

What's New in SolidCAM 2016



SolidCAM

iMachining – The Revolution in CAM!



2016

the iMachining Edge

The unique, revolutionary Milling technology
iMachining[®]
patent by SolidCAM

TIME SAVINGS
70%
... AND MORE!

iMachining Technology-Wizard
Full automatic calculation of:
Feed Rate
Spindle Speed
Step Over
Depth

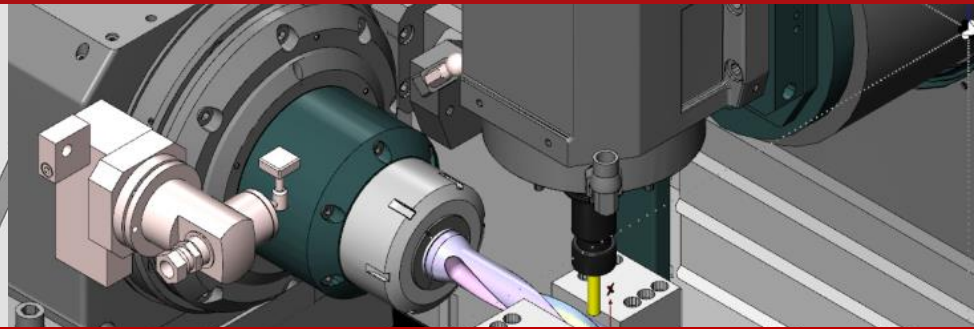
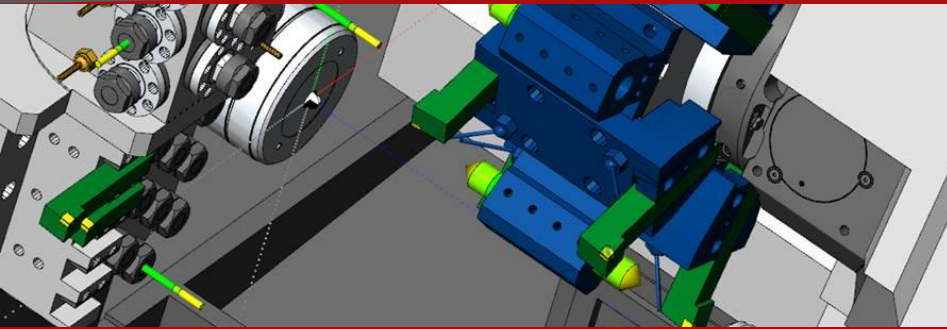
TOOL MATERIAL
MACHINE GEOMETRY

iMachining 2D & 3D | 2.5D Mill | AFRM | HSS | 3D HSR/HSM | Indexial Multi-Sided | Sim. 5X | Turning | Advanced Mill-Turn | Solid Probe

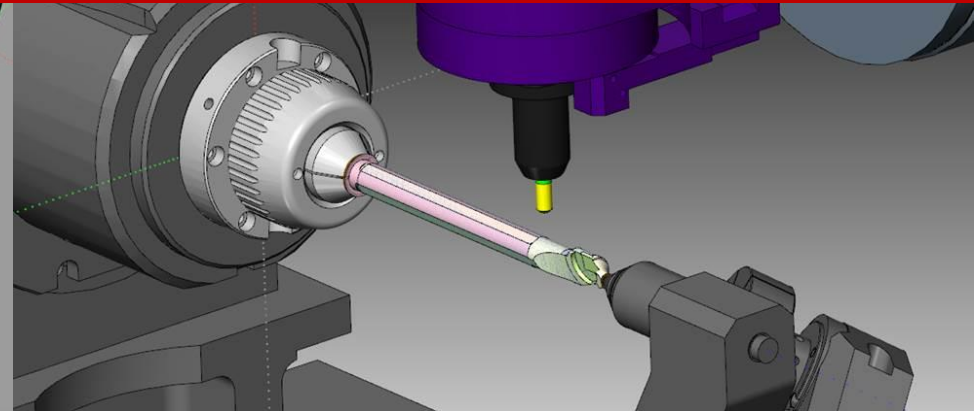
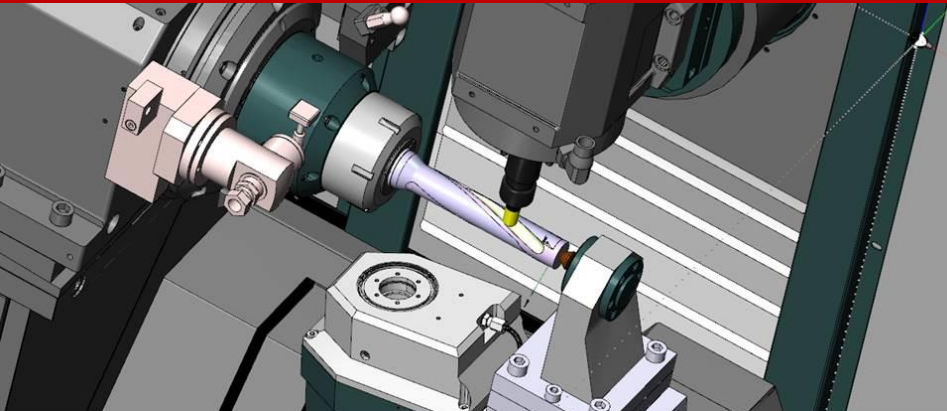
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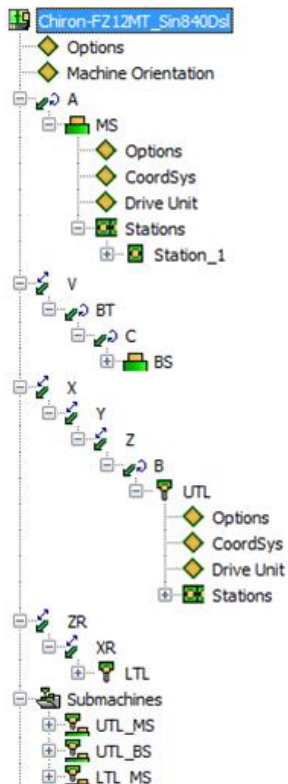
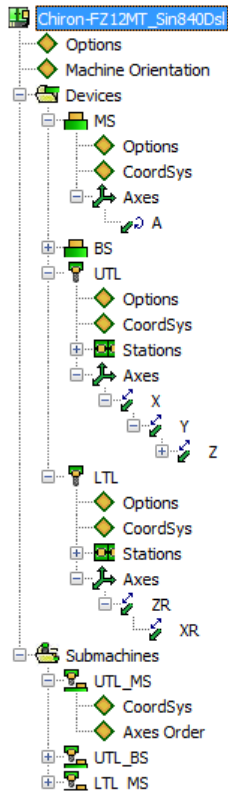
What's New in SolidCAM 2016



SolidCAM2016: Advanced Mill-turn solution



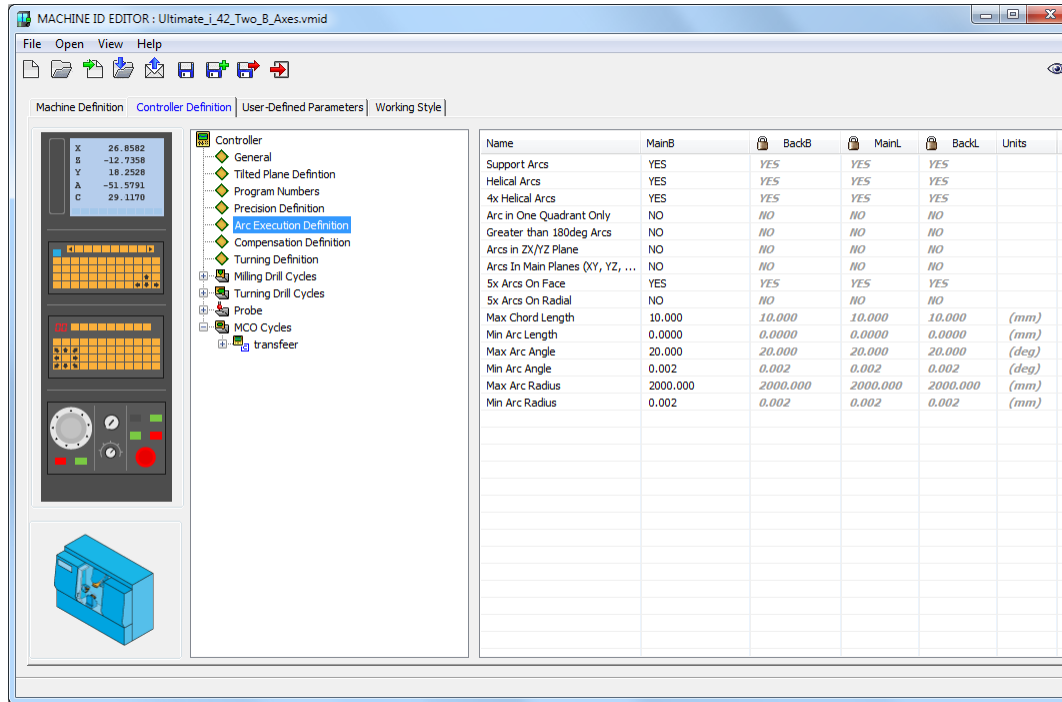
VMID (Virtual Machine ID) change : Devices on Axes



- **Devices on Axes** (and not Axes on Devices): support of several devices mounted on the same axis
- **The VMID definition is now similar to the Machine Simulation structure**

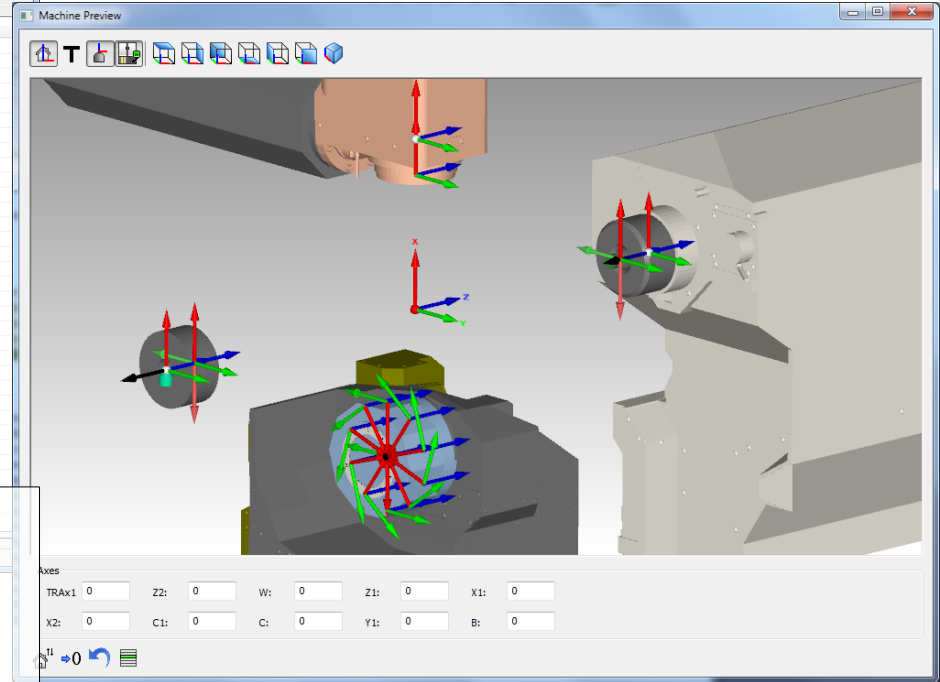
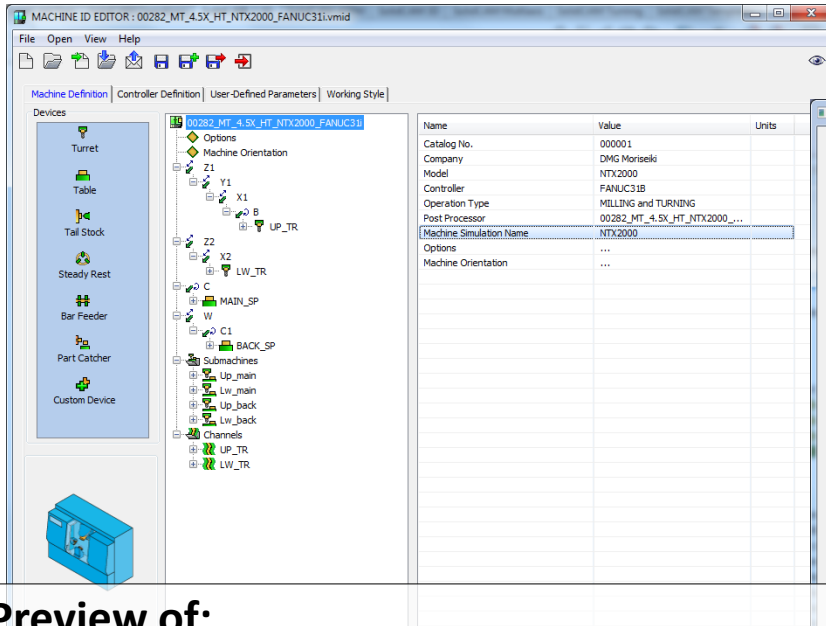


VMID (Virtual Machine ID) change : Separation of parameters by Submachines & Channels



- **More flexible definition of Controller parameters : possibility to apply different values to parameters used in different Submachines & Channels**

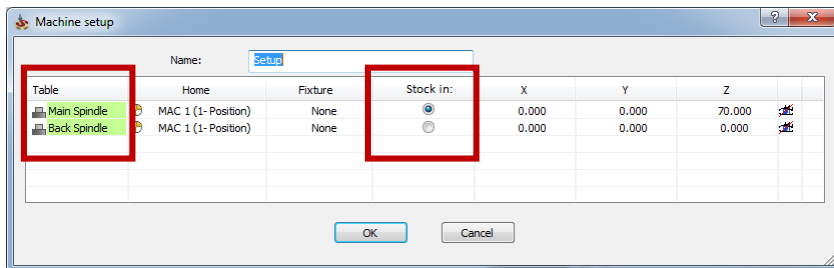
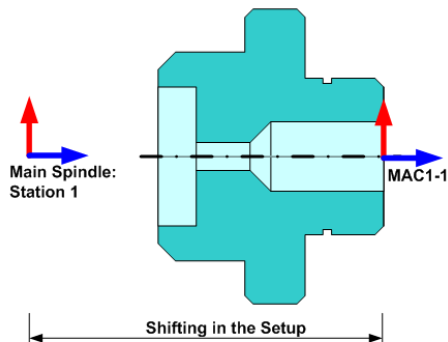
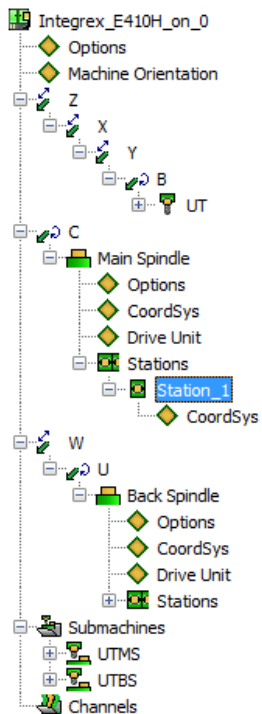
Interactive Machine Preview for VMID



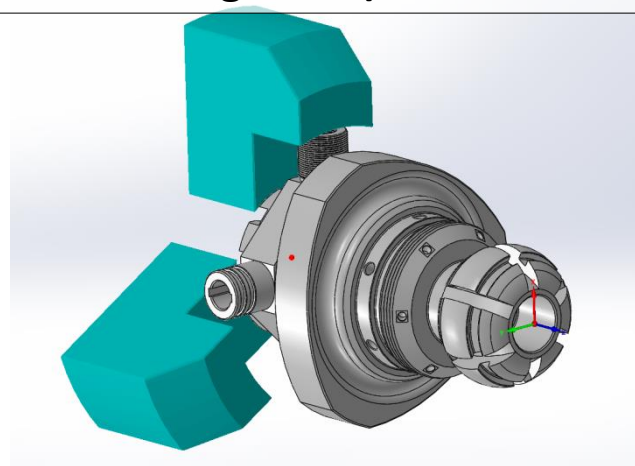
Preview of:

- Machine's STLs
- Device/Stations CoordSys
- Kinematic axes

Stock positioning: Mounting the stock on the table



- Stock is mounted on the table (instead of Submachine) – same as on the real machine
- Definition of initial stock position (on which Table the machining starts)



Tracking the stock position in the Machine: New Clamp options

The image shows three panels from the SolidCAM software interface. The left panel, 'Action on ...', lists various machine components like Machine, Axe B, MS, BS, and Ettau R.1. The middle panel, 'Process', shows a 'Start definition' for 'BS Chuck' with options like Table Name, Clamp, Message, Device, Dwell (sec), Check Torque, Message, Movement, and Part Move. A red arrow points from the 'Clamp' option in the middle panel to the right panel. The right panel, 'Properties', shows a table with columns 'Name', 'Value', and 'New Line'. The 'Clamp' row has a dropdown menu with options: OPEN, CLOSE, CLOSE ON STOCK, and RELEASE STOCK. The 'CLOSE ON STOCK' and 'RELEASE STOCK' options are highlighted with a red box.

Name	Value	New Line
Clamp	OPEN	Yes
	CLOSE	
	CLOSE ON STOCK	
	RELEASE STOCK	

- The stock tracking is added in order to assist the programmer in definition of CAM-part movements
- Chuck device is moved to the Table as “Clamp” action, with 2 additional options:
 - “Close on stock” (connect stock to this table)
 - “Release stock” (when machining is complete – stock is removed from the machine)

Interactive Machine Preview for MCO

Machine Control Operation

Technology: General

Operation name: MACHINE_CTRL_4

Template: []

Cycle: []

Action on ...

- Machine
- UP_TR
- LW_TR
- MAIN_SP
- BACK_SP
- Submachine
- Cnc Operator
- Misc

Process

- Start definition
- Device
- Movement
- Coolant Flood
- Coolant Throug
- Rotation
- Spindle Orientz
- Message
- Part Move
- Tool Change
- Unload Tool

Properties

No.	Mode	X1 (X)	Y1 (Y)	Z1 (Z)	B (Rv)	Feed (m...
1	[]	-10	25	95	0	RAPID
2	[]		Home Ref			5000

Ability to define locations, where the current device will be.

