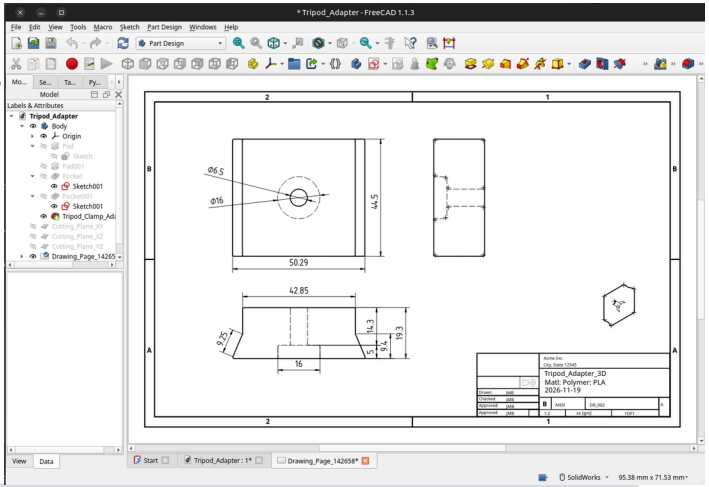
```
'''
Click on your 3D model in the tree view panel first,
  Then run this macro to create an ANSI B size drawing.
'''

import FreeCAD as App
import FreeCADGui as Gui
import TechDraw
import os
import glob
import time

```







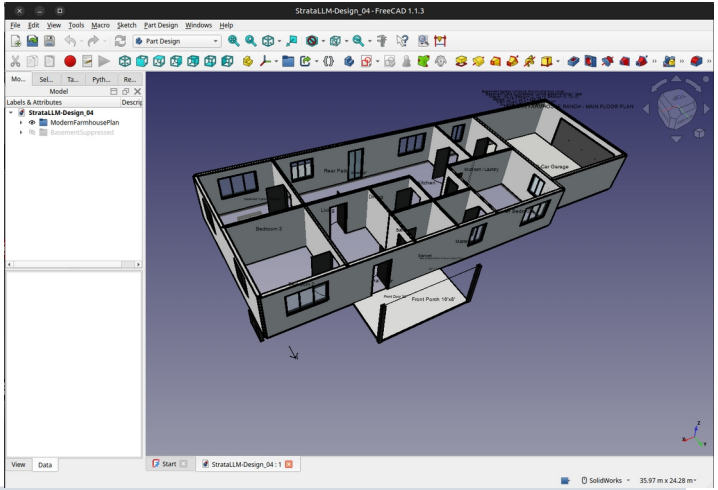
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FreeCAD & AI (StrataLLM)

- Design in FreeCAD (sketch driven, parametric 3D solid → *.3mf file)
- Local AI (StrataLLM***) to generate a 3D design of a house
  - Includes rooms, walls, windows, doors, porch, garage, etc.
  - Based on AI prompts!

> Build a FreeCAD v1.0 macro, US feet/inches, that runs with no errors.
>
> House: single-story modern farmhouse ranch, [~1,200–1,500 SF] main house, [3 bed / 2 full bath], attached [2-car] garage on the [west], main entry on the [north], rear patio on the [south].
>
> Geometry rules (important): walls are real 3D solids with door/window openings cut through them — not a flat drawing. It must orbit in 3D AND auto-set to a top-down orthographic "blueprint" view (neutral background, black lines). Walls must clearly contrast the background. Labels small, screen-space, centered in rooms, never big enough to hide the model.
>
> I don't know room sizes — derive them from function using normal residential norms, then fit the whole thing under [1,500 SF]. Follow these rules: master is the largest bedroom; every bedroom fits a bed + dresser with room to walk around it; bathrooms fit standard fixtures with clear floor space; kitchen/dining/living read as one open area, not a hallway. All pedestrian doors 36" clear (ADA), including the patio slider; the vehicle garage door is exempt.

  - Takes a few hours.
  - It took 4 attempts …

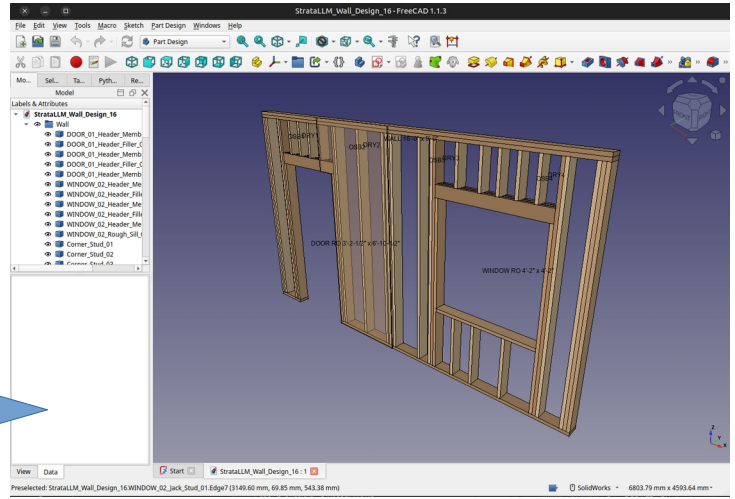


- *** Thanks Shawn!

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FreeCAD & AI (Local: StrataLLM)

- Local AI (StrataLLM), generate CAD models a 2”x6” wall of varying dimensions for:
  - Wall length (8’ or 9’) tall.
  - Multiple windows and doors, -variable dimensions
    - but one size for all apertures
  - Create a Bill of Materials (BoM)
  - Incl. studs, drywall, OSB, fasteners, etc.
  - Takes <2 hrs per attempt.
  - 16 attempts later …



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Resources & Support

- Bambu Studio Official Site: https://www.bambulab.com/studio
  - https://flathub.org/en/apps/com.bambulab.BambuStudio
- OrcaSlicer GitHub: https://github.com/bambulab/OrcaSlicer
  - https://www.orcaslicer.com/download
- Community Tutorials: https://www.bambulab.com/community
- Models
  - https://www.printables.com
  - https://www.thingiverse.com
  - https://makerworld.com
  - https://www.yeggi.com

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Questions, comments or rewards:

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