

CamOptimization User Manual

Overview

CamOptimization is a Fusion 360 add-in that enhances CAM workflows by optimizing operations based on Material Removal Rate (MRR). It calculates centroid Z-heights for adaptive processes, adjusts parameters like spindle speed, feed rate, stepdown, and stepover, and supports milling, drilling, slotting, chamfering, facing, profiling, circular, and trace operations. Results are saved to a CSV file, with detailed logging for traceability, making it ideal for CNC machining precision. It optimizes stock settings for Setup 1 and configures clearing operations for Setup 2 (Top Hat Clearing).

Key Features

- Optimizes CAM operations (e.g., adaptive, contour, drill, chamfer) using MRR-based calculations.
- Calculates centroid Z-heights for pockets in adaptive operations.
- Supports metric and imperial units with automatic conversion.
- Allows saving and loading presets for quick parameter reuse.
- Generates detailed logs and CSV outputs for operation parameters.
- Provides a preview dialog to review and apply optimized settings.

System Requirements

- **Fusion 360:** Latest version with CAM capabilities (cloud updates recommended).
- **Operating System:** Windows 10/11 or macOS (compatible with Fusion 360).
- **Permissions:** Write access to the add-in's directory for logging, CSV, and preset files.
- **Internet Connection:** Not required for operation, but recommended for initial download and updates.

Installation

1. Download CamOptimization:

- Obtain the CamOptimizationAddIn.py file and associated Resources folder from the Autodesk App Store or the developer's distribution channel (AutomatedVikingLLC).
- Ensure the Resources folder contains the add-in's icon for proper display.

2. Install the Add-In:

- Open Fusion 360.
- Go to **Tools > Scripts and Add-Ins** (under the **Add-Ins** section).
- In the **Add-Ins** tab, click **Add-Ins > Create Add-In**.
- Navigate to the folder containing CamOptimizationAddIn.py and select it.
- Check **Run on Startup** for automatic loading.
- Click **Run** to load the add-in.

3. Verify Installation:

- Switch to the **Manufacture Workspace**.
- Under the **Tools** tab, locate the **CAM Optimization** panel.
- Confirm the **Optimize CAM by MRR** button is visible (see *Figure 1*).

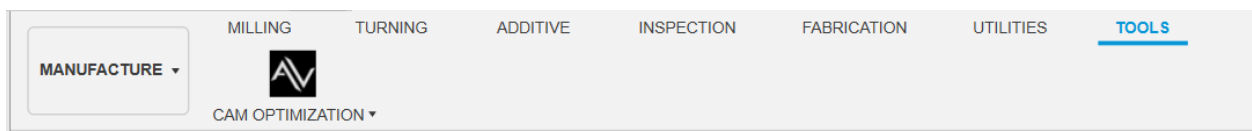


Figure 1: CamOptimization button in the Manufacture Workspace Tools tab

Using CamOptimization

CamOptimization operates in the Manufacture Workspace and requires an active design with CAM setups containing operations (e.g., adaptive, contour, drill). Follow these steps to use the add-in:

Step-by-Step Instructions

1. Prepare a Design with CAM Setup:

- Open or create a Fusion 360 design with a part for machining.
- In the **Manufacture Workspace**, create a setup with operations (e.g., 2D Adaptive, Contour, Drill).
- Ensure operations have assigned tools and valid geometry (e.g., pockets for adaptive operations).

2. Switch to Manufacture Workspace:

- Select the **Manufacture Workspace** from the workspace dropdown.

3. Select a Setup (Optional):

- In the CAM browser, select the desired setup. If none is selected, the add-in defaults to the active or first setup.

4. Launch CamOptimization:

- Go to the **Tools** tab > **CAM Optimization** panel > **Optimize CAM by MRR** button.
- A dialog appears with input fields (see *Figure 2*):
 - **Presets:** Select a saved preset or “None” for defaults.
 - **Target MRR:** Desired material removal rate (cubic mm/min or cubic in/min).
 - **Roughing Chip Load:** Chip load for roughing operations (mm/tooth or in/tooth).
 - **Finish Chip Load:** Chip load for finishing operations.
 - **Maximum Spindle Speed:** Maximum RPM for tools.
 - **Chamfer Width:** Width for chamfer operations.