Machine Preview

Axis

TRAx1: 0 Z2: -740 W: 0 Z1: 95 X1: -10

X2: 0 C1: 0 C: 0 Y1: 25 B: 0

Define axes position of relevant device in Machine preview → import the position to the Movements list

Drive units : Improvement in Spin definition

The screenshot displays the SolidCAM software interface. On the left, a tree view shows the machine configuration with 'Drive Unit' highlighted. In the center, a table lists drive unit properties:

Name	Value	Units
Active	YES	
Rotation Vector	A	
Number of gears	2	
Gear #1	0.00 - 4000.00rpm, 5kW	
Gear #2	3000.00 - 7000.00rpm, 10kW	

Below the table is a 'Gear #1 Properties' dialog box with the following fields:

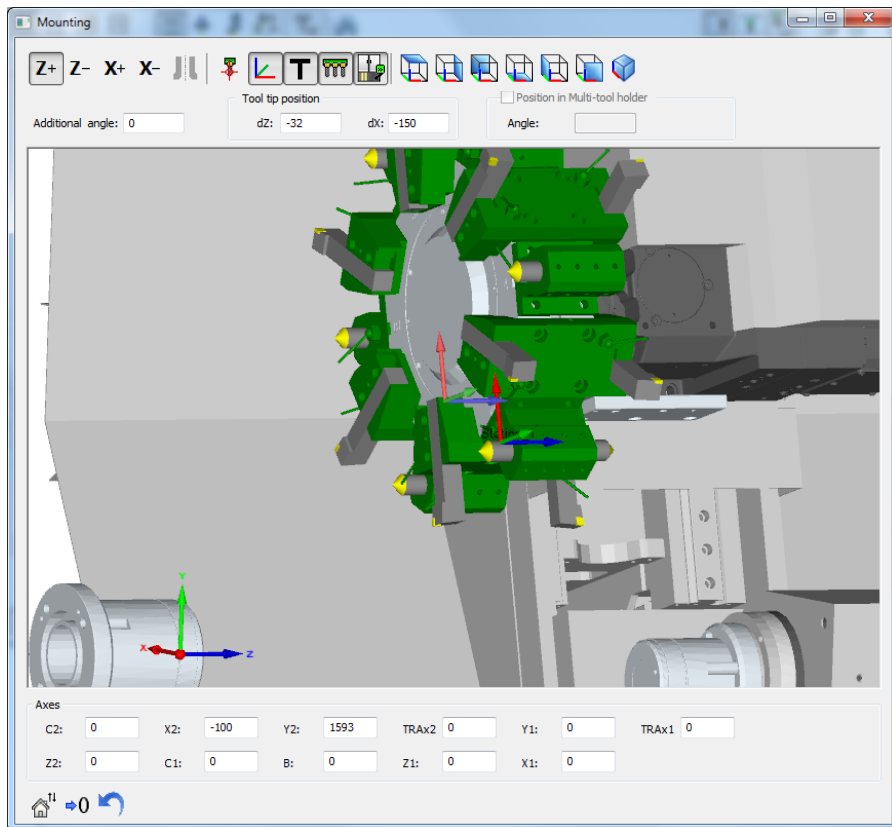
- Spin (rpm): Min: 0, Max: 30000
- Power (kW): 15

On the right, the 'Data' tab shows 'Spin' settings:

- Spin rate: S (rpm) selected, value 3000; V (m/min) value 113.097
- Gear selection: Gear #1 (0-4000rpm, 5kW)
- Spin finish: checked, S (rpm) selected, value 3000; V (m/min) value 113.097
- Gear selection: Gear #1 (0-4000rpm, 5kW)
- Spin direction: CW selected, CCW unselected

- Support of several Gears on the same device = spin definition as on real machine
- Automatic selection of the Gear according to the Spin defined

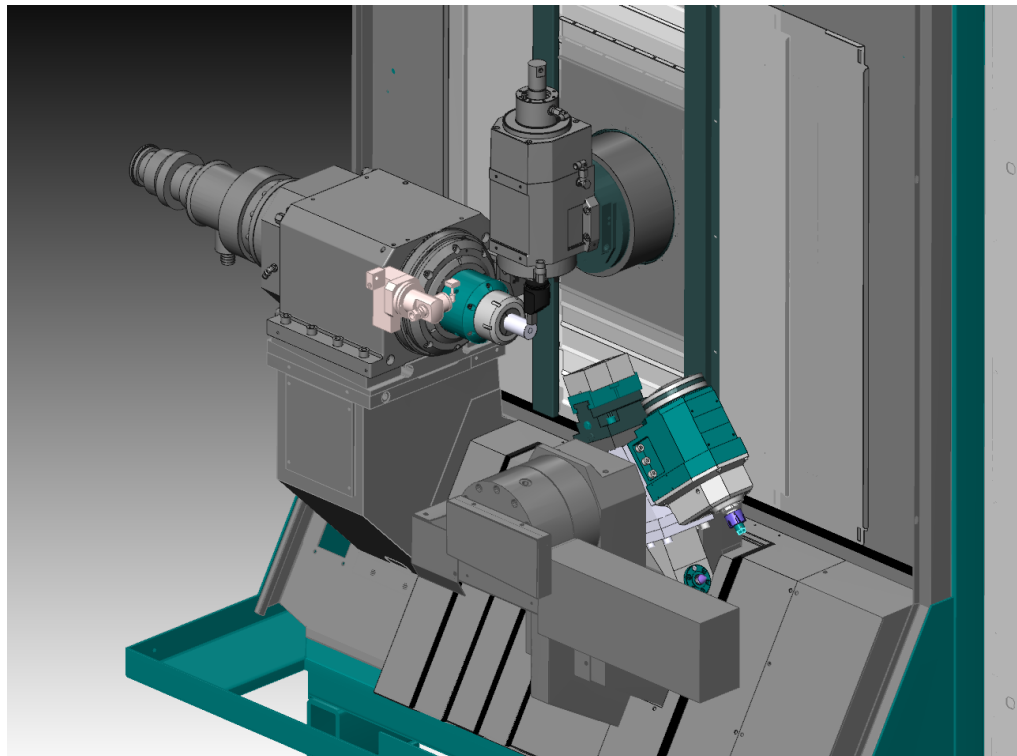
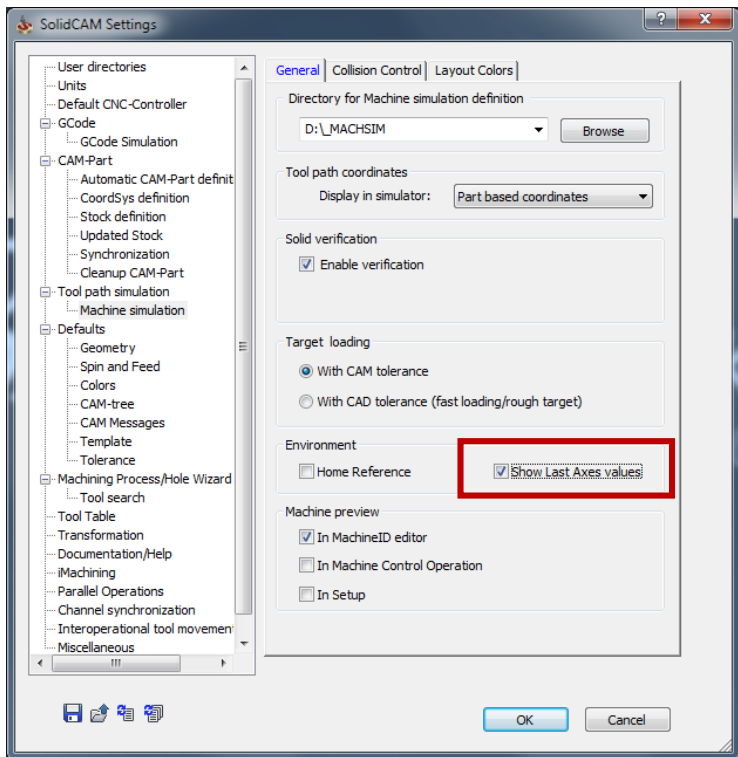
Interactive Machine Preview for Tooltable



New Mounting interface:

- Possibility to see other tools mounted on the same turret
- Preview of machine (if Machine model for Machine simulation is defined)
- Control over machine axes position – for better understanding of mounting

Machine Simulation : Show actual axes positions



No need anymore to select previous MCOs in order to launch MachSim on selected operation

Result: Extended support of complex mill-turn CNC machines



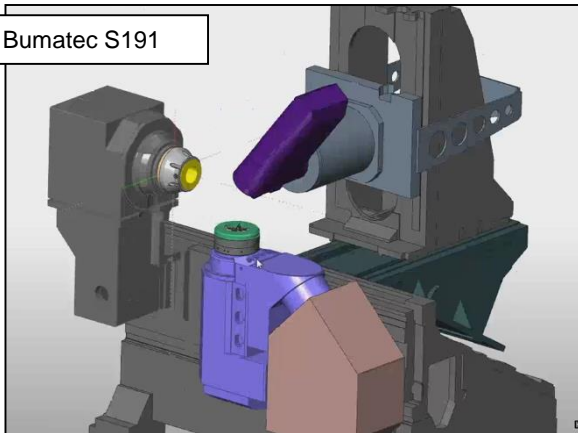
Extended support of complex mill-turn machines in all stages:

- Virtual machine (*.VMID) definition
- Tool mounting
- CAM-part programming
- Machine Simulation
- G-code generation

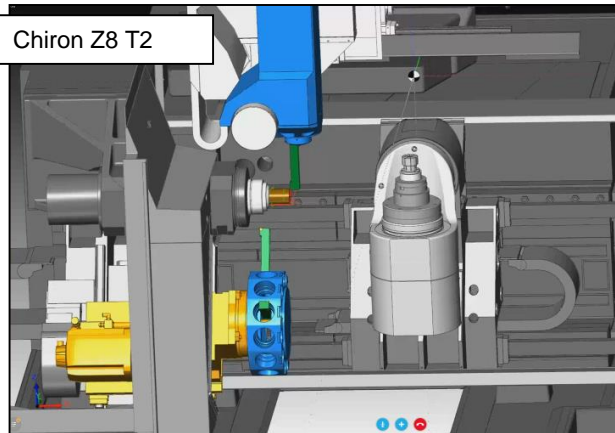


Extended support of complex mill-turn CNC machines

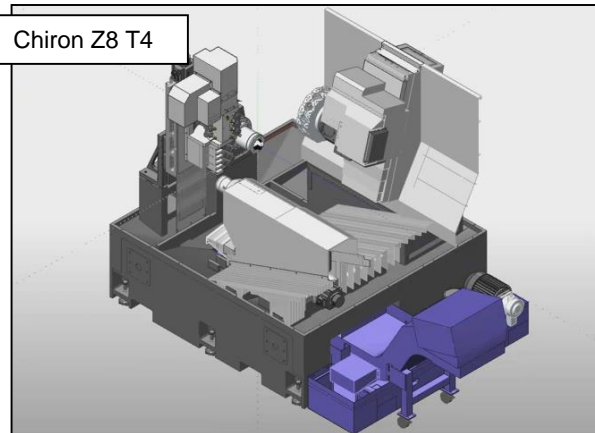
Bumatec S191



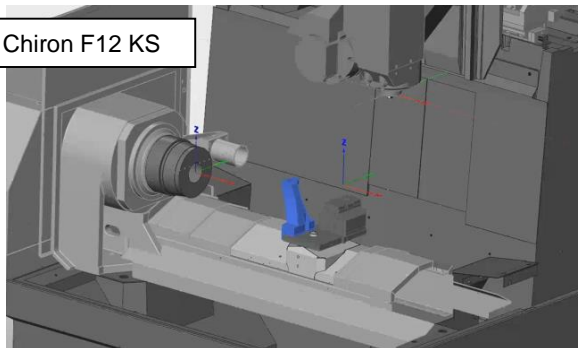
Chiron Z8 T2



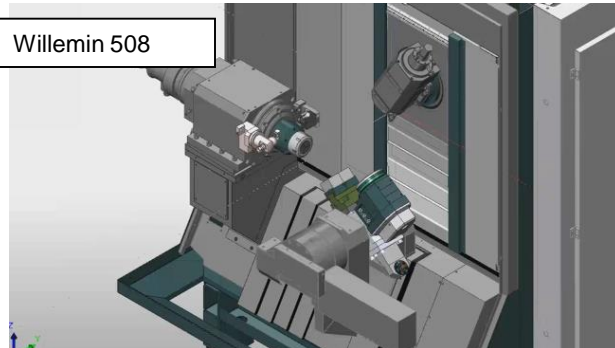
Chiron Z8 T4



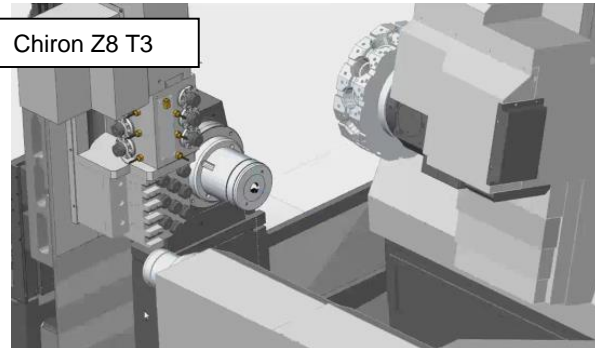
Chiron F12 KS



Willemin 508



Chiron Z8 T3



What's New in SolidCAM 2016

Channel Synchronization

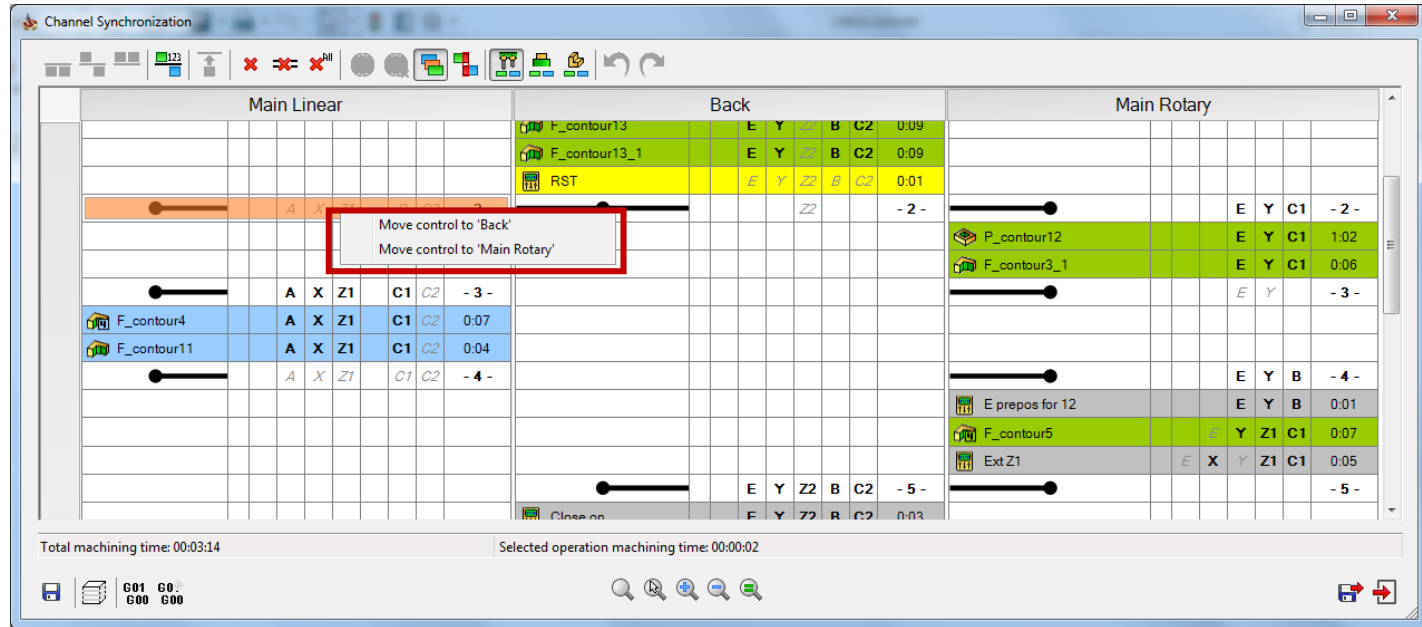
Channels Synchronization : Colors definition in Machine ID file (*.VMID)

The screenshot displays the SolidCAM software interface. On the left is the 'SolidCAM Settings' window with a tree view of various settings. The 'Channel synchronization' option is highlighted in blue. In the center is the 'MACHINE ID EDITOR' window, which has a 'Working Style' tree on the left and a table of parameters on the right. The 'Channel Synchronization' item is selected in the tree. A 'Color' dialog box is open in the foreground, showing a grid of color swatches. A red box in the top toolbar highlights the 'Channel Synchronization' icon.

Name	Value
Sub	(153, 204, 255)
Main	(153, 204, 0)
Rotary	(153, 204, 0)
Linear	(153, 204, 255)
Workpiece No.1	(255, 255, 204)
Workpiece No.2	(210, 201, 222)
Workpiece No.3	(198, 239, 206)
Machine Control Operation	(192, 192, 192)
Stock Management Operators	(255, 255, 0)

- Operation in Channel Synchronization manager could be colored by Table, by Turret and by Workpiece
- Colors of table, turret, workpiece and various stock management operations are set in *.VMID file
- Colors of Label and of the cell in case of manual operation duration definition is set in SolidCAM settings

Channels Synchronization : Axes transfer from channel to channel



- Right click on non-kinematic (gray italic) Axis in Table allows to transfer control over this axis to another channel

Channels Synchronization : Continuous production

Channel Synchronization

Channel	Operation	A	X	Z1	B	C1	C2	Duration
Main Linear	F_contour4	A	X	Z1	B	C1	C2	0:07
Main Linear	F_contour11	A	X	Z1	B	C1	C2	0:04
Main Linear	Close on							0:03
Main Linear	Transfer		Y	Z2	B			0:01
Main Linear	F_contour9	E	Y		B	C2		0:13
Back	Z2							
Main Rotary	P_contour12	E	Y	C1				1:02
Main Rotary	F_contour3_1	E	Y	C1				0:06
Main Rotary	E prepos for 12	E	Y	B				0:01
Main Rotary	F_contour5	Y	Z1	C1				0:07
Main Rotary	Ext Z1	E	X	Y	Z1	C1		0:05

Total machining time: 00:03:14
Selected operation machining time: 00:00:01

- **Reordering of the operations inside the same channel in order to provide synchronization between the start and the end of the CAM-part machining process**
- **Possibility to emulate the machining of several workpieces on different tables simultaneously**

Channels Synchronization : Clash reports' visualization

The screenshot shows the 'Channel Synchronization' window with three columns: 'Main Linear', 'Back', and 'Main Rotary'. The 'Back' column contains a list of operations with their respective axes and drive units. A red box highlights a cell in the 'Back' column containing 'Z2 B -2'. Arrows point from this cell to a floating tip that reads: 'P_contour12' and 'F_contour4' can't be executed simultaneously due to the CAM-tree order destruction. 'P_contour12' and 'F_contour11' can't be executed simultaneously due to the CAM-tree order destruction.

Operation	Axis	Drive Unit	Time
F_contour4	A X Z1	C1	0.07
F_contour11	A X Z1	C1	0.04
F_contour9	E Y Z2 B C2		0.13
Z2 home	E Y Z2 B C2		0.01
TR_contour10	E Y Z2 B C2		0.01
F_contour13	E Y Z2 B C2		0.09
F_contour13_1	E Y Z2 B C2		0.09
RST	E Y Z2 B C2		0.01
P_contour12	E Y C1		1.02
E prepos for 12	E Y B		0.01
F_contour5	E Y Z1 C1		0.07
Ext Z1	E X Y Z1 C1		0.05
Close on	E Y Z2 B C2		0.03

- Problematic places (axis, drive unit, operation cells) filled by red color
- When select the operation, arrow to the operation/axis/drive unit caused the problem appear
- Floating tip with explanation

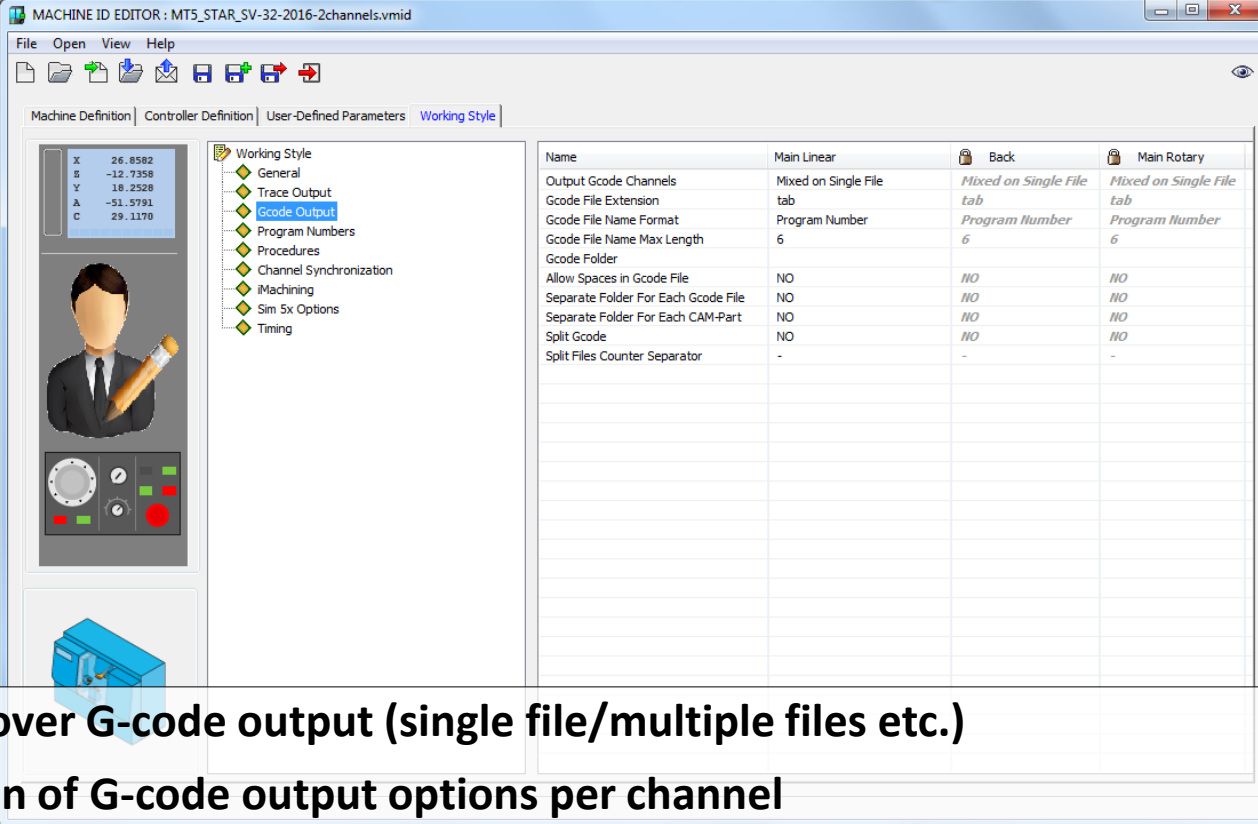
Channels Synchronization : Time mode

The screenshot displays the 'Channel Synchronization' software interface. The main window is divided into three columns: 'Main Linear', 'Back', and 'Main Rotary'. Each column contains a list of operations with their respective synchronization labels and durations. A red box highlights a synchronization icon in the top toolbar. The total machining time is 00:02:24.

