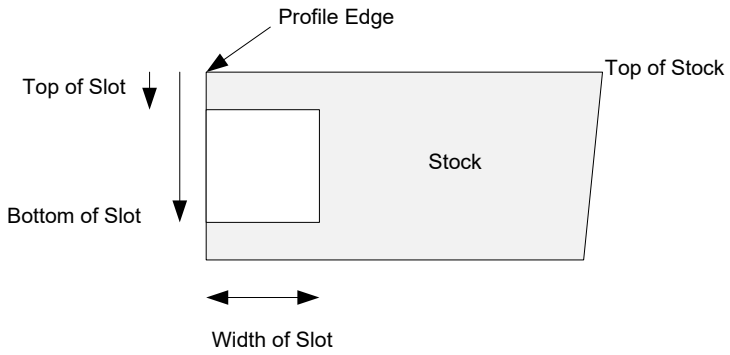
Slotter Plugin for CamBam

[Version 1.0.6]

Purpose

This plugin is intended to provide the capability to cut horizontal slots around the edge of the stock that has been profiled to a required shape like this:



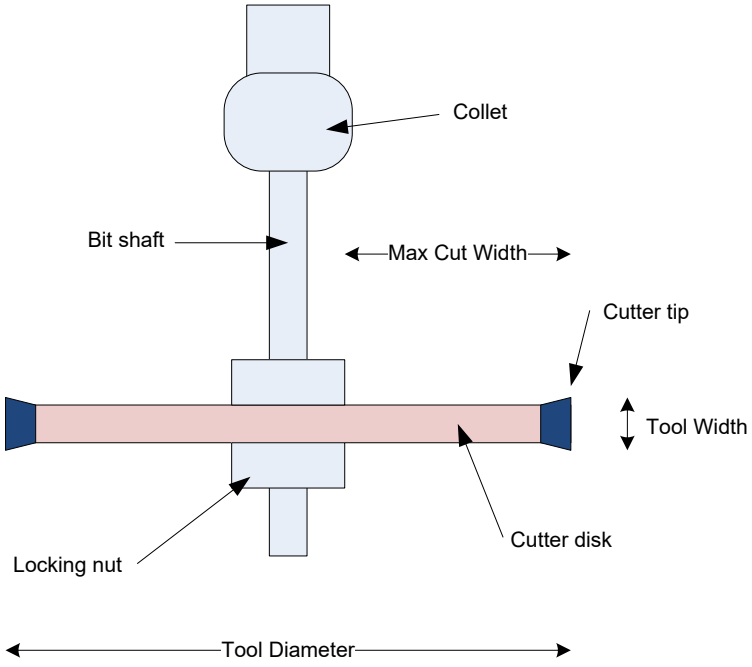
A slot like this might be used for:

- Making a groove for a sliding component.
- Creating a tongue and groove joint.
- Creating a groove for an insert panel

Slots can be cut inside or outside an edge, and will depend on the direction of the CAD entity and whether the entity is open or closed. Most CAD entity types can be used (except for Text, Points and Regions).

This is done by means of a new MOP type: Slotter.

It is intended to use slot cutter bit that has the following form:



For a cutting task of this type some care is required to ensure that:

- There is clearance between the bottom of the bit shaft and the waste board/machine bed.
- The slot width cannot be greater than the radius of the cutter minus the radius of the locking nut/shaft, or perhaps the collet if the shaft is short.
- The slot height (Top – Bottom) must be equal to or greater than the tool width.
- Clearance must be provided for the cutter on the inside (or outside) of the edge.
- Top of stock clearance needs to allow for extended end of bit shaft.

It is also to be assumed that the cutter is Z-zeroed at the bottom most part of the cutter tip. The (X,Y) zero will correspond to that set for the profiled edge.

The additional parameters to be specified in the new MOP are:

- Tool diameter – the overall diameter of the cutter tip
- Cut overlap – the fraction of the tool width that will be overlapped in the Z direction. The default is 0.0, a cut overlap fraction of 0.2 for a tool width of 2.0mm will overlap the cuts by 0.4 mm in the Z direction.
- Tool width – the width of the cutting tip
- Tool clearance – to allow the tool to be lowered down clear of the profiled edge of the stock
- Cut increment – the horizontal increment for each cut.
- Slot top – the Z-value of the top of the slot
- Slot bottom – the Z-value of the bottom of the slot
- Slot width – the width of the cut from the profiled edge.
- Inside Slot – true if the slot is cut inside the edge profile, false if outside (see Notes)
- Milling Direction: Conventional, Climb and Mixed.