- **Engrave Depth:** Negative depth for trace/engrave operations.
- **Save Preset:** Save current inputs as a preset.
- **Delete Preset:** Delete an existing preset.

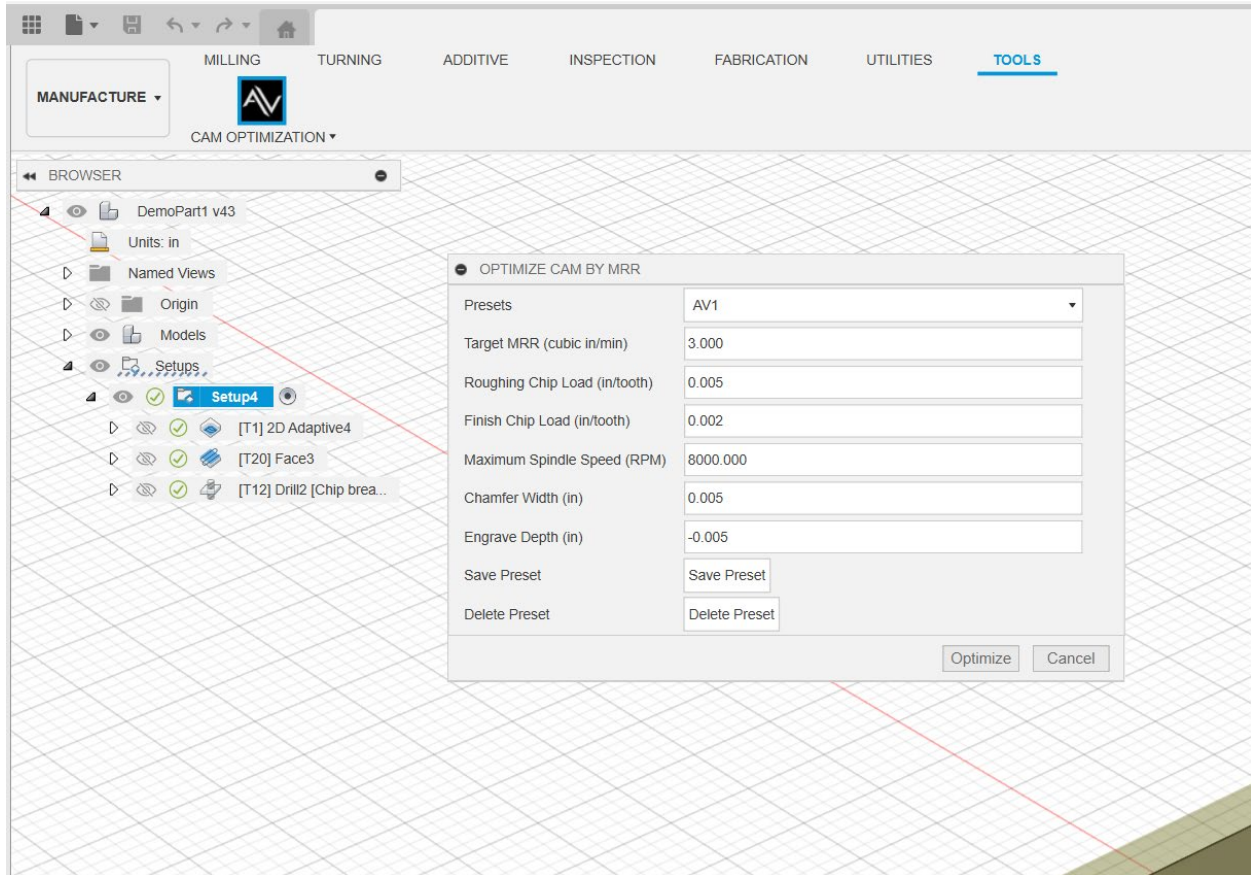


Figure 2: CamOptimization dialog

5. Configure Parameters:

- Adjust input values or select a preset to populate fields.
- To save a preset, check **Save Preset**, enter a name in the prompted dialog, and click **Save**.
- To delete a preset, check **Delete Preset**, select a preset, and click **Delete**.
- Ensure **Engrave Depth** is negative and all values are positive.