Operation	Labels	Duration
F_contc	A X Z1 C1	0:07
F_contour11	A X Z1 C1	0:04
F_contour9	E Y B C2	0:13
F_contour10	E Y B C2	0:09
F_contour11	E Y B C2	0:09
F_contour3_1	E Y C1	0:06
F_contour5	E Y Z1 C1	0:07
Ext.Z1	E X Y Z1 C1	0:05
TR_cor	A E X Z1 B C1 C2	0:18
TR_contour1	Y Z1 B	0:26
F_contour3	F Y C1	0:04

- Preview of operations in real time mode
- Impossible to change synchronization labels and operations order – it's only preview mode

Channels Synchronization : G-code

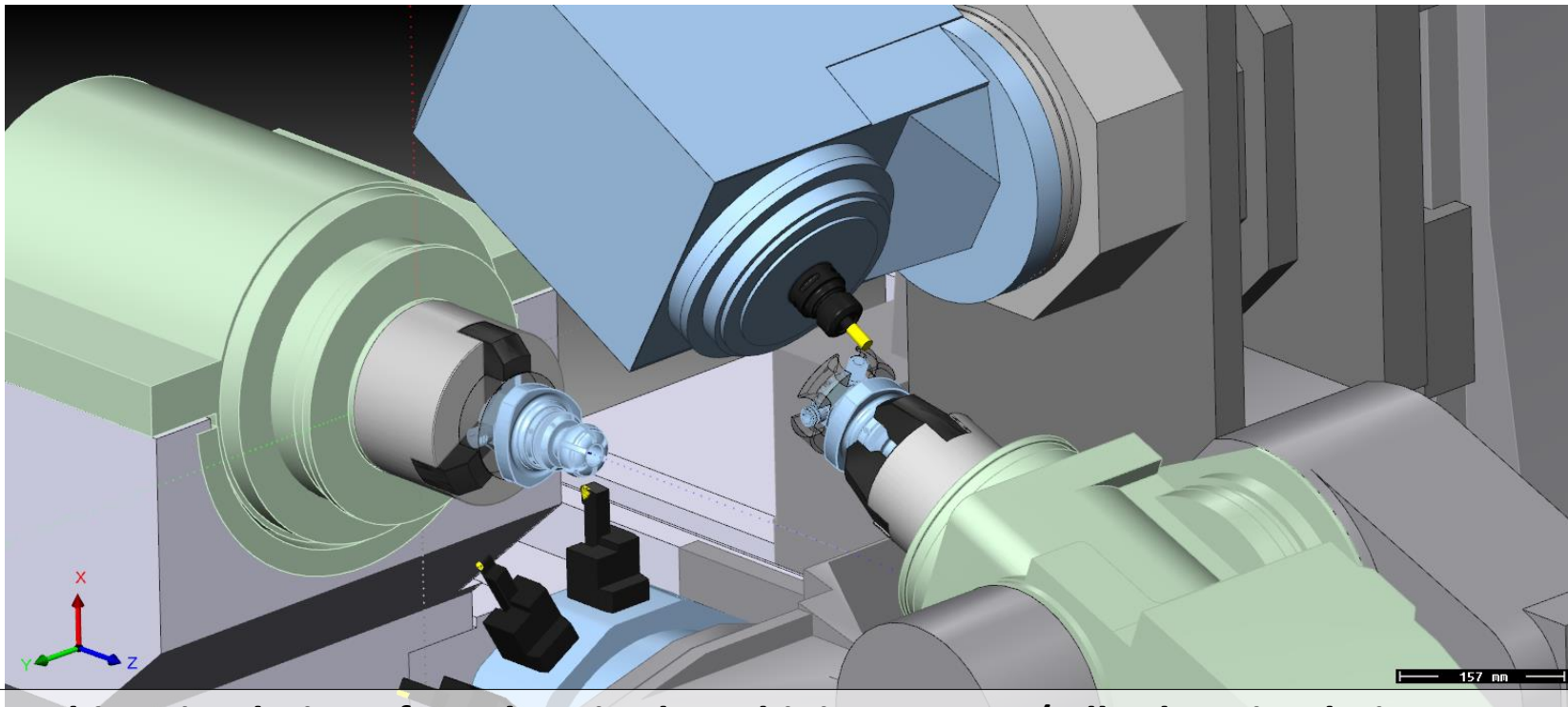


The screenshot shows the MACHINE ID EDITOR software interface. The title bar reads "MACHINE ID EDITOR : MT5_STAR_SV-32-2016-2channels.vmid". The menu bar includes "File", "Open", "View", and "Help". Below the menu bar are icons for file operations. The main window is divided into several panes. On the left, there is a "Machine Definition" pane showing coordinate values for X, S, Y, A, and C. Below this is a 3D model of a machine tool. The central pane is titled "Working Style" and contains a tree view with categories like General, Trace Output, Gcode Output, Program Numbers, Procedures, Channel Synchronization, iMachining, Sim Sx Options, and Timing. The "Gcode Output" category is selected. On the right, a table defines G-code output options for Main Linear and Main Rotary channels.

Name	Main Linear	Back	Main Rotary
Output Gcode Channels	Mixed on Single File	<i>Mixed on Single File</i>	<i>Mixed on Single File</i>
Gcode File Extension	tab	<i>tab</i>	<i>tab</i>
Gcode File Name Format	Program Number	<i>Program Number</i>	<i>Program Number</i>
Gcode File Name Max Length	6	<i>6</i>	<i>6</i>
Gcode Folder			
Allow Spaces in Gcode File	NO	<i>NO</i>	<i>NO</i>
Separate Folder For Each Gcode File	NO	<i>NO</i>	<i>NO</i>
Separate Folder For Each CAM-Part	NO	<i>NO</i>	<i>NO</i>
Split Gcode	NO	<i>NO</i>	<i>NO</i>
Split Files Counter Separator	-	<i>-</i>	<i>-</i>

- Control over G-code output (single file/multiple files etc.)
- Definition of G-code output options per channel

Channels Synchronization : Machine Simulation



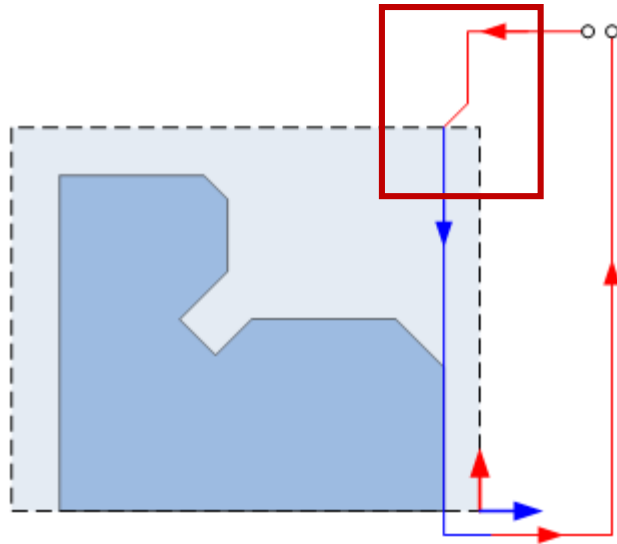
- Machine simulation of synchronized machining process (all other simulations execute operations in CAM-tree order)

What's New in SolidCAM 2016

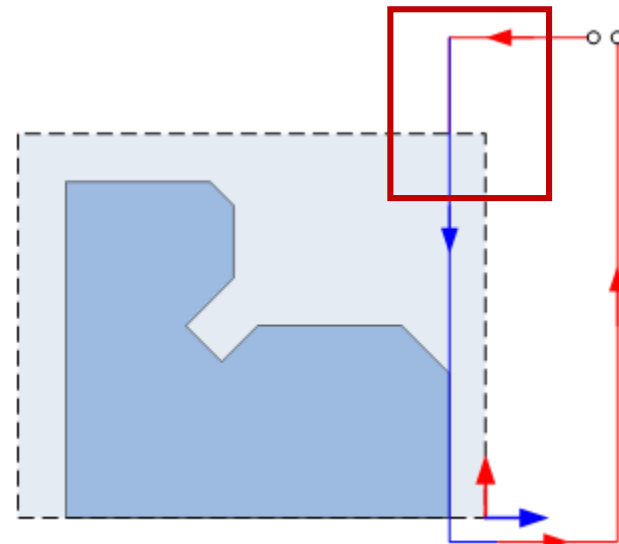
Turning

Turning: Changes in compensation

Previous versions



SolidCAM 2016



Optimized (less movements) entrance to compensation in turning operation


Turning: Standard Chuck definition

Name: Show

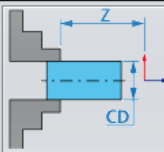
Defined by:

Clamping method

Main sub



Chuck position



Clamping diameter (CD):

Axial position (Z):




Name: Show

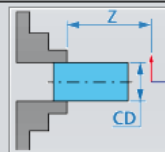
Defined by:

Clamping method

Mirrored



Chuck position

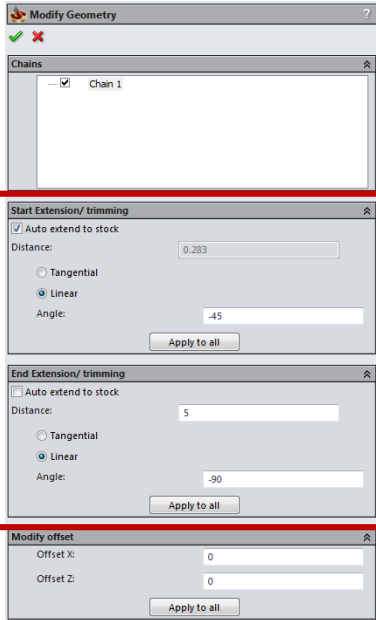


Clamping diameter (CD):

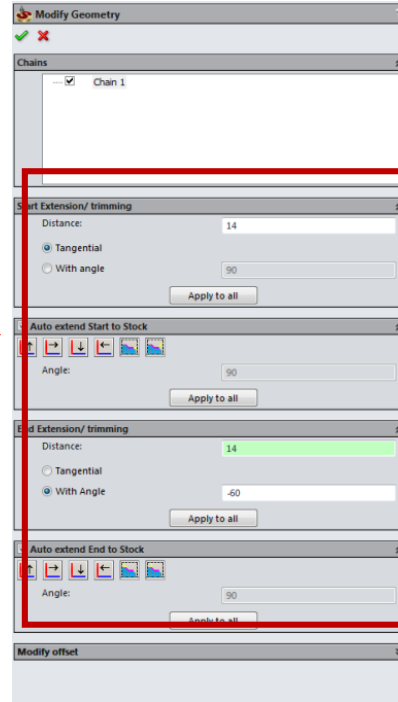
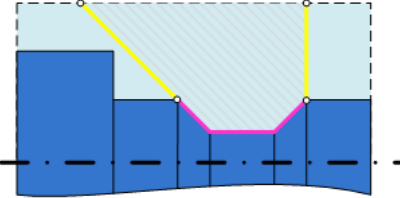
Axial position (Z):

Change in interface defining the orientation of poliarc (radiobuttons replaced by checkbox)

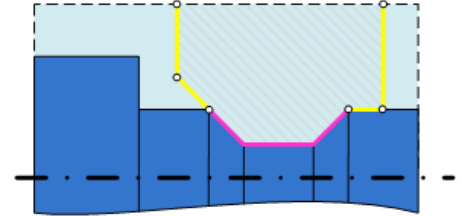
Geometry: Enhanced geometry extension options



Previous versions

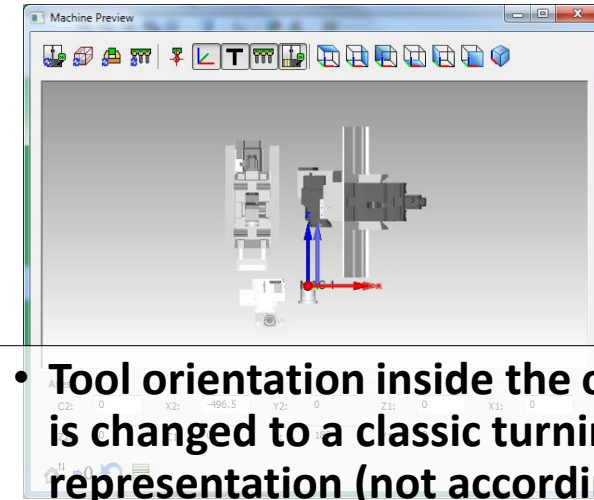
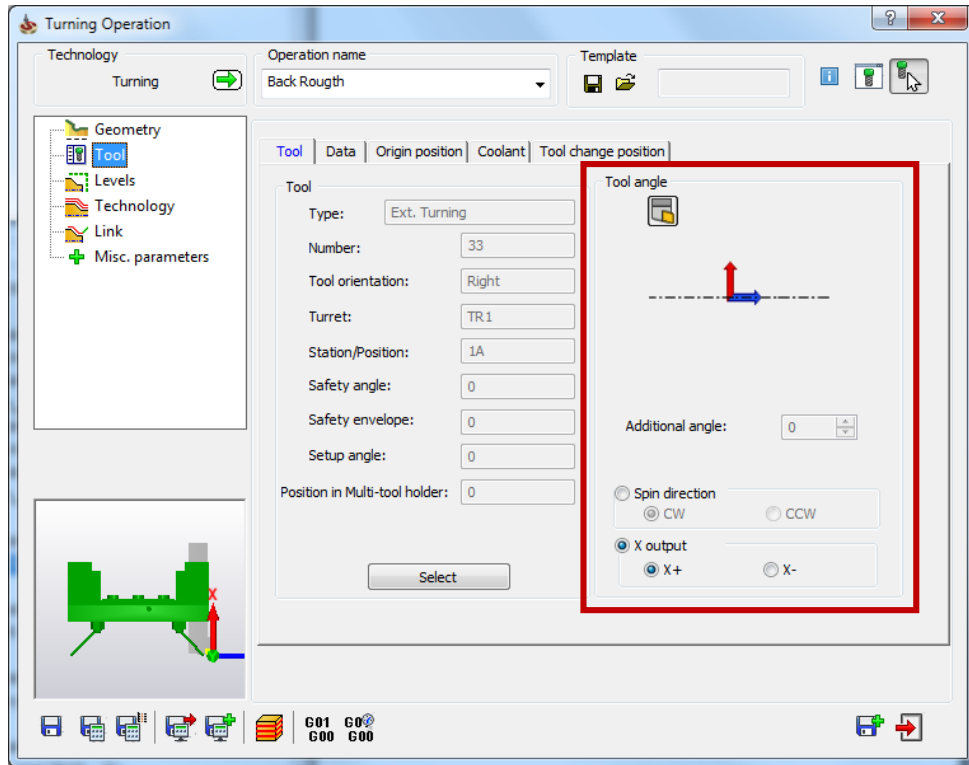


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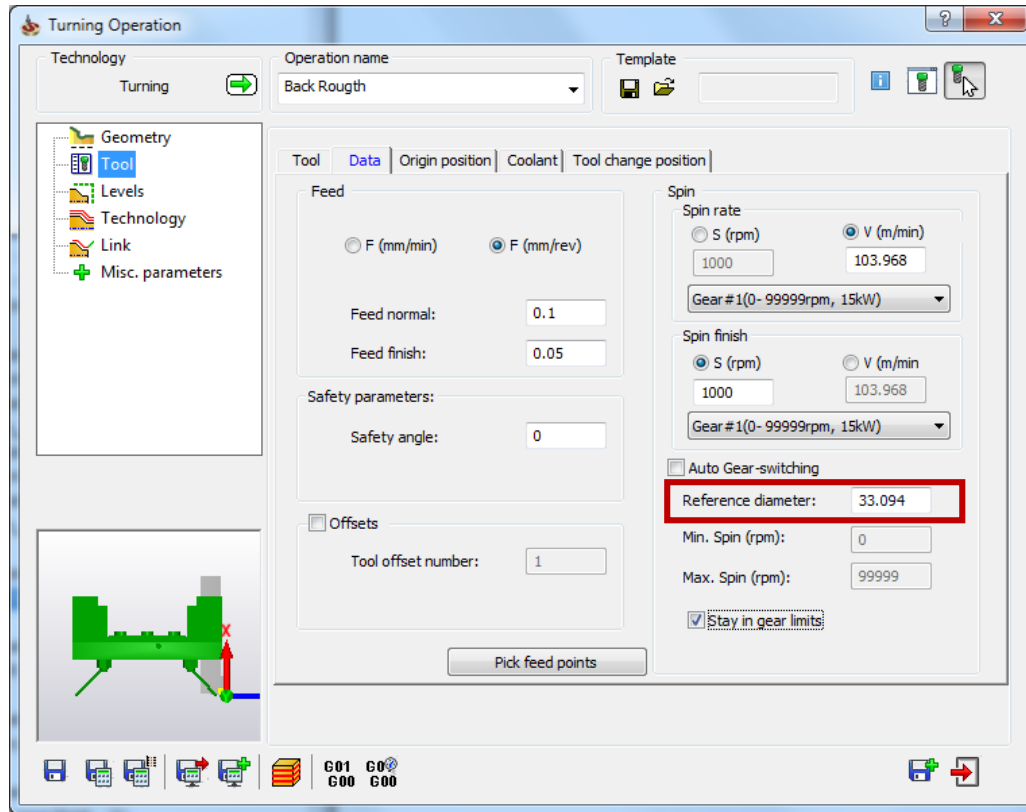
More flexible extension of the geometry by 2 segments on both sides of the polyarc

Turning: non-kinematic tool orientation definition inside the operation



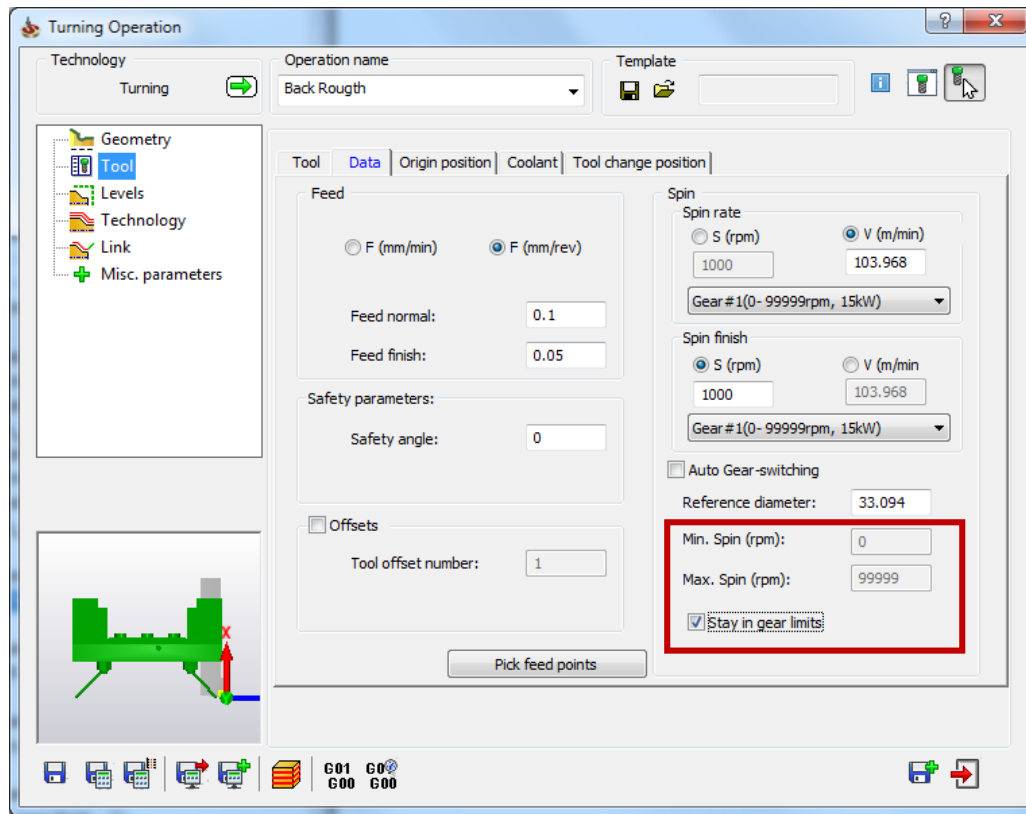
- **Tool orientation inside the operation is changed to a classic turning representation (not according to the actual tool position in the machine)**
- **Actual tool orientation is visualised in Machine Preview dialog available from within the Operation**
- **X output (+ or -) and Spin direction are now connected**

Turning: Reference diameter



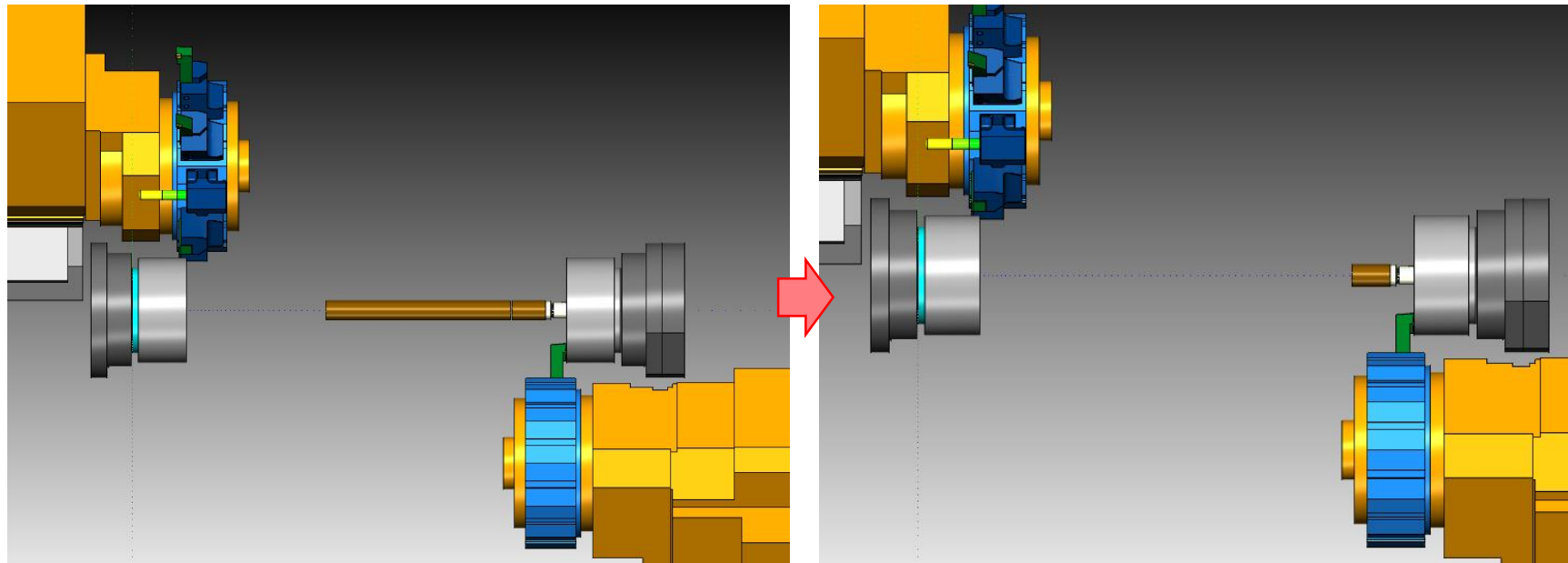
- For V (m/min) spin definition – reference diameter added.
- Spin for smaller/ larger diameter is calculated accordingly