Installation

The Slotter.dll file must be placed inside the CamBam plugins folder, and CamBam restarted. The Slotter MOP option will then appear in the CAM tools section of the main toolbar, the <Machining> menu and the <Machining> context menu as a new MOP type.

Operation

To use the plugin it is necessary to create and then select one or more CAD shapes (but not including PointList, MText or Region types). The shapes can be open or closed.

After selecting one of more CAD entities, create a new Slotter MOP from the <Machining> menu then:

1. Set the required parameters to define the tool and slot dimensions
2. Create the tool paths as normal from the MOP context menu.
3. Create and save the G-Code as normal from the MOP context menu.

The tool path is constructed (roughly) as follows:

1. A move to a point clear of the profiled edge of the stock (inside or outside the edge)
2. A plunge move down to the required depth for the top of slot.
3. A horizontal cut move into the stock to a depth set by the cut increment.

4. A horizontal cut following the profiled edge of the stock to the end (perhaps beginning) of the CAD entity.
5. A horizontal move to clear the edge of the stock
6. Lower the cutter by its cut width, and repeat from (3) until the bottom of the slot is reached.
7. Increment the cutter move into the stock and repeat from (2) until the full width of the slot is cut.

Notes

1. .The depth of each cut is taken as the width of the cutter tip.

2. The vertical plunge moves for the cutter are set at normal in the MOP properties; and the horizontal plunge moves are taken at normal cut speeds, as this is a normal cut operation.

3. For closed shapes, “inside” and “outside” is obvious. For open shapes some experimentation is required to get the slot on the required side of the profiled edge.

4. This version has been compiled for .NET 3.5, though it seems to also work for CamBam V1.0. A .NET4.0 version is also available.

5. When cutting an inside slot on a profile that has a narrow neck then:

    a. If the neck is sufficiently narrow to prevent the cutter passing though it for all cutting paths then two, or more, correct sets of tool paths will be created. The neck section may not be correctly slotted.

    b. If the neck does not allow the cutter to pass through for some outer-most tool paths, but does for some inner-most paths then the constructed tool paths **will not be correct.** A warning is issued.

6. The following CamBam functions are not supported:

    a. Show cut widths

    b. Toolpath filter

7. The Milling Direction options can be used to control the cutter direction. The options are Conventional, Climb and Mixed. The effect of this depends on the Optimisation Mode. If the Optimisation Modes is set to **None** then:

    a. **Conventional** moves the cutter in a anticlockwise direction with a rapid back to the starting point for non-closed shapes

    b. **Climb** moves the cutter in a clockwise direction with a rapid back to the starting point for non-closed shapes.

    c. **Mixed** moves the cutter in alternating CW and ACW directions thus saving the rapid move for non-closed shapes.

    If an optimisation mode is chosen (e.g. **Standard** or **Experimental**) for a non-closed shape then the behaviour is different for Conventional and Climb, i.e. The initial milling direction is CW or ACW, but there is an additional “return path” in the opposite direction (cutting at the same depth). The reason for this is currently unclear.

    Note also that the meaning of CW and ACW depends on the **Inside Slot** setting. If Conventional or Climb millings directions are required for finishing control then it is

necessary to carefully check the cutter direction by simulation (or air running your machine) to ensure the desired result is achieved.

Slotter Plugin Versions

Version	Date	Notes
1.0.0	28/3/2017	First version for feedback and comment.
1.0.1	4/4/2017	Icon not added to toolbar if CAMToolbar plugin has already added it. Initial zero-cut tool path removed.
1.0.2		Warning message added if cutter width is larger than slot depth.
1.0.3	26/7/2018	Addition of a cut overlap parameter to allow an overlapping of cuts in the Z direction.
1.04	28/7/2018	Cut Overlap parameter moved to Step Over section. Copy and Paste bug fixed
1.05	2/9/2019	Further Copy and paste bugs repaired
1.06	26/12/2018	Milling direction options implemented