6. Preview and Apply Optimizations:

- Click **Optimize** to process the setup's operations.

- A preview dialog shows optimized parameters (e.g., spindle speed, feed rate, stepdown) for each operation (see *Figure 3*).
- Review values and click **Apply** to update operations or **Cancel** to discard.
- For setups with face operations and “Continue Machining” enabled, a prompt asks whether to enable multiple depths.

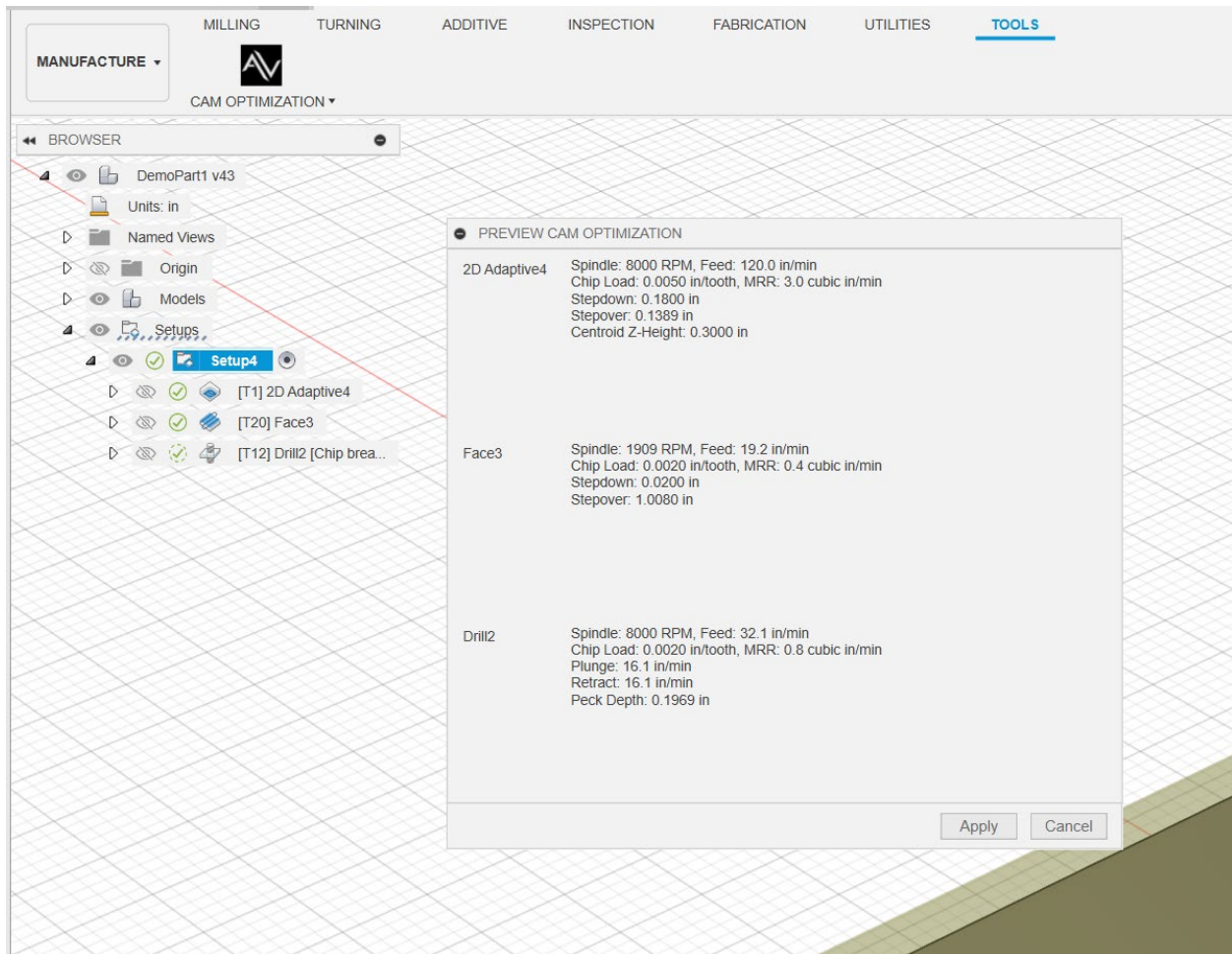


Figure 3: Preview dialog with optimized parameters

7. Review Outputs:

- **Dialog:** Displays optimized settings or errors for each operation.
- **CSV File:** centroids.csv in the add-in's directory contains setup/operation names, spindle speeds, feed rates, stepdowns, stepovers, and centroid Z-heights.
- **Log File:** camOptimization_events.log details operations and errors.

Example Use Case

- **Scenario:** Optimize a 2D Adaptive operation for a pocket in a CNC-machined part.