Turning: Stay in Gear limits



- 2 option to define spin limits:
- Take values from the selected Gear automatically
- Enter the values manually

MachSim: Remove redundant stock after CutOff

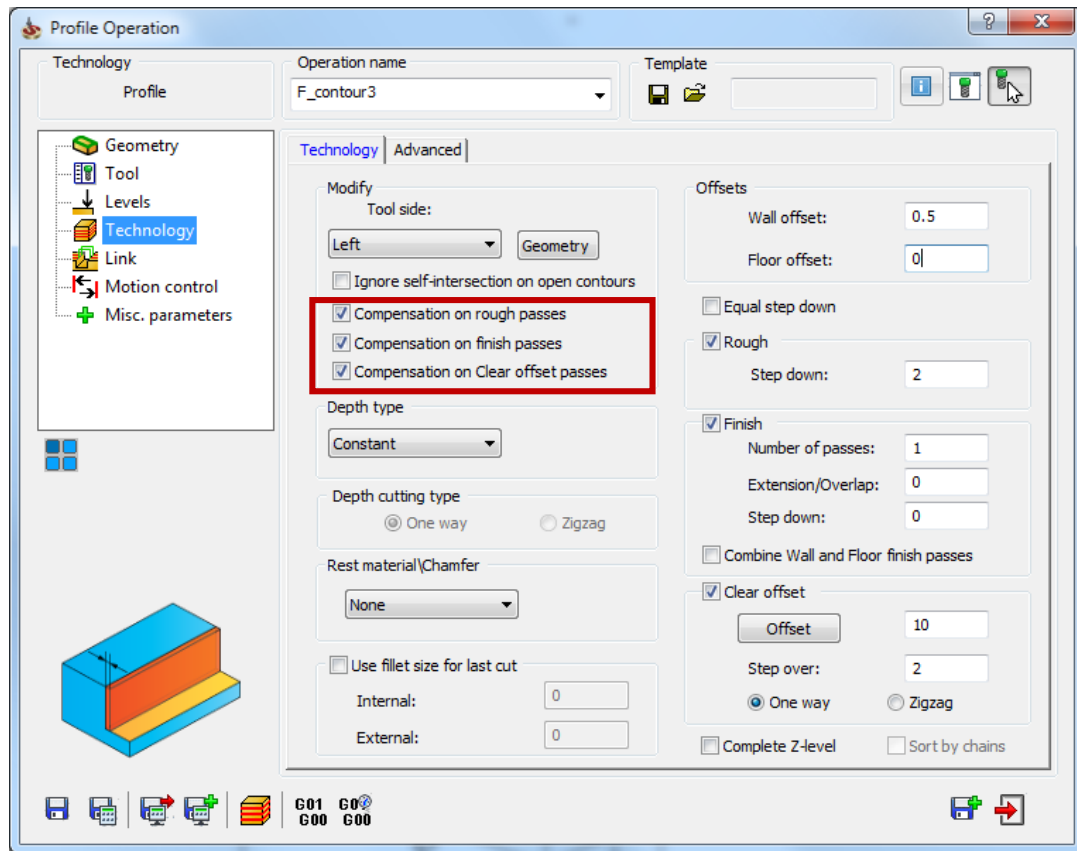


In new version the needless piece of stock remained after the CutOff operation is automatically deleted

What's New in SolidCAM 2016

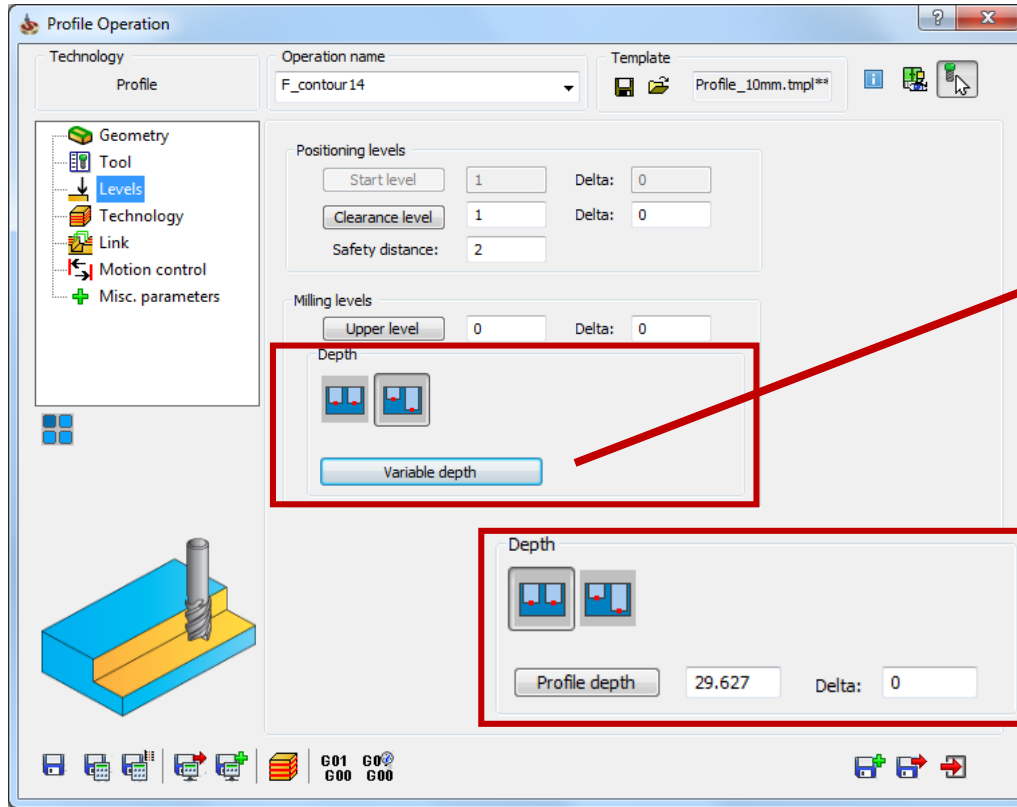
2.5D Milling

2.5D Milling: Compensation for Rough, Finish and Clear Offset separately



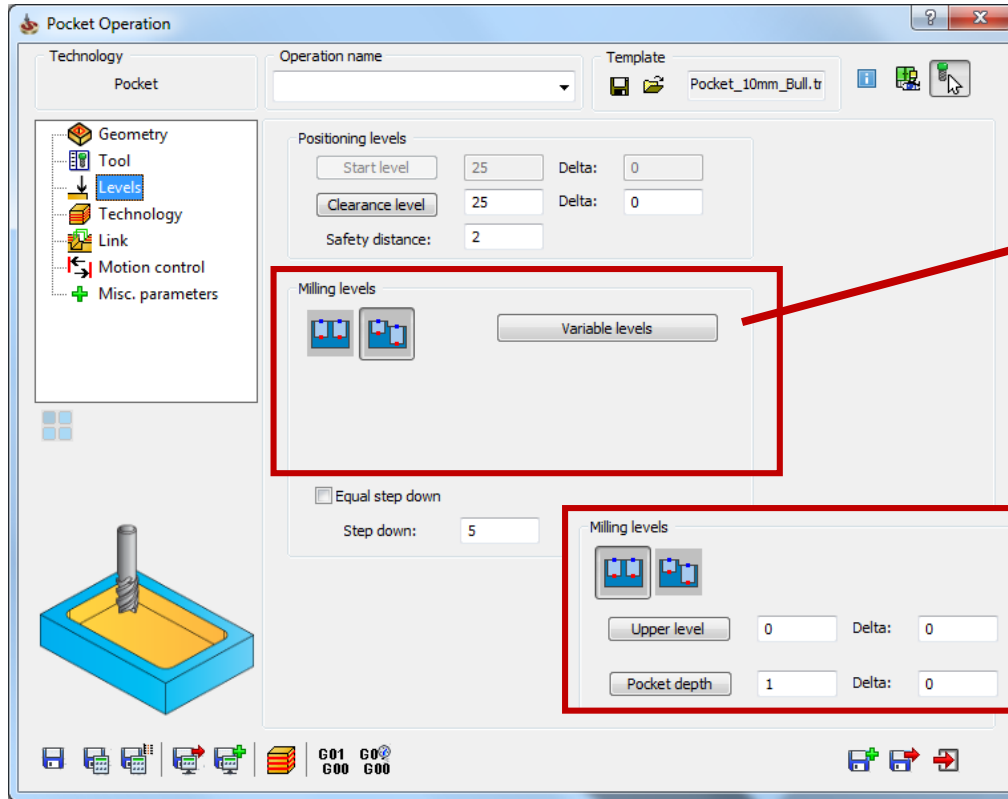
Possibility to turn on compensation separately for Rough, Finish and Clear Offset passes.

2.5D Milling: Variable Depth in Profile



Possibility to define various depth for each profile chain

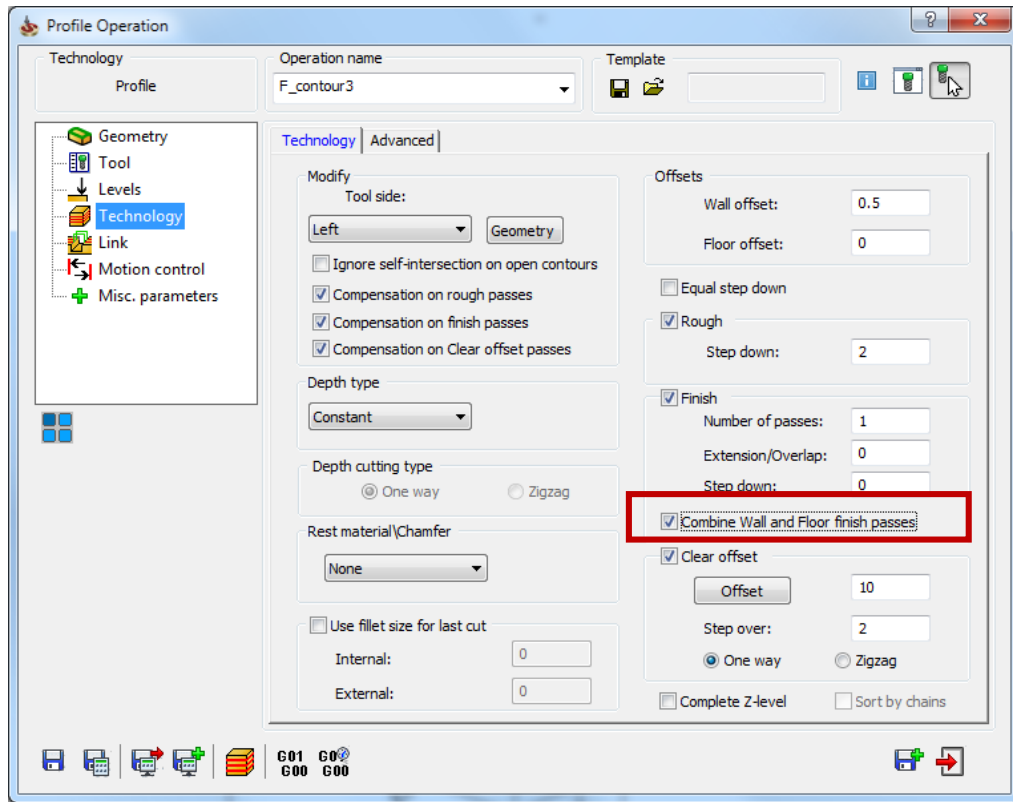
2.5D Milling: Variable Levels in Pocket



Chain	Upper level	Upper lev...	Depth	Delta
2-Chain	0.000	0.000	5.000	0.000
4-Chain	0.000	0.000	5.000	0.000

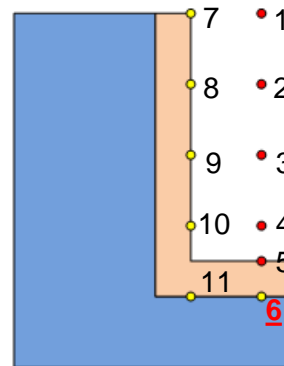
Possibility to define various upper level and depth for each pocket chain

2.5D Milling: Combine Wall and Floor finish passes

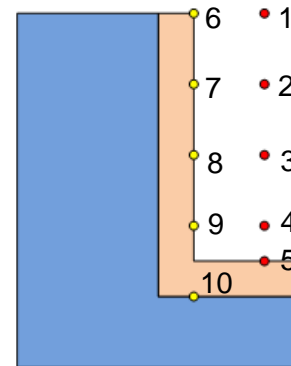


Combine wall and floor offset passes to one pass

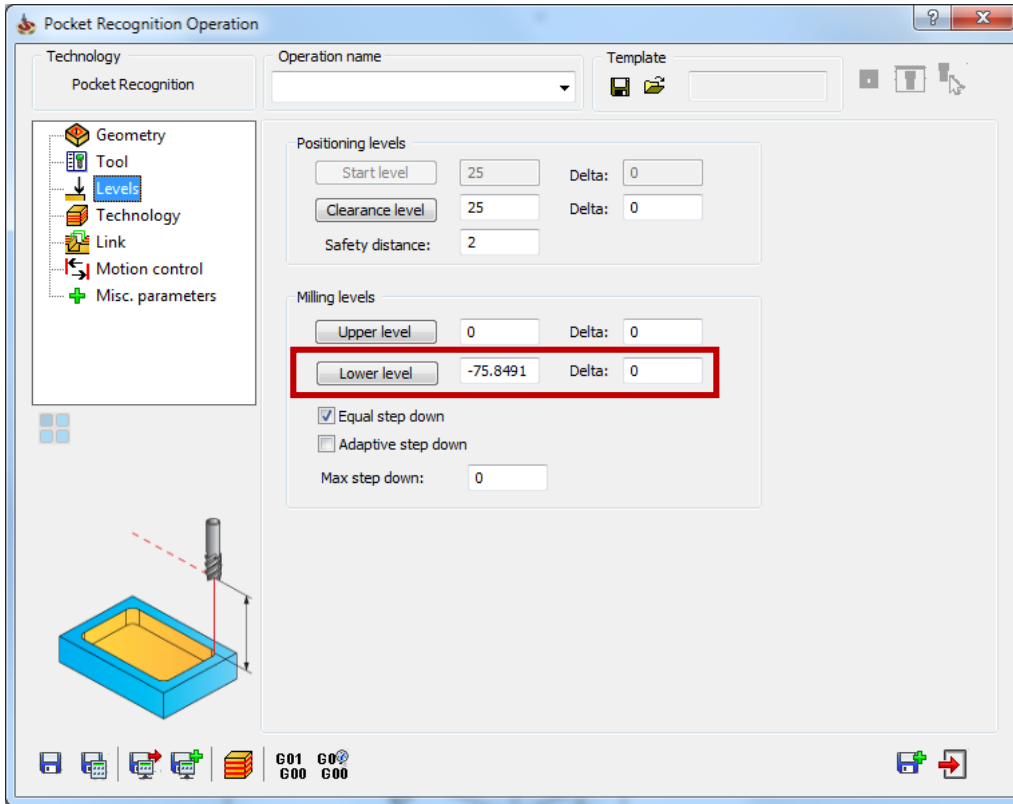
Combine Floor and Wall finish passes



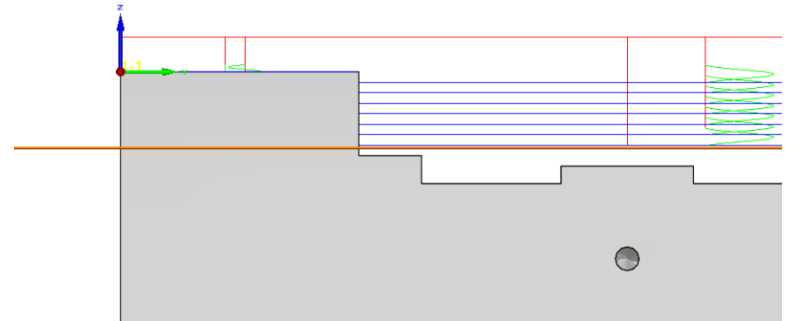
Combine Floor and Wall finish passes



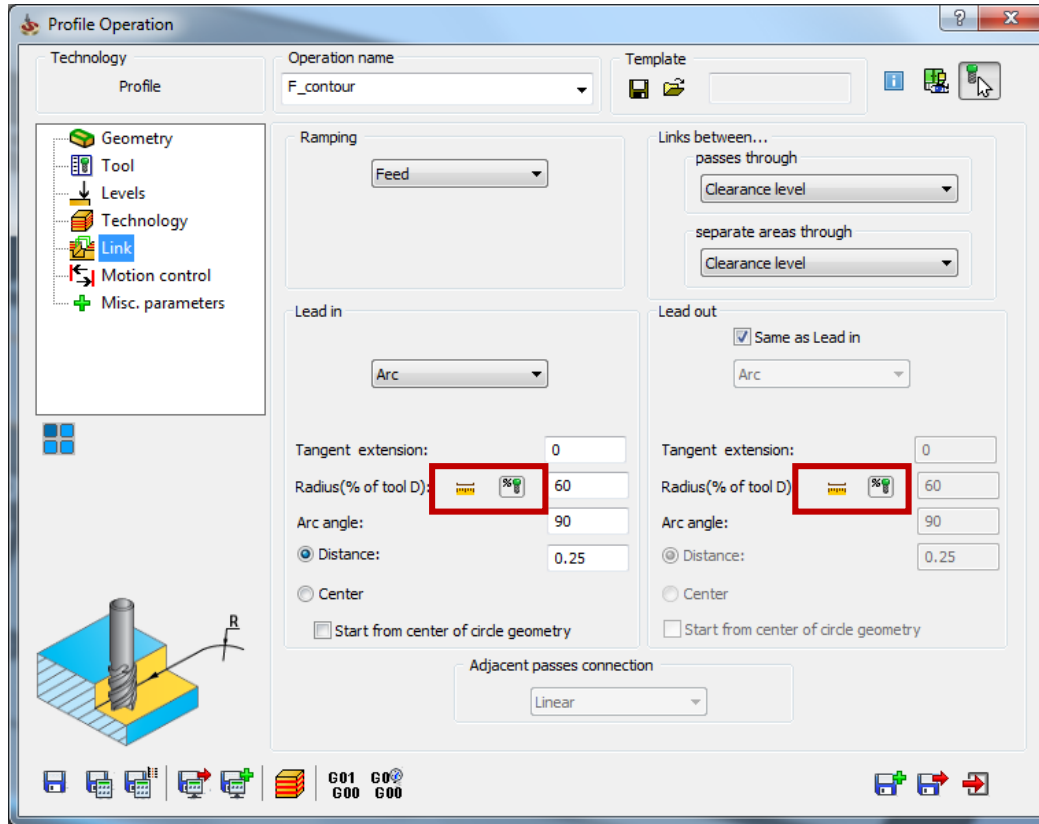
Pocket Recognition: Limit the machining depth



Limit the depth of cutting in Pocket Recognition operation



2.5D Milling: Lead in/out radius in % of tool diameter

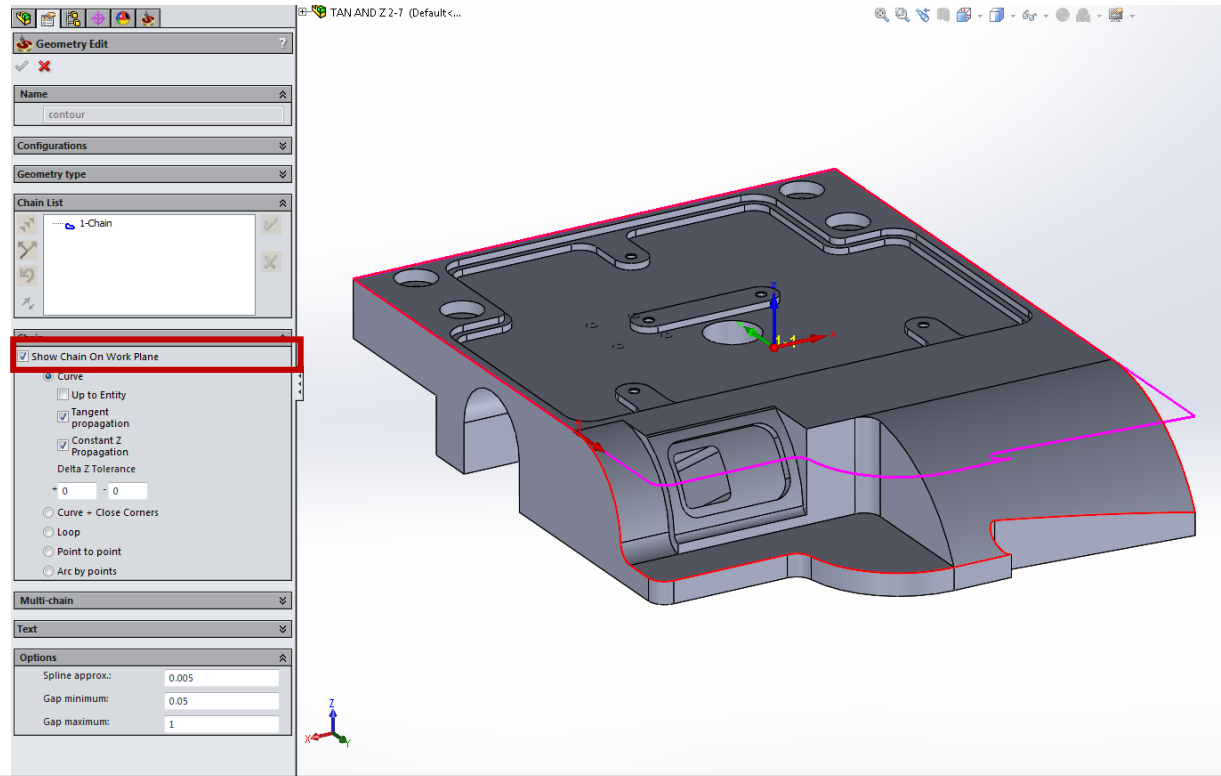


Possibility to define lead in and lead out radiuses not only in mm/inch, but in % of tool diameter too.