- **Steps:**
 1. Create a setup with a 2D Adaptive operation targeting a pocket.
 2. In the Manufacture Workspace, select the setup.
 3. Launch CamOptimization, set **Target MRR** to desired cubic in/min, and adjust chip loads.
 4. Click **Optimize**, review the preview dialog, and click **Apply**.
 5. Check centroids.csv for optimized parameters (e.g., stepdown, centroid Z-height).

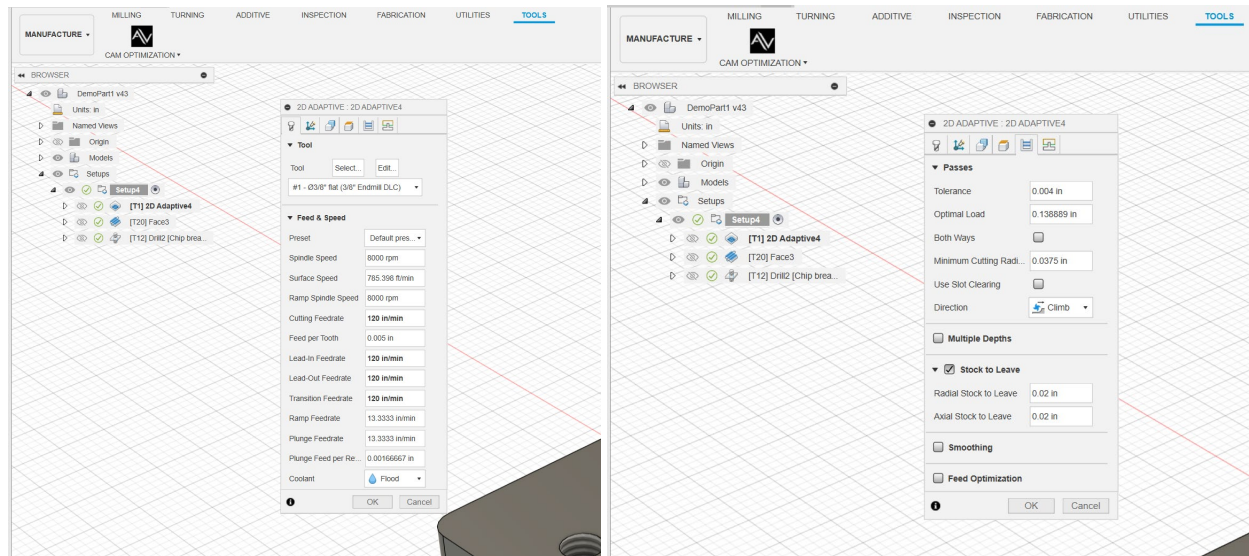


Figure 4: Optimized adaptive operation with updated parameters to meet MRR and FPT

CamOptimization generates logs, a CSV file, and a preset file for tracking and configuration.

- **Location:** camOptimization_events.log in the add-in's directory or temporary directory (e.g., %TEMP%\camOptimization_log.log on Windows).
- **Content:** Timestamps, optimization steps, errors, and parameter calculations.
- **Access:** Open in a text editor to review operations or debug issues.

- **Location:** centroids.csv in the add-in's directory.
- **Content:** Columns for Setup, Operation, Spindle_Speed_RPM, Feed_Rate, Stepdown, Stepover, and CentroidZ_height.
- **Access:** Open in a spreadsheet (e.g., Excel) or text editor for analysis.

- **Location:** presets.json in the add-in's directory.
- **Content:** User-defined presets with MRR, chip loads, spindle speed, chamfer width, and engrave depth.
- **Access:** Managed via the Save/Delete Preset options in the dialog.



Troubleshooting

Issue: “No CAM data exists in the active document”

- **Cause:** No CAM setups or operations in the document.
- **Solution:** Create a setup with operations in the Manufacture Workspace.

Issue: “No valid centroids found”

- **Cause:** Invalid pocket geometry or no planar faces/edge chains.
- **Solution:** Verify pocket selections in adaptive operations are valid (planar faces or closed edge loops).

Issue: “Failed to save CSV” or “Permission denied”

- **Cause:** Excel is already open with centroid data and file is write protected.
- **Solution:**
 - Close out Excel so the file can be written with latest data.
- **Cause:** Lack of write permissions in the add-in directory.
- **Solution:**
 - Run Fusion 360 as an administrator.
 - Move the add-in to a writable directory (e.g., Documents\Fusion 360\AddIns).
 - Check the log file for fallback locations (temporary directory).

Issue: “Invalid depth calculation” or “Tool diameter not found”

- **Cause:** Missing tool or geometry parameters.
- **Solution:** Ensure operations have assigned tools and valid geometry settings.

Issue: Add-In Does Not Appear

- **Cause:** Installation or loading error.
- **Solution:**
 - Check **Scripts and Add-Ins** for errors.
 - Verify the Resources folder is in the add-in’s directory.
 - Review camOptimization_events.log for initialization issues.

Advanced Tips

- **Presets:** Save frequently used parameters as presets for consistent setups.
- **Multiple Setups:** Run CamOptimization for each setup individually, selecting the setup in the CAM browser.
- **Log Analysis:** Use camOptimization_events.log to debug complex operations or verify centroid calculations.
- **Unit Conversion:** The add-in automatically handles metric/imperial units based on the document's settings.
- **Continue Machining:** For setups using "Continue Machining," ensure previous setups have valid adaptive operations.

Support

For issues not covered:

- **Log Files:** Share camOptimization_events.log and centroids.csv with support for diagnostics.
- **Developer Contact:** Check the Autodesk App Store page for support details or contact support@automatedviking.com.

License

CamOptimization is distributed under the terms specified by AutomatedVikingLLC. Refer to the EULA provided during install or Autodesk App Store's licensing agreement for details.

Version History

- **Version 1.6** (June 2025): Initial release with MRR-based optimization, centroid calculation, and preset support.