What's New in SolidCAM 2016

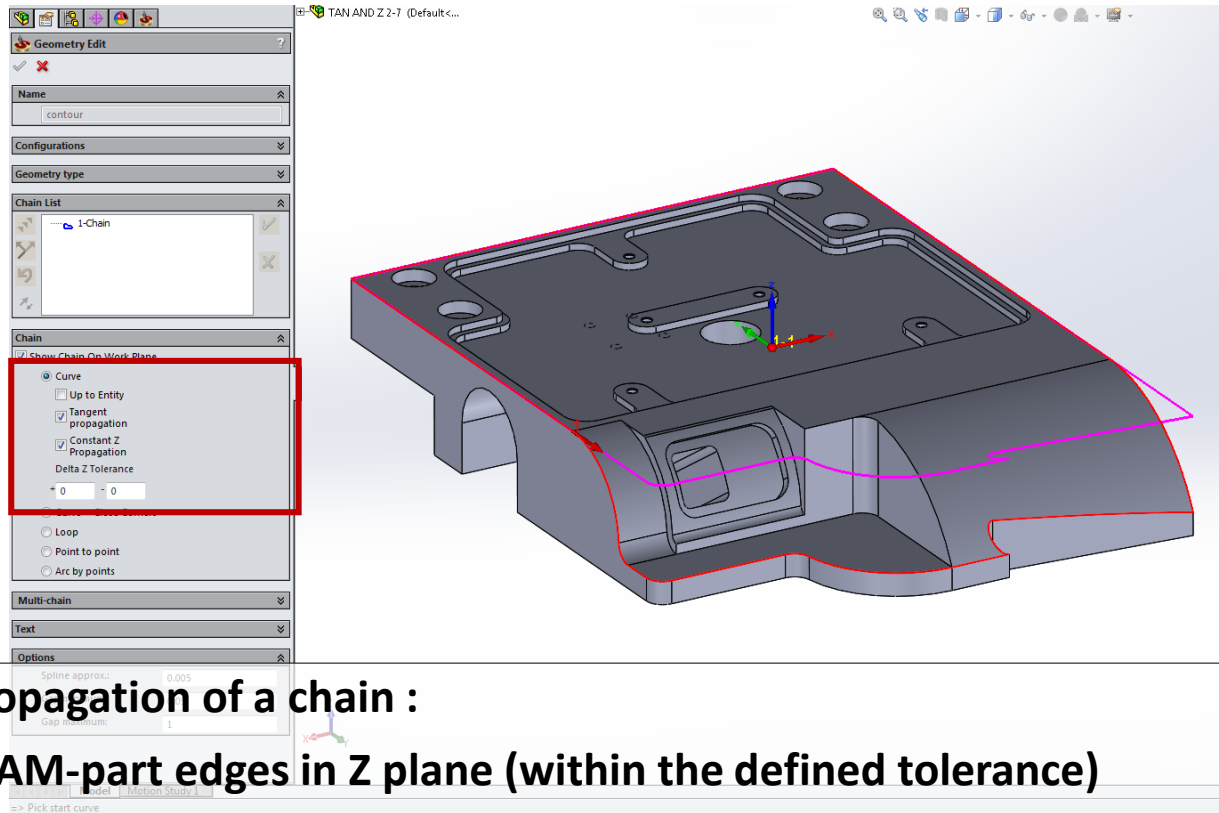
Geometry

Geometry: Show chain on work plane



- Shows the chain projected to the XY plane (the way it will be used in the operation)

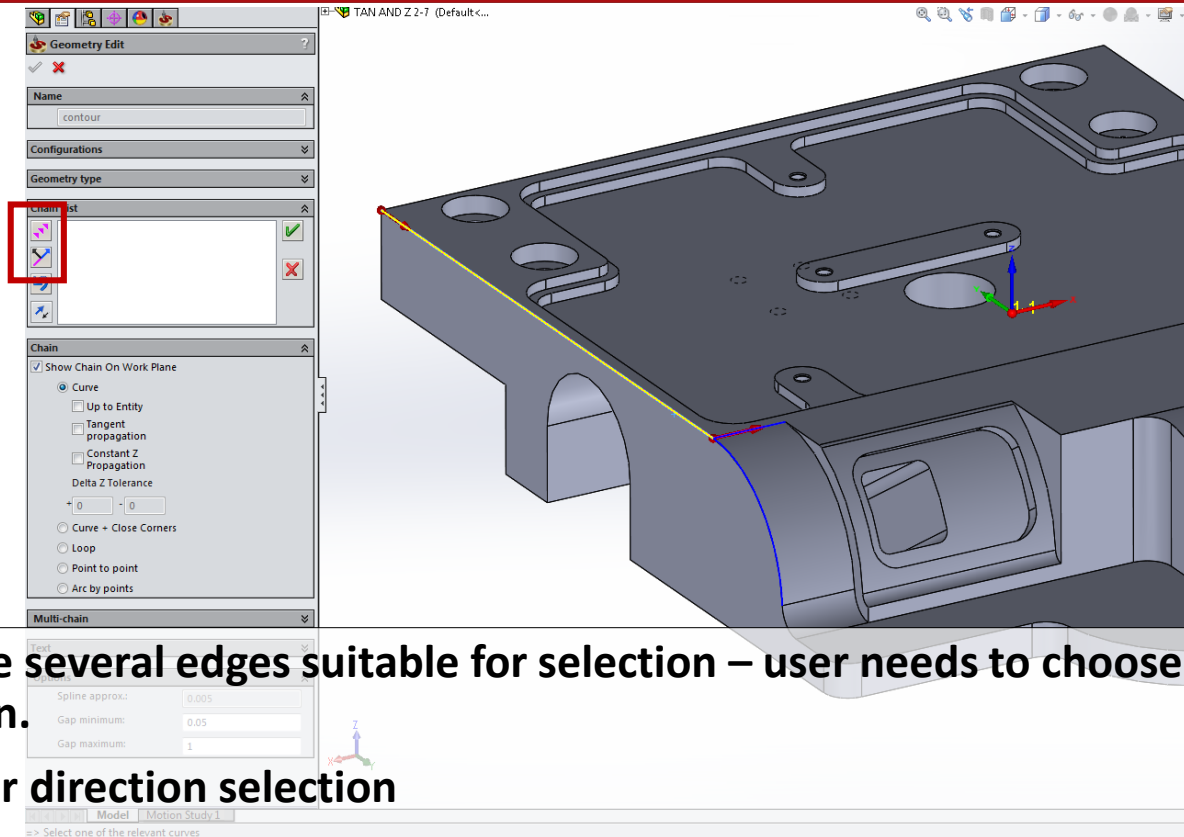
Geometry: New Propagation options



Automatic propagation of a chain :

- **Along the CAM-part edges in Z plane (within the defined tolerance)**
- **Along edges tangential to the previously selected one**

Geometry: New Buttons for faster chain selection



When there are several edges suitable for selection – user needs to choose which one should be taken.

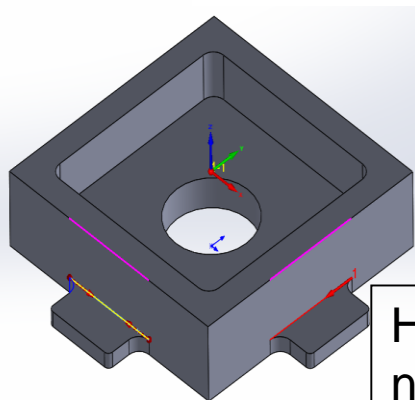
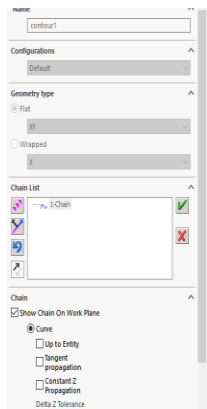
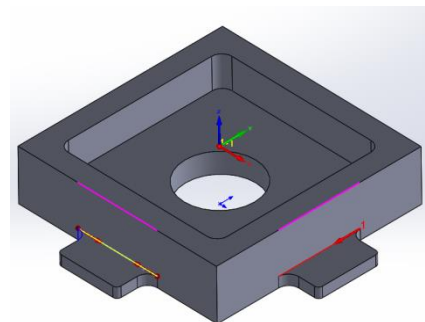
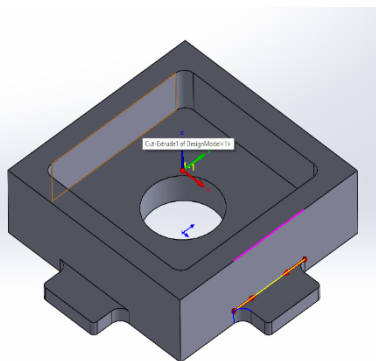
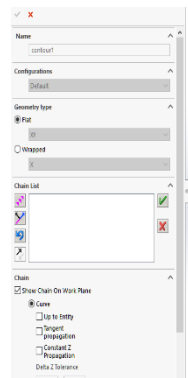


- button for direction selection



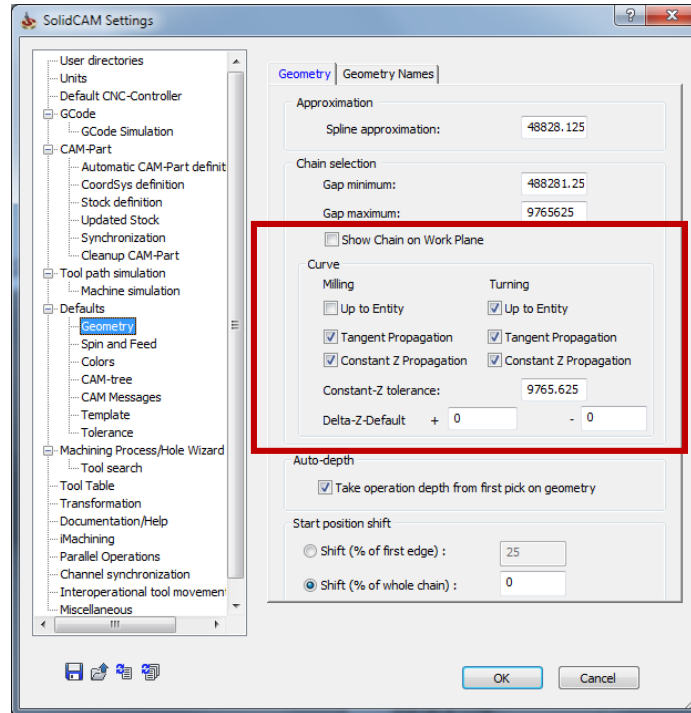
- button to continue automatic selection process

Geometry: Next Chain Creation



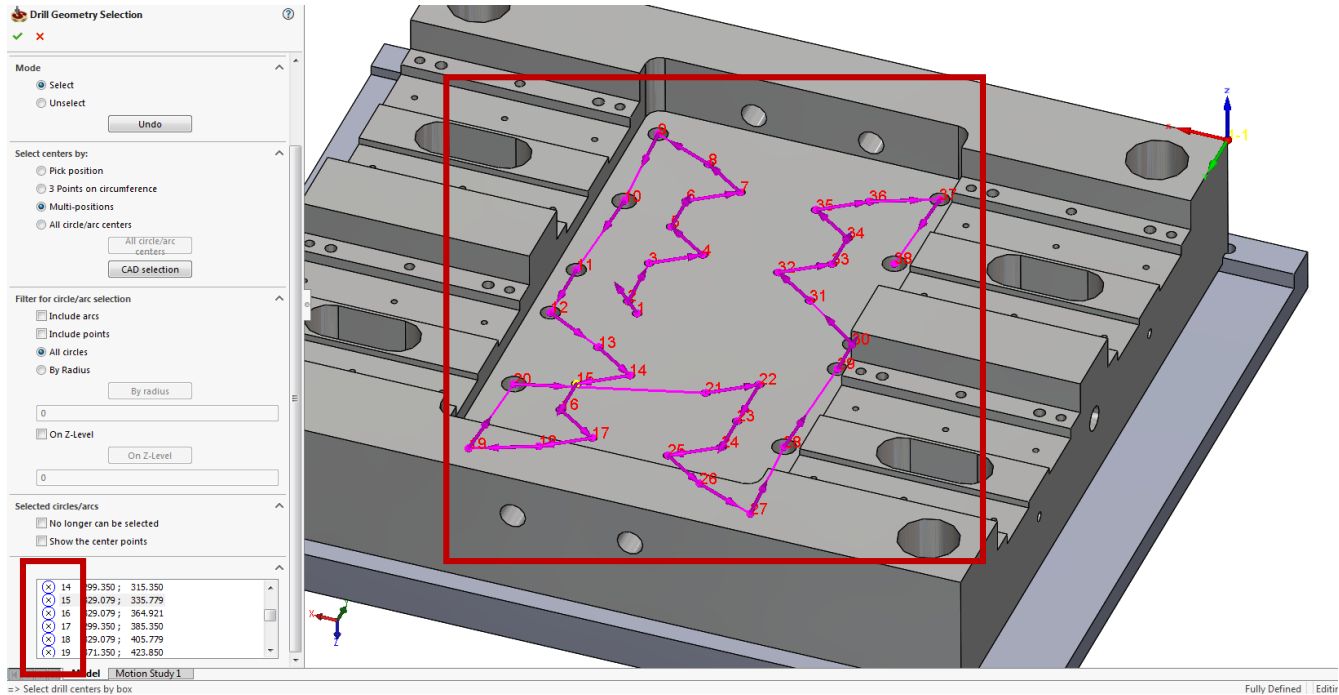
Holding the Control button and picking the next curve will start to create your next chain.

Geometry: Control over chain selection defaults



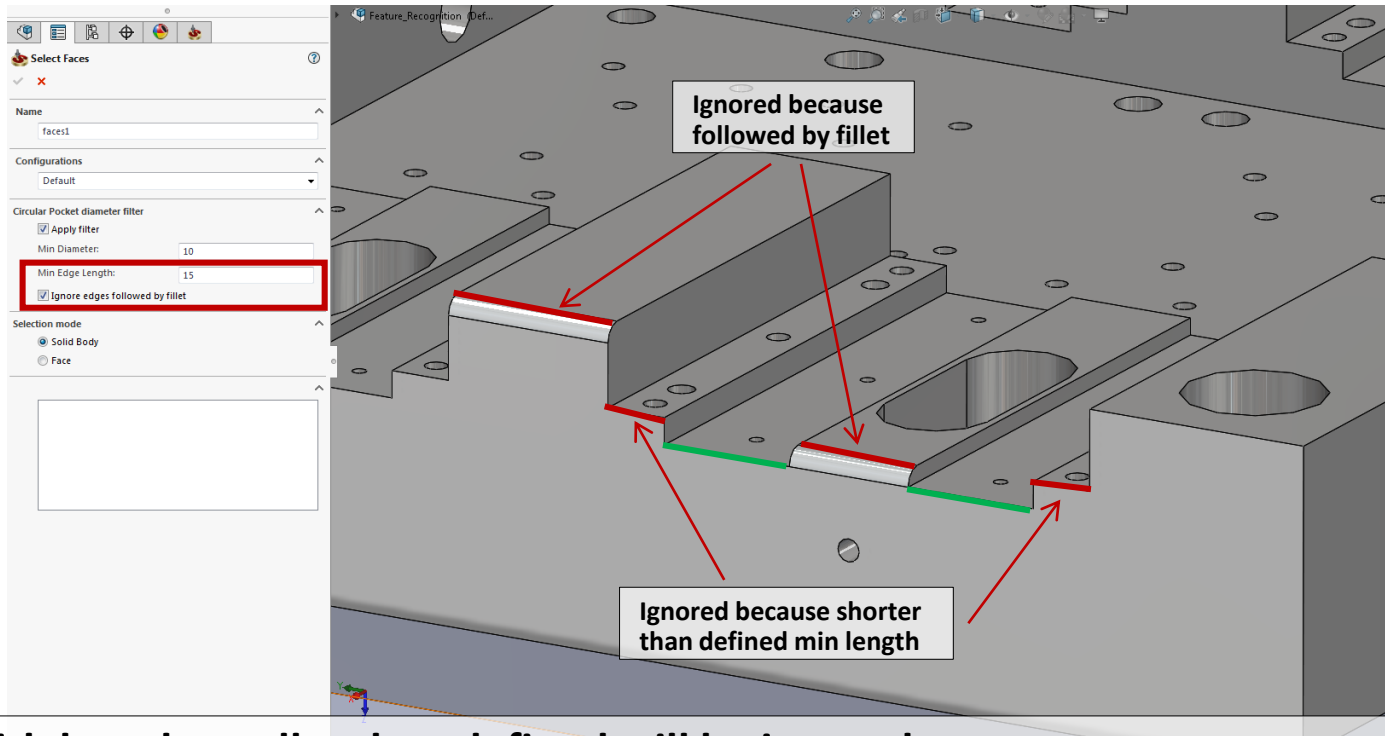
Possibility to define in settings which options are active by default

Geometry: Preview of holes numbers in drill geometry



Better visualisation of define holes and easier matching with the list of drill points.