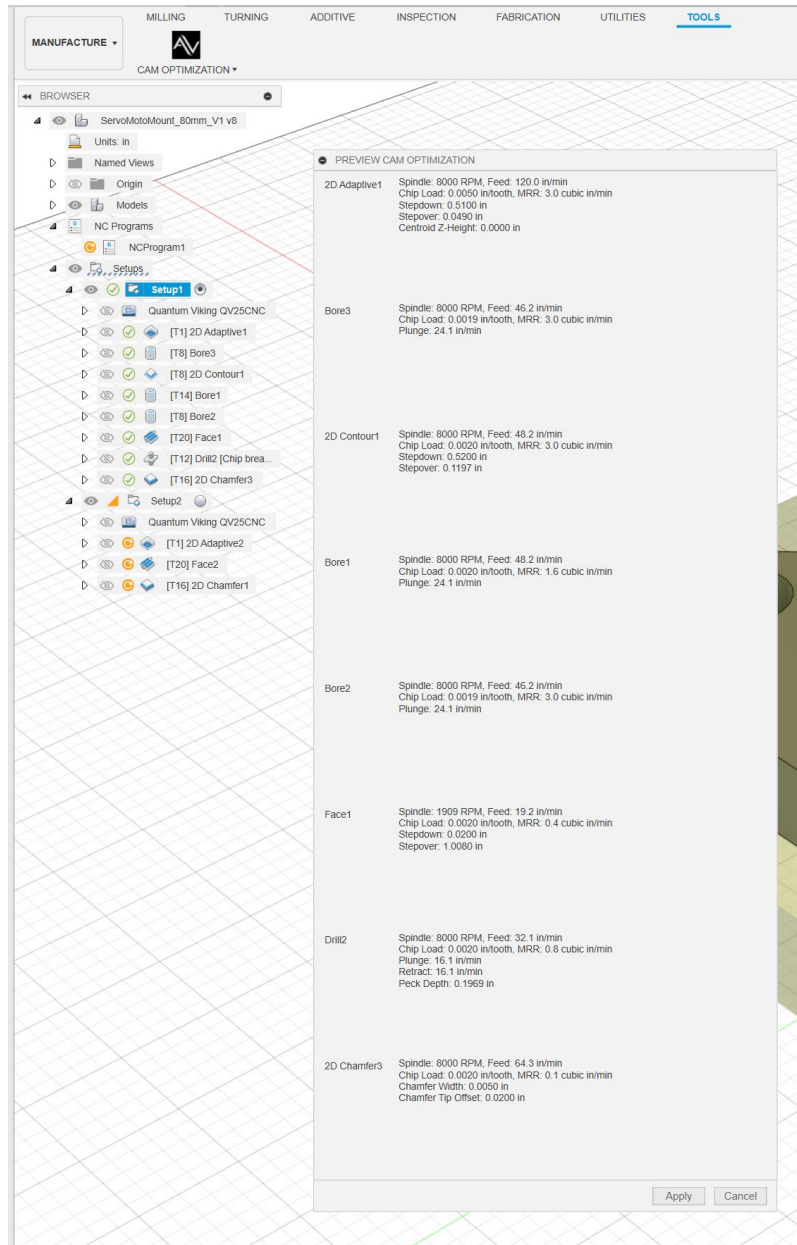


Figure 6: CamOptimization optimizing setup 1 (First side machine)

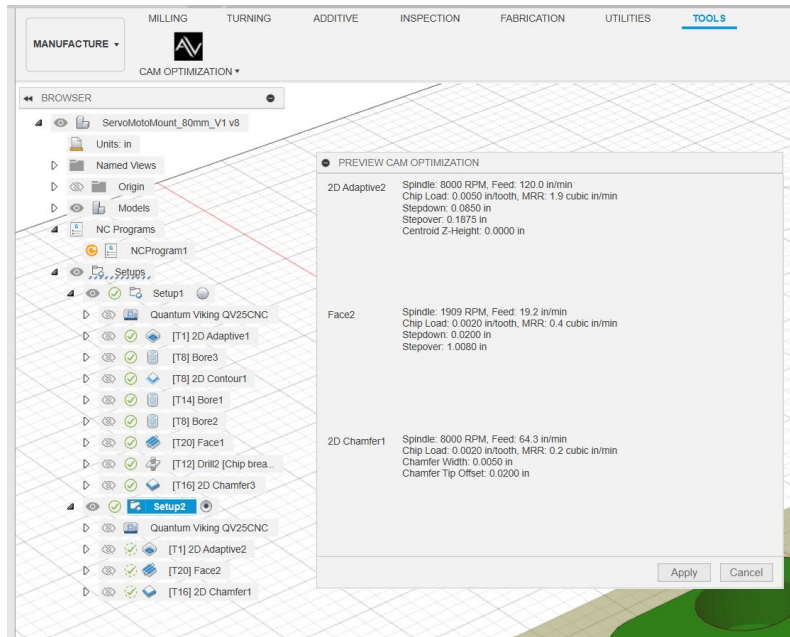


Figure 7: CamOptimization optimizing setup 2 (Second side machine)

This manual is provided as-is. Ensure you have the latest version of CamOptimization and Fusion 360 for optimal performance.