Geometry: Chamfer recognition filters

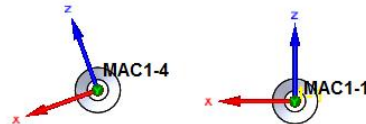
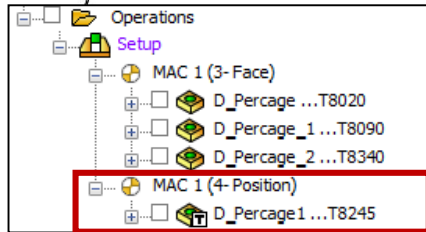
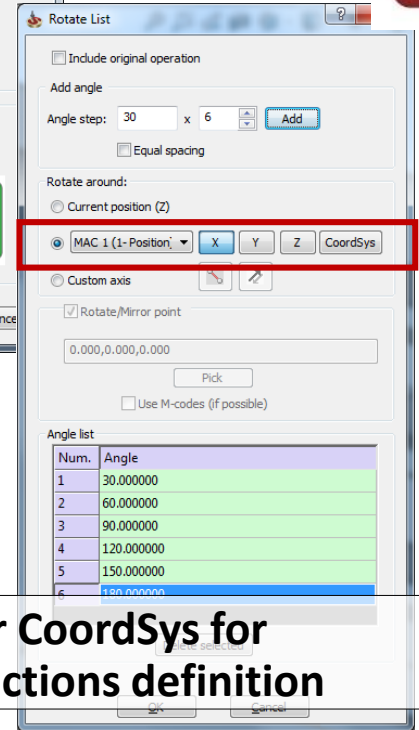
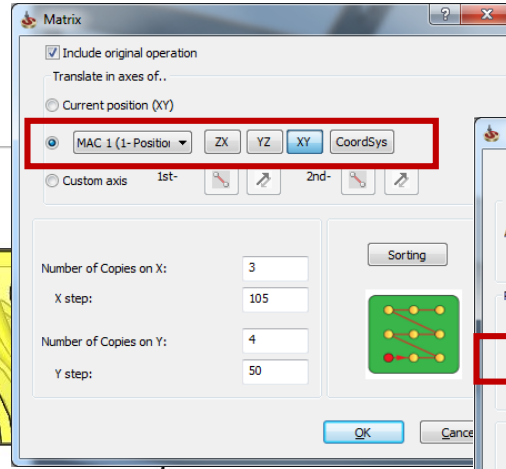
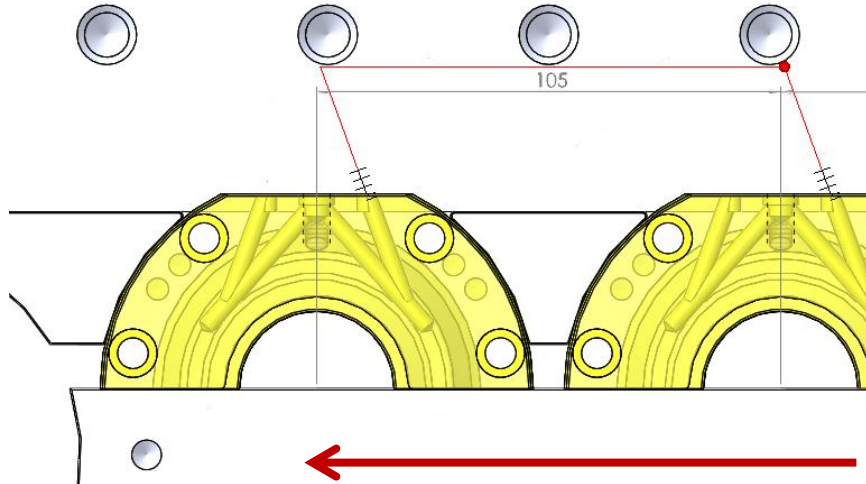


- Chains with length smaller than defined will be ignored
- Edges followed by fillet optionally could be ignored

What's New in SolidCAM 2016

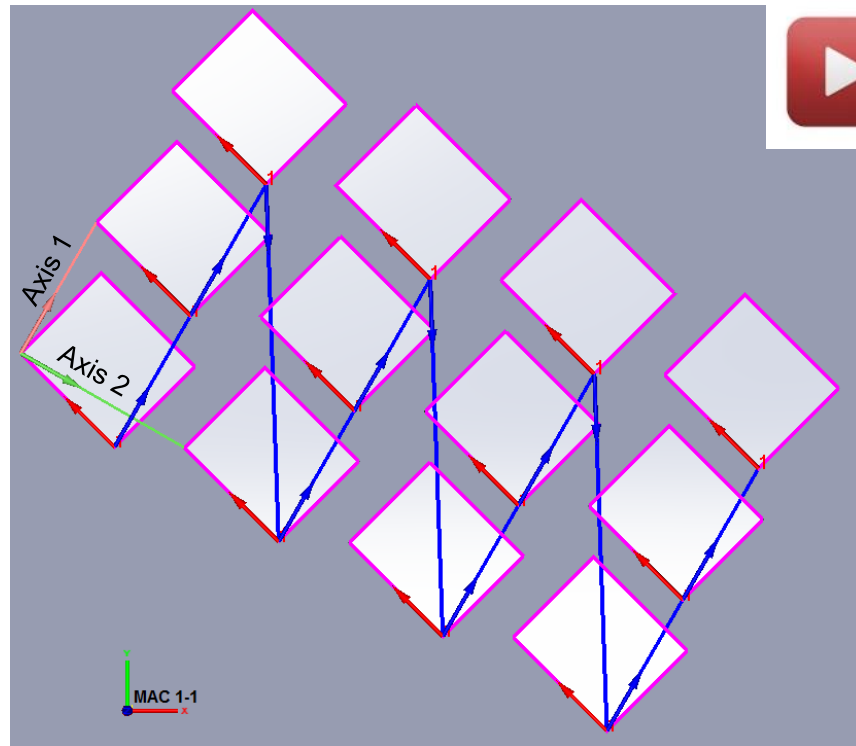
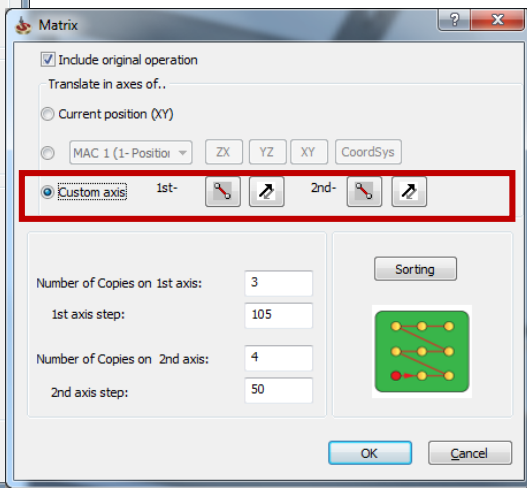
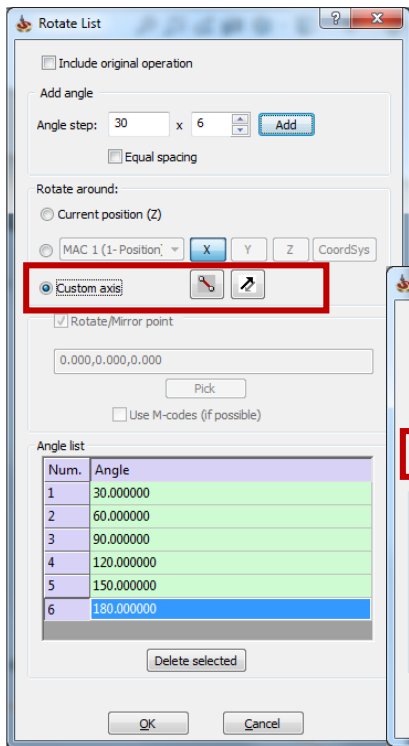
Transformation

Transform: Selection of custom transformation direction (CoordSys)



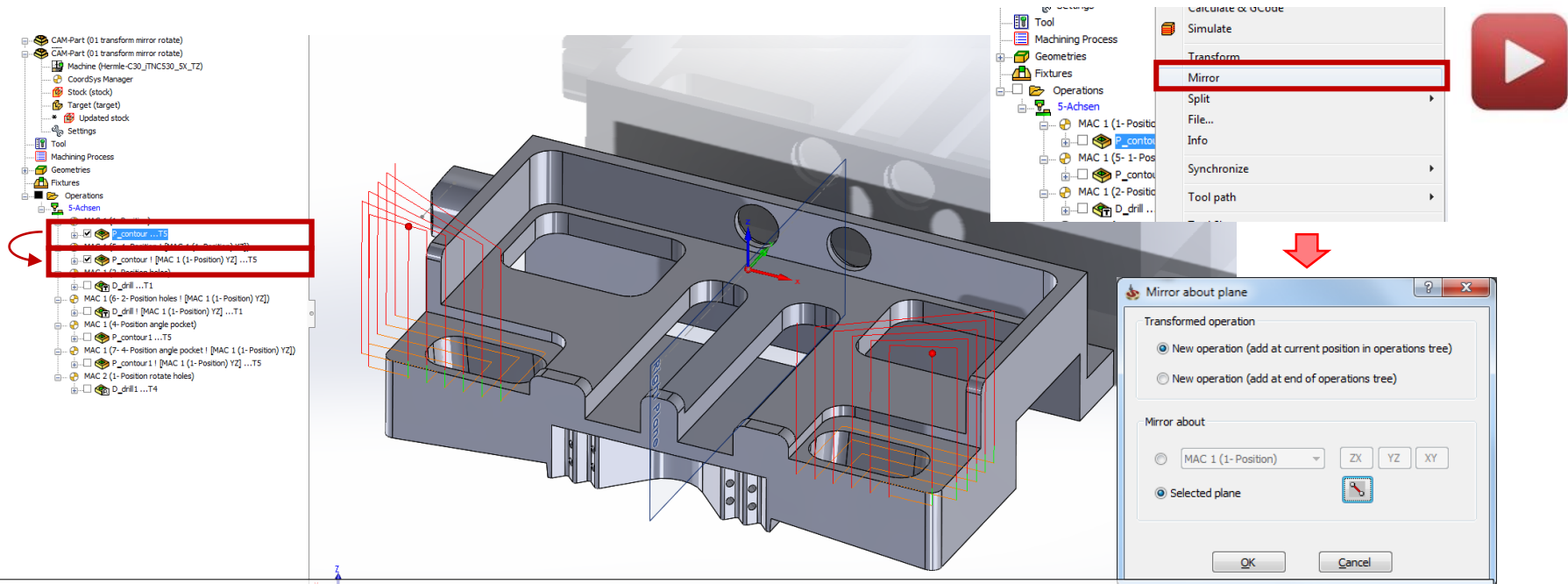
Use axes of another CoordSys for transformation directions definition

Transform: Selection of custom transformation direction (Vector)



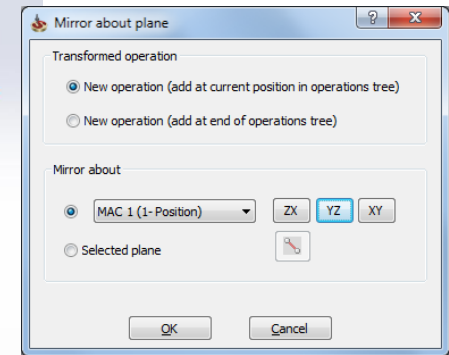
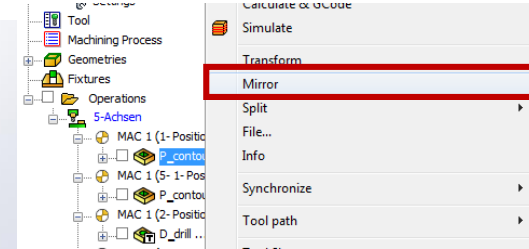
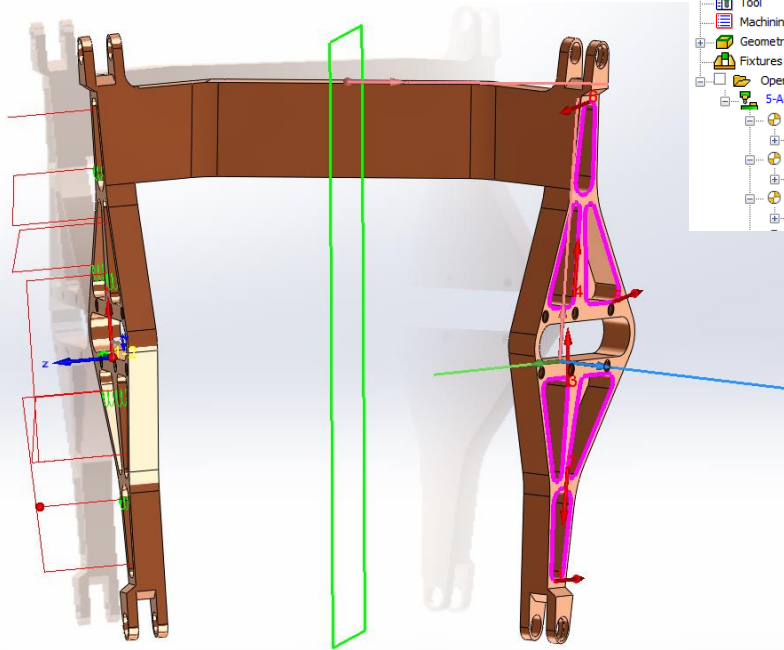
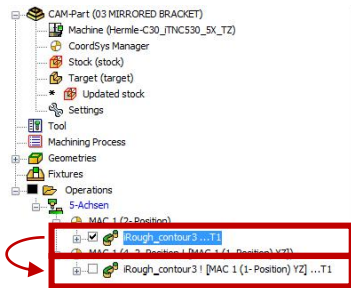
Use custom axes for definition of transformation directions

Transform: Mirror



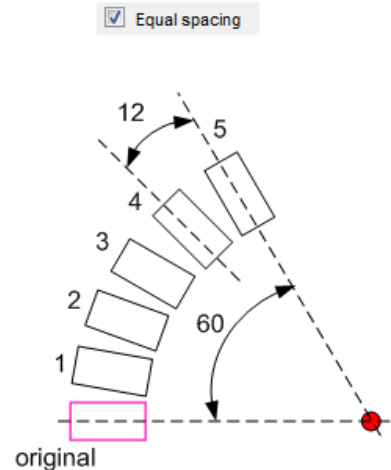
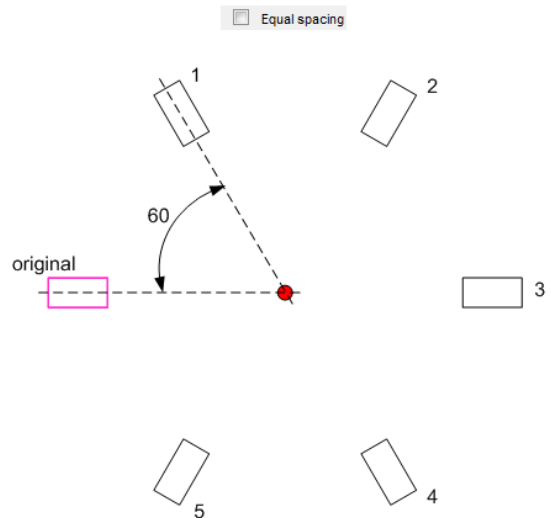
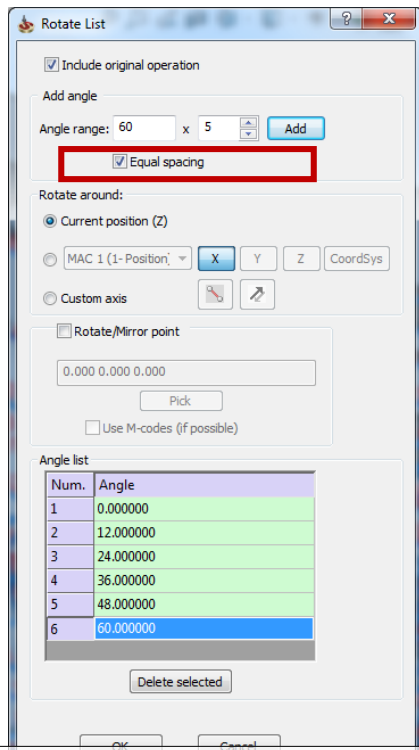
- Mirror according to selected plane or one of standard planes of selected CoordSys
- Additional operation is created
- Keep cutting direction (climb/conventional)

Transform: Mirror



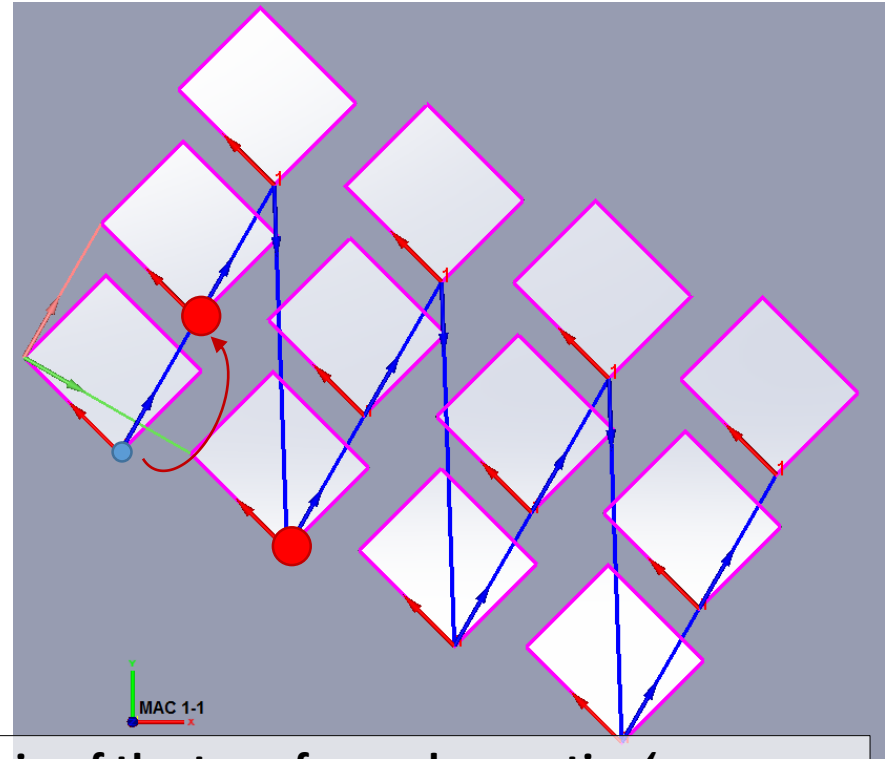
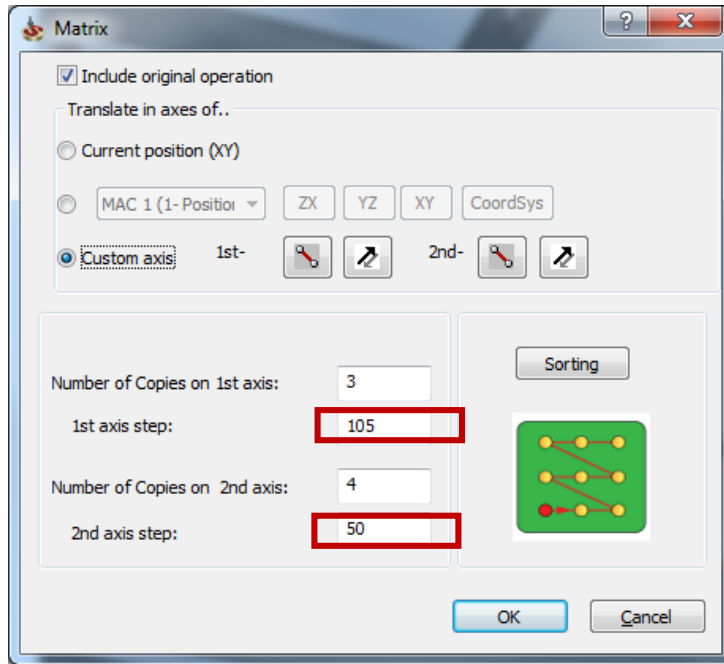
- Preview of mirroring direction and new operation's geometry
- Additional CoordSys is created if required

Transform: Equal spacing in Rotate transformation



- Option to define angles for translation by angle range and amount of step

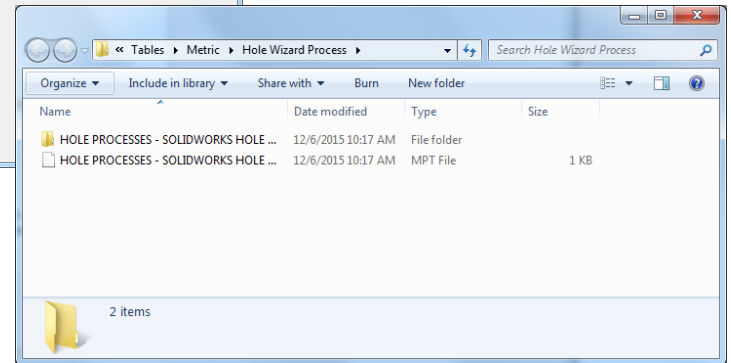
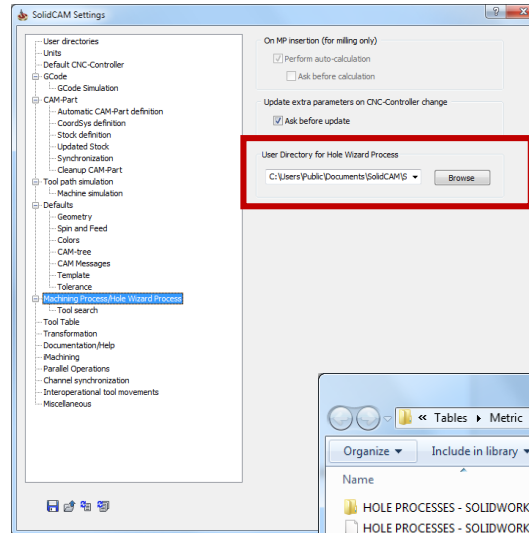
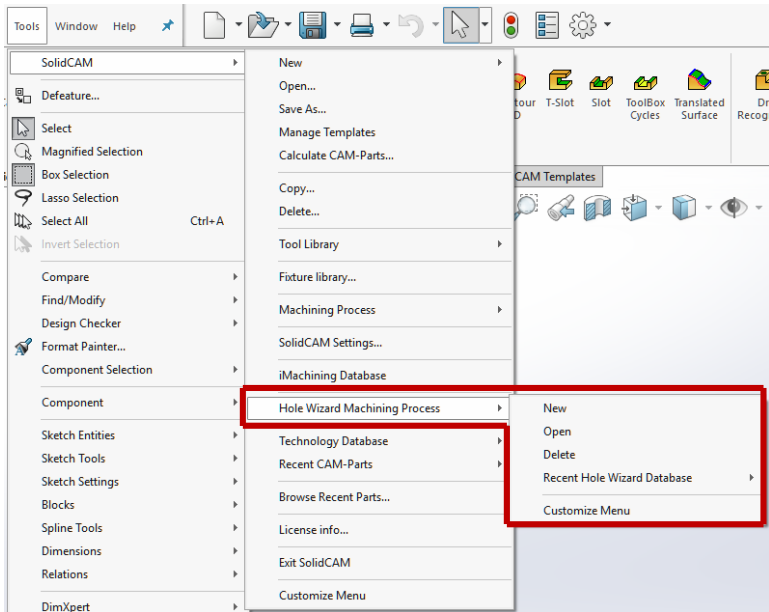
Transform: Pick matrix step from the model



- Pick the point where the start of first chain of the transformed operation's geometry should be → it is taken as a step in Matrix transformation

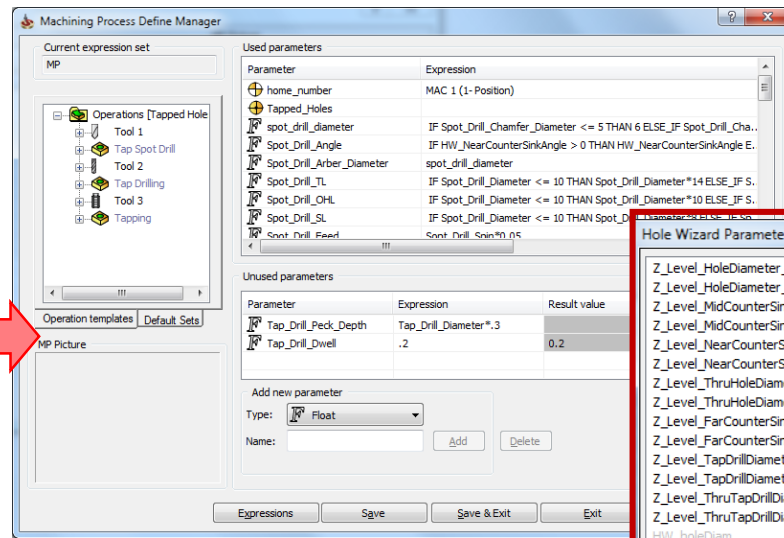
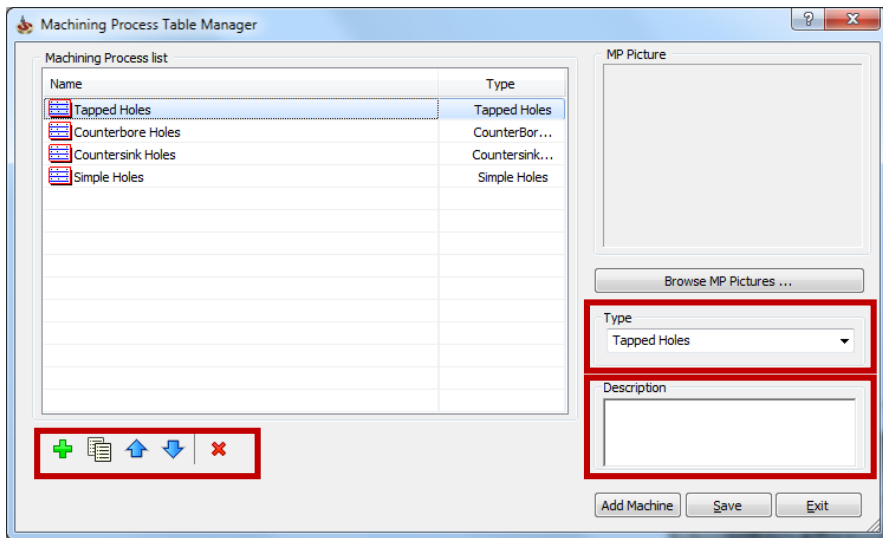
Hole Wizard

Hole Wizard: Separated folder



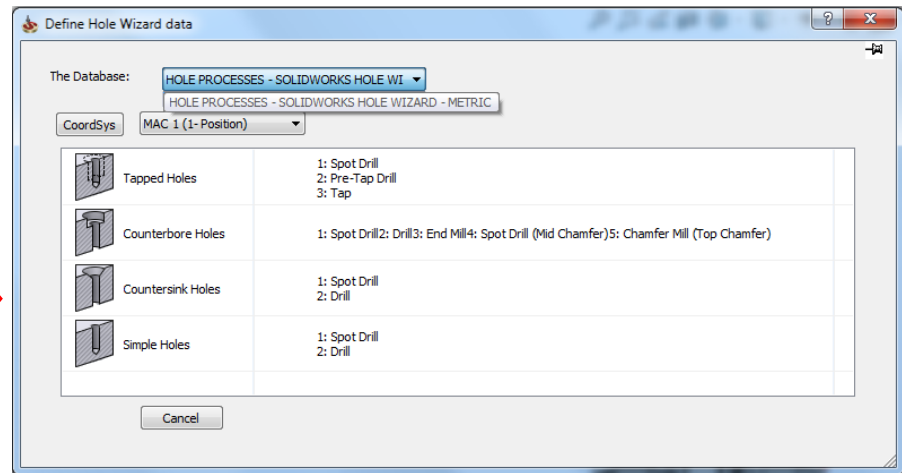
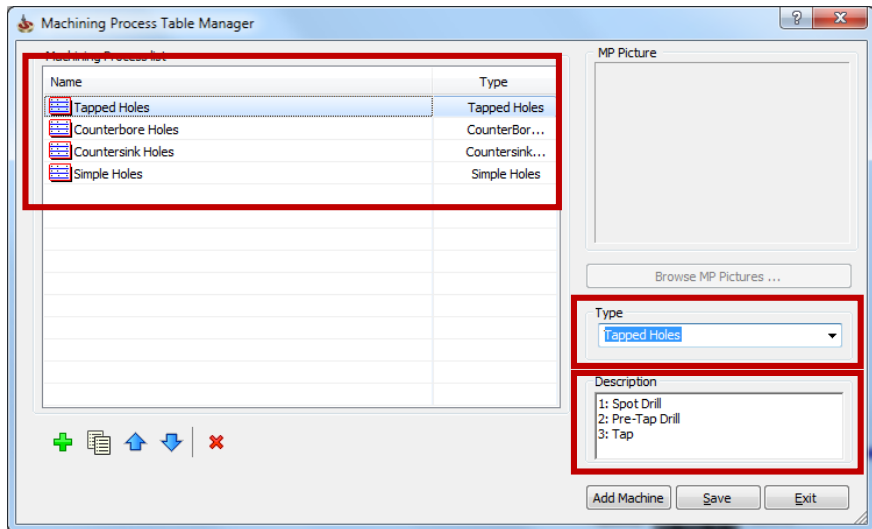
- Separated folder for Hole Wizard Machining Process files

Hole Wizard: Customization



- New Actions (reorder, copy, cut, paste) added to the table of Machining Processes
- Type of holes filters the list of available Hole Wizard parameters, making the definition of formulas easier

Hole Wizard: Enhanced User Interface

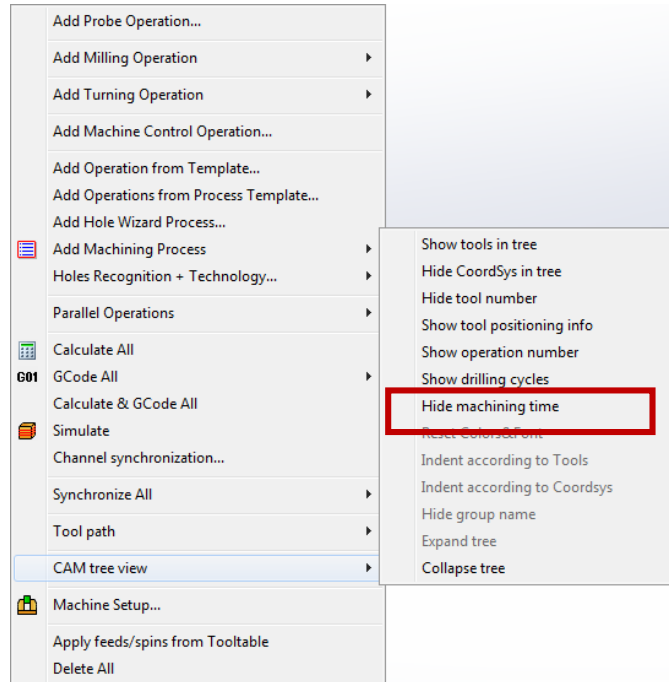
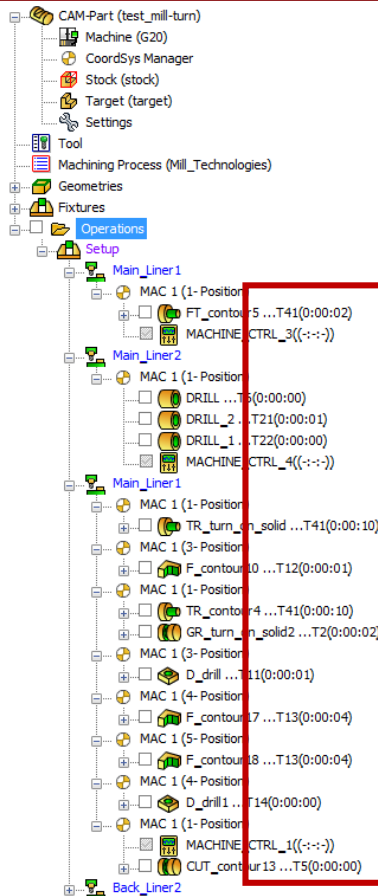


- **Combobox of Databases contains only DBs compatible with current machine (= have the same Drilling cycles)**
- **Description is added in order to make selection of the Machining Process easier**

What's New in SolidCAM 2016

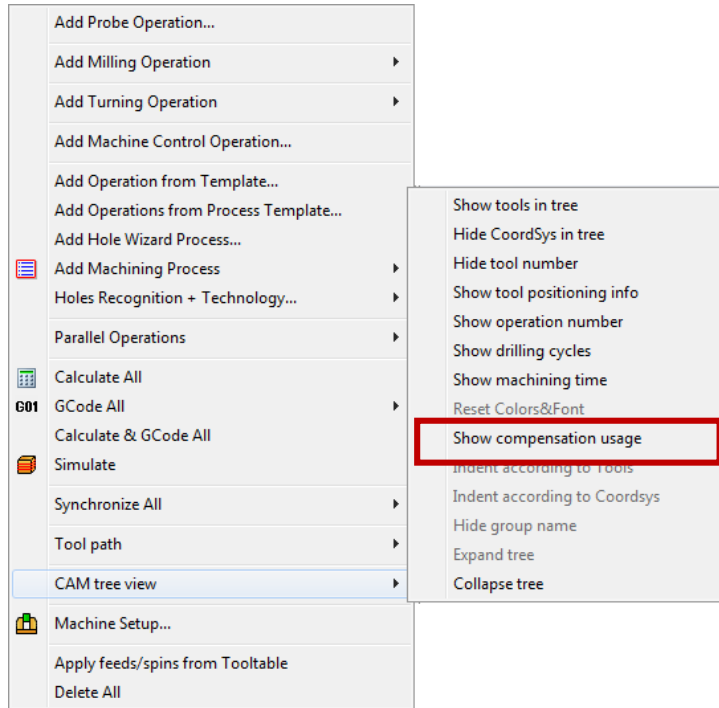
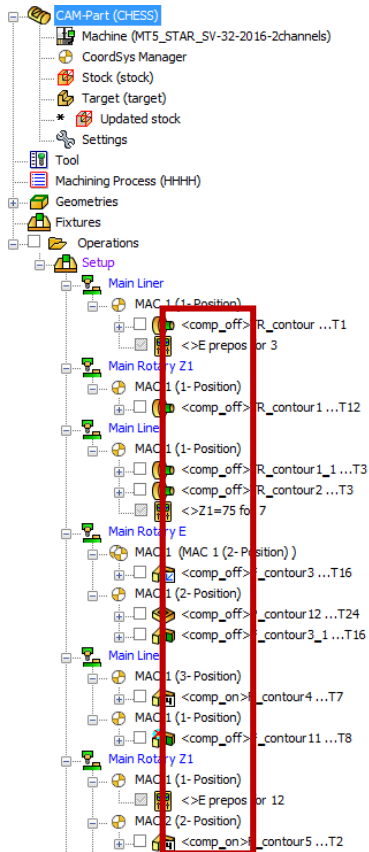
CAM-tree

CAM-tree: Show machining time



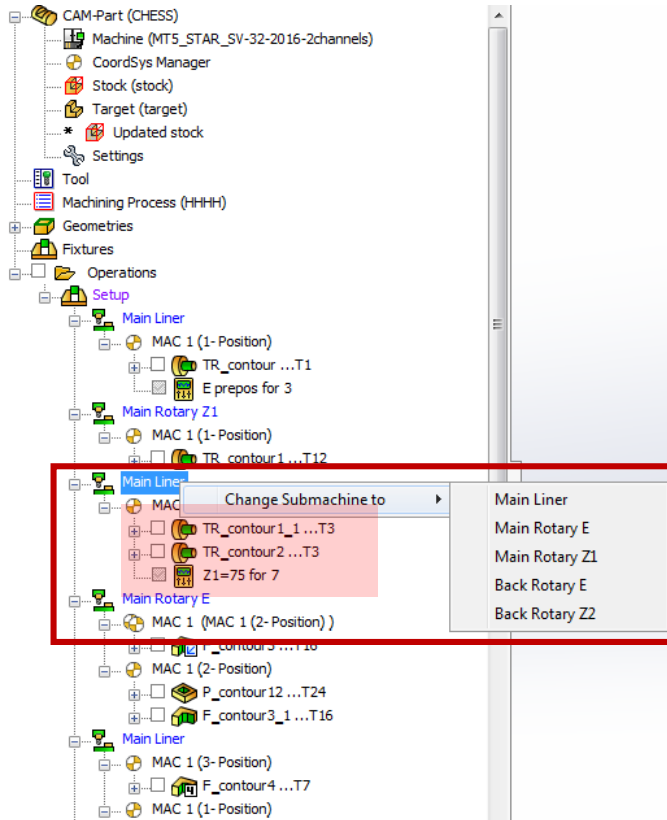
Show machining time in CAM-tree

CAM-tree: Show information about compensation usage



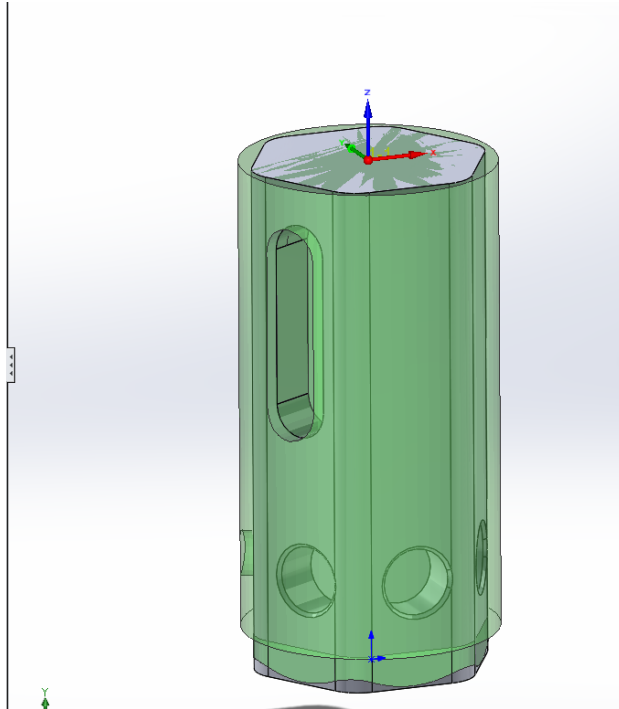
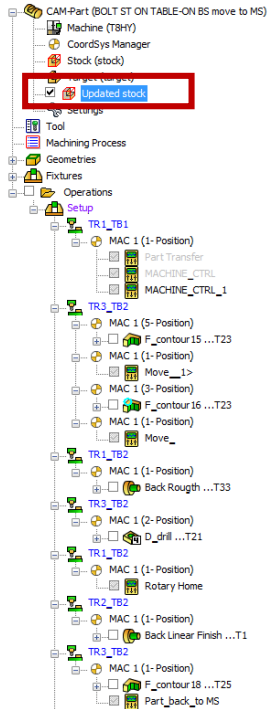
Show indicator whether compensation is used in the operation or not

CAM-tree: Change Submachine from the CAM-tree



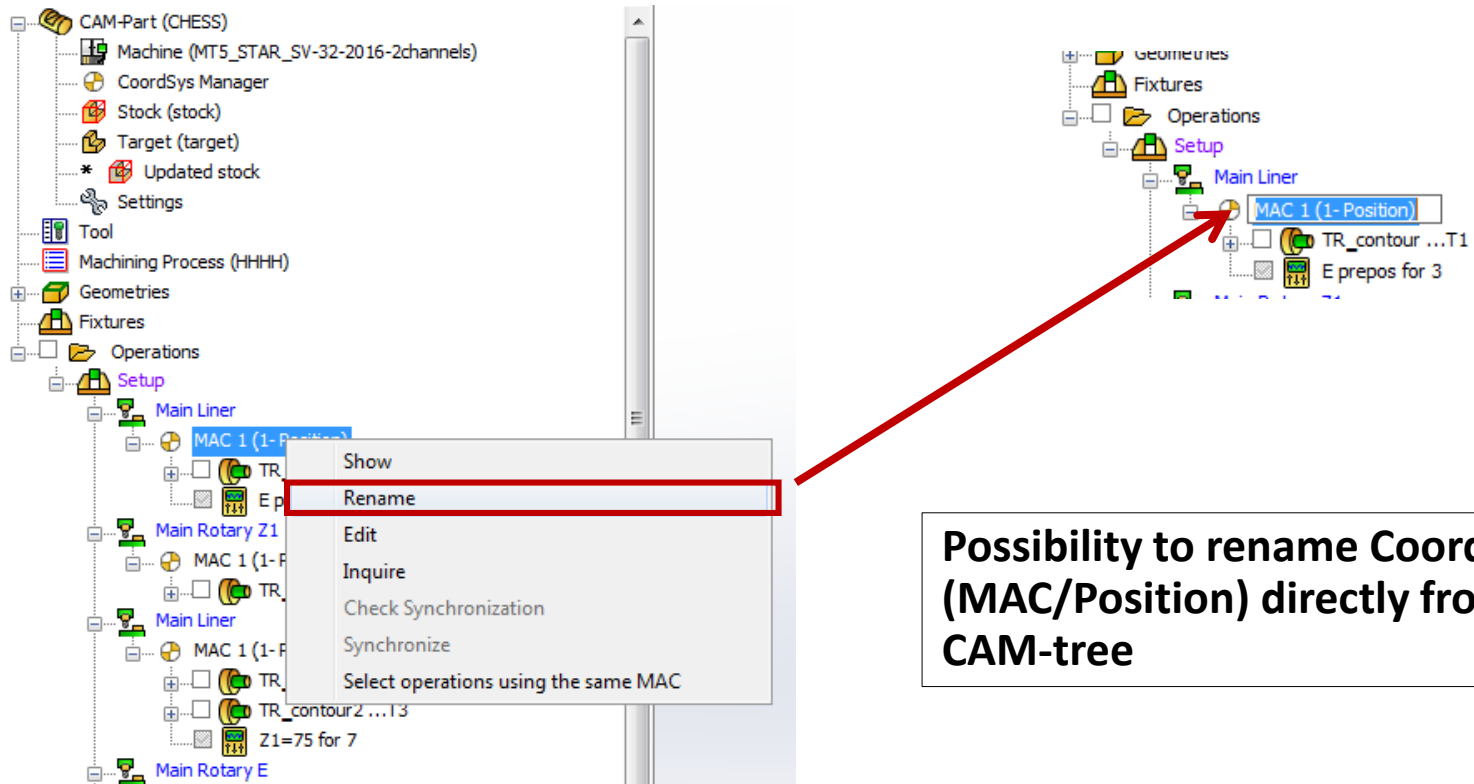
Right click on the submachine item in the CAM-tree allows to change submachine in all operation between selected submachine and the next one in the CAM-tree

CAM-tree: Show updated stock



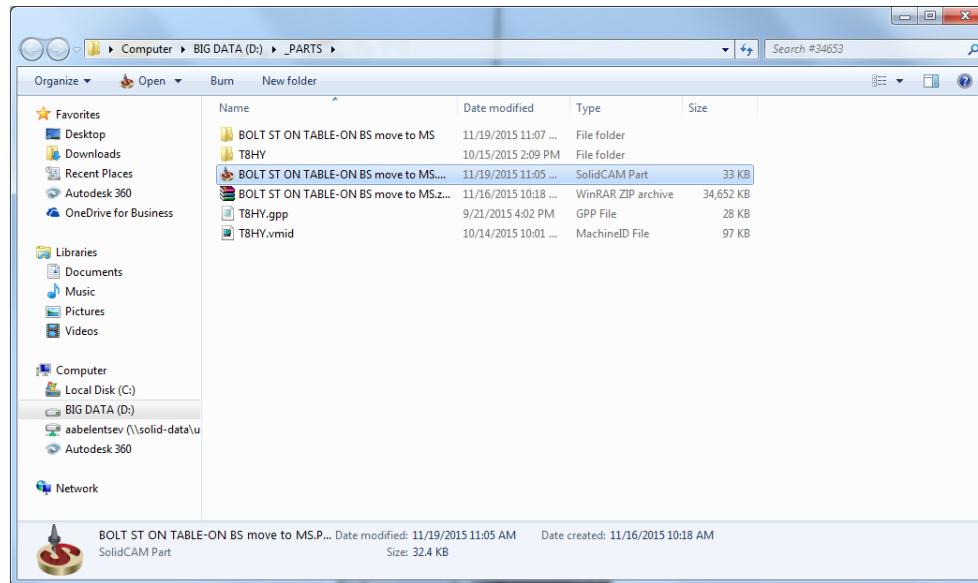
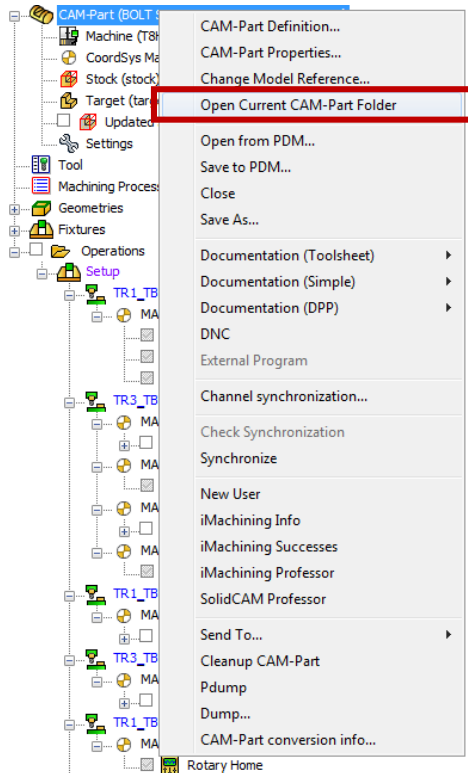
- Option to see rest material left after the last operation during new operations definition.
- Preview in CAD area
- Color and transparency are taken from HostCAD simulation settings

CAM-tree: Rename CoordSys



Possibility to rename CoordSys (MAC/Position) directly from the CAM-tree

CAM-tree: Open Current CAM-part folder

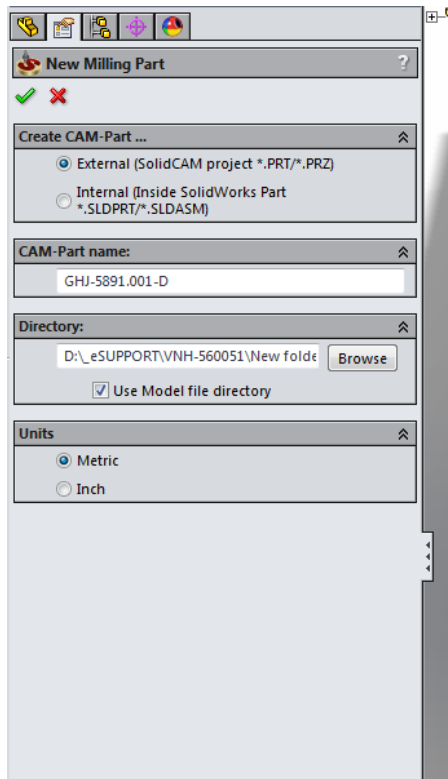
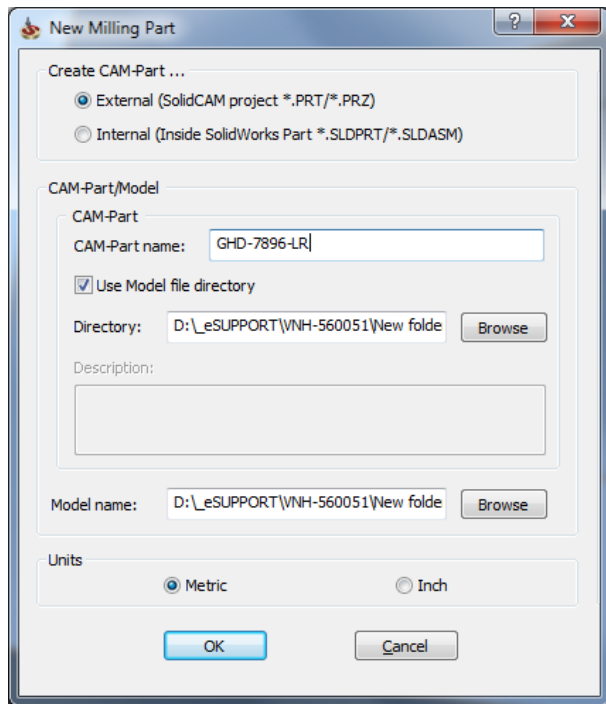


Reach the folder containing the current CAM-part by single click

What's New in SolidCAM 2016

General

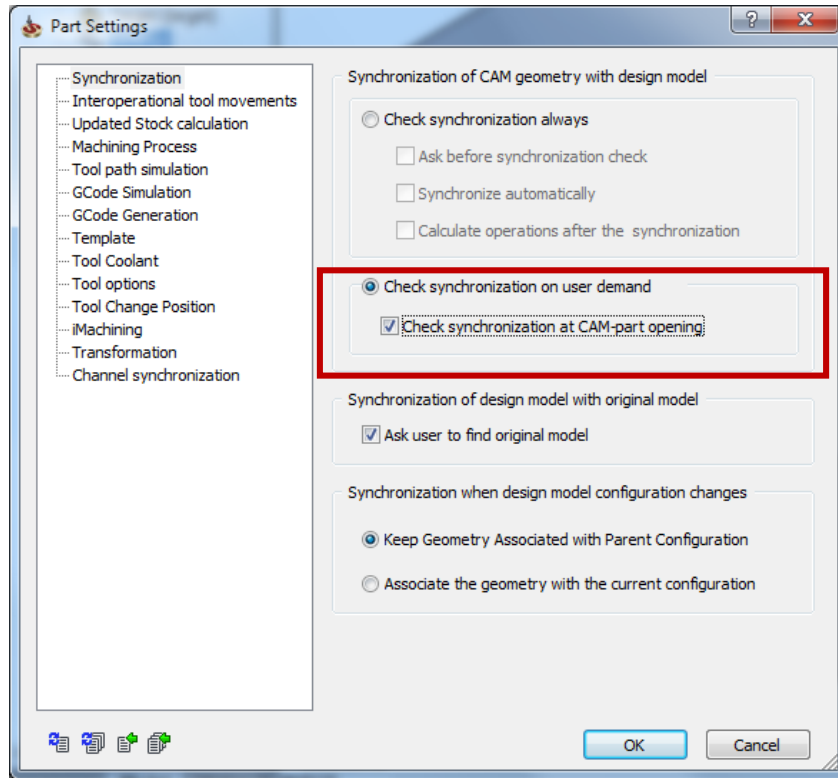
Integration: More SolidWorks-integrated dialogs



Dialogs integrated in SolidWorks Feature manager:

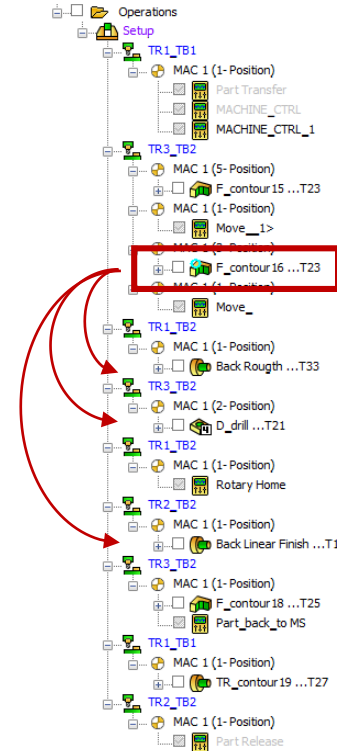
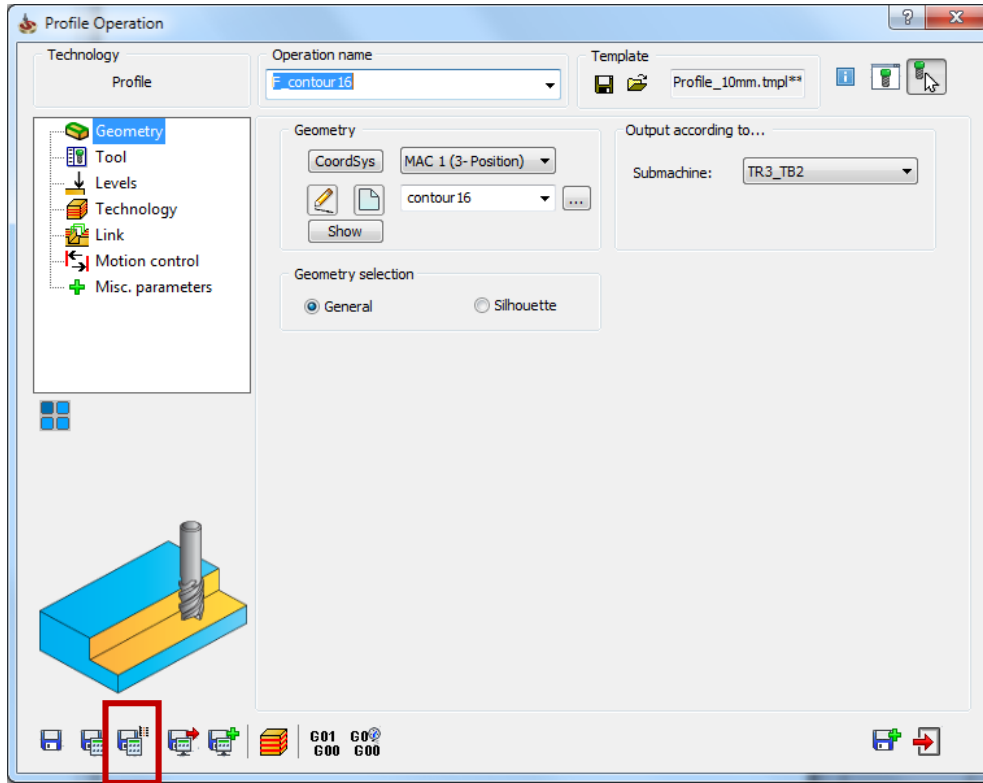
- New CAM-part
- CoordSys Definition

Synchronization: Check Synchronization at CAM-part opening



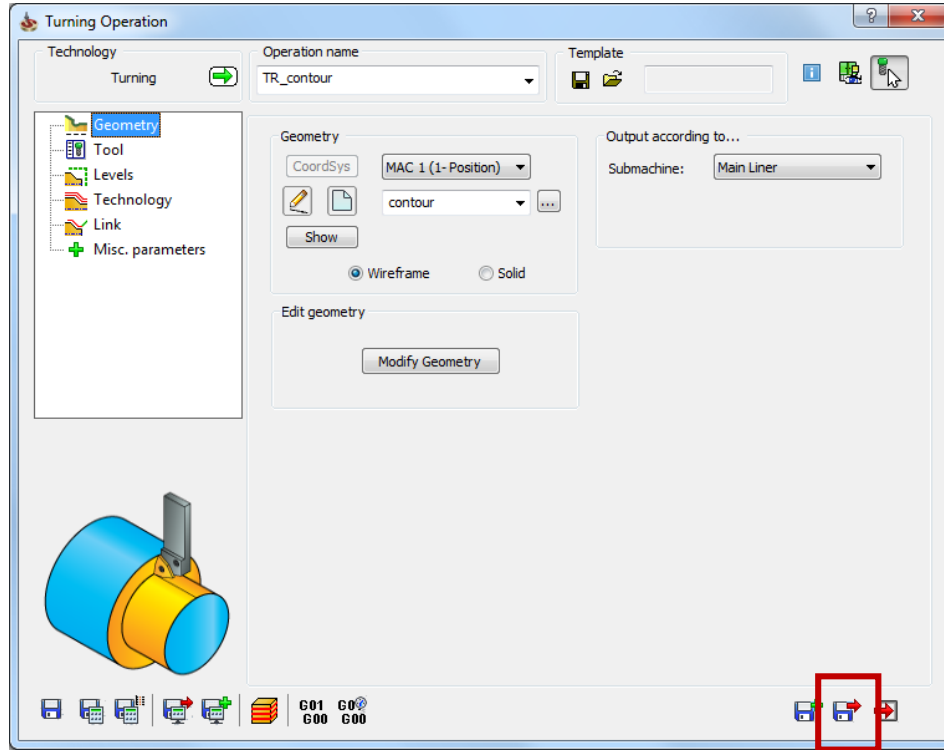
Check synchronization with original CAD-model every time user opens the CAM-part

Milling operations: Calculate with related operations



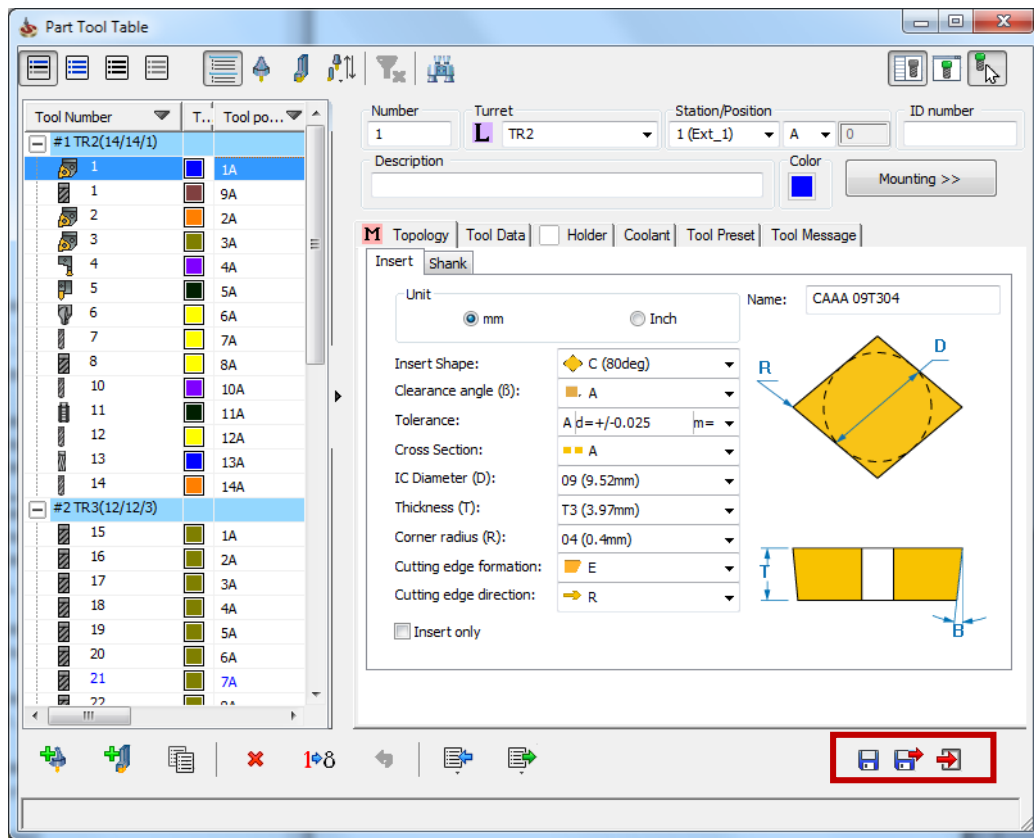
Option to calculate current operation and all following dependant ones

Operations: “Save&Exit” button



Button to save operation and exit without calculation

Tooltable: Save Tooltable without closing

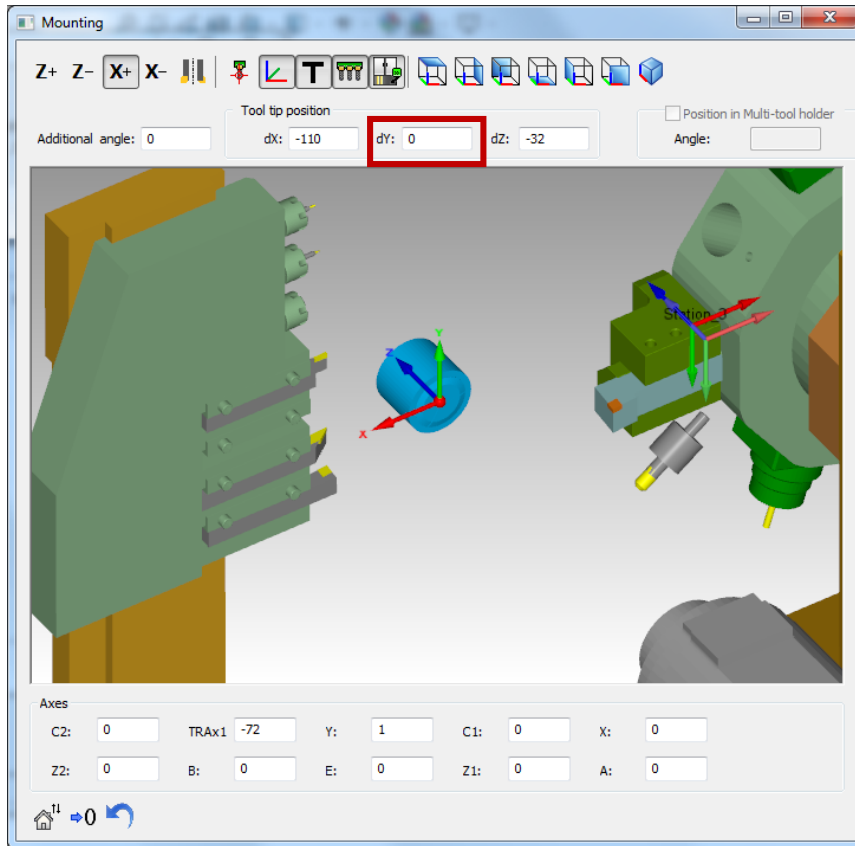


3 new buttons in tooltable:

- Save
- Save and Exit
- Exit

*-Now there is an option to save the tooltable without closing the dialog.

Tooltable: dY tool tip position shifting



In addition to dX and dZ values, now there is a possibility to define dY coordinate of tool tip in Station's CoordSys as well

Tooltable: "Rough" option to tooltable

The screenshot displays the 'Part Tool Table' window. On the left, a tree view shows tool groups: '#1 Rotary (10/9/9)' and '#2 Liner (7/5/5)'. The main table lists tool parameters for various tools. A red box highlights the 'Rough' checkbox in the 'Number of flutes' section of the tool parameters panel.

Tool Number	T...	Rough	Station...	Tool type	ID Num...	Diameter
#1 Rotary (10/9/9)						
2				END MILL		6 mm
10				Ext. Turning		
12				Ext. Turning		
15				END MILL		10 mm
16				BULL NOS...		6 mm
20				Int. Turning		
24		R		END MILL		6 mm
27		R		TAPER MILL		12 mm
28				FACE MILL		12 mm
#2 Liner (7/5/5)						
1				Ext. Turning		
3				Ext. Turning		
5				Ext. Groov...		
7				END MILL		2 mm
8				ENGRAVING		4 mm

Tool parameters for tool 24 (Rotary):

- Number: 24
- Turret: R Rotary
- Station/Position: 2 (Station_2)
- ID number: 0
- Description: [Empty]
- Color: Yellow
- Mounting: <<
- Topology: [Checked]
- Tool Data: [Checked]
- iData: [Checked]
- Holder: [Unchecked]
- Shape: [Unchecked]
- Coolant: [Unchecked]
- Tool Preset: [Unchecked]
- Tool Message: [Unchecked]

Tool parameters:

- Mm: [Selected] Diameter (D): 6
- Inch: [Unselected] Arbor diameter (AD): 6
- Length: Mm: [Selected] Total (TL): 80
- Inch: [Unselected] Outside holder (OHL): 60
- Shoulder length (SL): 30
- Cutting (CL): 24
- H length: 100
- Number of flutes: 2
- Rough

Additional information in tooltable about tool for Rough machining only

Tooltable: Tools quantity information

The screenshot shows the 'Part Tool Table' window with a table of tool data. The first two rows are highlighted with red boxes. The first row is the turret title row: '#1 Rotary(10/10/9)'. The second row is the first tool: '2', 'Rough', '1A', 'END MILL', '6 mm'. The third row is another tool: '4', '4A', 'FACE MILL', '12 mm'. The table continues with tools 10, 12, 15, 16, 20, 24, 27, and 28. The second section of the table is highlighted with a red box: '#2 Liner(7/6/5)'. The first row of this section is '1A', 'Ext. Turning'. The second row is '2A', 'Ext. Turning'. The third row is '4A', 'Ext. Groov...'. The fourth row is '3A', 'ENGRAVING', '4 mm'. The fifth row is '7A', 'END MILL', '2 mm'. The sixth row is '6A', 'ENGRAVING', '4 mm'.

The right panel shows the tool data editor for 'Liner'. The 'Number' is 1, 'Turret' is Liner, 'Station/Position' is 1 (Turn1), and 'ID number' is 0. The 'Description' is empty, and the 'Color' is blue. The 'Topology' tab is active, showing 'Insert' and 'Shank' options. The 'Unit' is set to mm. The 'Name' is CAAA 09T304. The 'Insert Shape' is C (80deg). The 'Clearance angle (β)' is A. The 'Tolerance' is A d=+/-0.025 m=. The 'Cross Section' is A. The 'IC Diameter (D)' is 09 (9.52mm). The 'Thickness (T)' is T3 (3.97mm). The 'Corner radius (R)' is 04 (0.4mm). The 'Cutting edge formation' is E. The 'Cutting edge direction' is R. There are diagrams showing the tool geometry and cutting edge direction.

Information about the tools quantity in turret title row in the following format:

#turretID TurretName (number_of_stations/mounted_tools/used_tools)