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# **OPTICAM** Tutorial



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## Preface

GibbsCAM<sup>®</sup> Wire EDM, powered by OPTICAM is a new Wire EDM product offering at GibbsCAM 14, based on the partnership between CAMBRIO and Camtek and bringing more than thirty year of experience focused on the programming of wire EDM machines. OPTICAM is fully integrated into the user interface of GibbsCAM user interface.

Using automatic feature recognition and integrated technologies and strategies, OPTICAM offers a very high automation level and significantly reduces programming time. After a short training period, any beginner will be able to create a correct NC program with only a few clicks, while experienced users will still have a high flexibility and the possibility to operate on a detailed level.

The examples given in the following chapters are only supposed to give a general overview of the work with GibbsCAM Wire EDM, powered by OPTICAM. They do not come close to showing every possible machining function. The aim of the examples is to give a general overview of the different machining functions.

This tutorial assumes you are able to use GibbsCAM software. If this is not the case, we strongly advise you to participate in a GibbsCAM training.

The following sample files, available from GibbsCAM, are required for this tutorial:

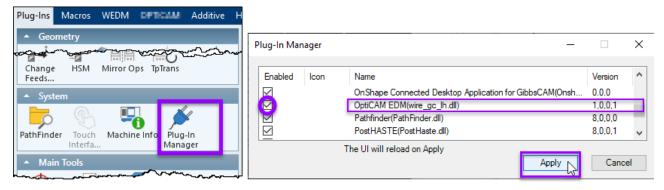
- GC14\_Opticam\_example\_1.vnc GC14\_Opticam\_example\_1.wire.opticam
- GC14\_Opticam\_example\_2.vnc GC14\_Opticam\_example\_2.wire.opticam
- GC14\_Opticam\_example\_3.vnc GC14\_Opticam\_example\_3.wire.opticam
- GC14\_Opticam\_example\_4.vnc
   GC14\_Opticam\_example\_4.wire.opticam
- GC14\_Opticam\_example\_5.vnc
   GC14\_Opticam\_example\_5.wire.opticam
- GC14\_Opticam\_example\_6.vnc GC14\_Opticam\_example\_6.wire.opticam
- GC14\_Opticam\_example\_7.vnc GC14\_Opticam\_example\_7.wire.opticam
- GC14\_Opticam\_example\_8.vnc GC14\_Opticam\_example\_8.wire.opticam
- GC14\_Opticam\_example\_9.vnc GC14\_Opticam\_example\_9.wire.opticam

### Getting Started

With each tutorial, you will open a sample file, use the OPTICAM user interface that appears to the left of the GibbsCAM workspace, and exercise OPTICAM functions.

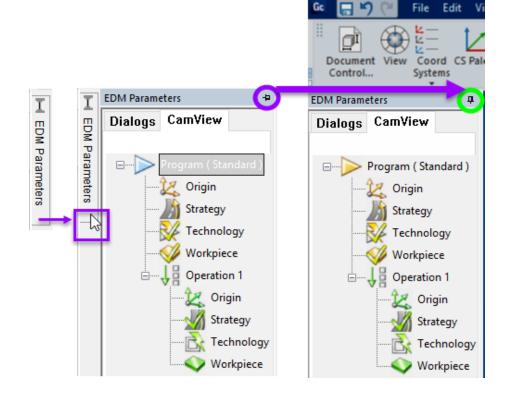
#### If the main menu bar does not have an OPTICAM menu

- 1. On the Plug-Ins menu, click Plug-In Manager.
- 2. In Plug-In Manager, tick the checkbox for OtiCAM EDM(wire\_gc\_lh.dll), and then click Apply.

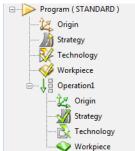


#### If the OPTICAM user interface does not appear

- Ensure that a *<filename>.wire.opticam* file exists in the same folder that contains the *<filename>.vnc* file
- If necessary, open the EDM Parameters pane and unpin it from where it is pinned or docked.



### The OPTICAM Feature Manager



When the OPTICAM Feature Manager is active, the GibbsCAM lists (tools, processes, and operations) are not used and are suppressed.

The Feature Manager is the central operating element of the OPTICAM software. It lists all programmed machining operations.

#### Setting the OPTICAM Feature Manager

If the Feature Manager is too narrow or too wide, you can set its width, as follows:

Position the cursor on the vertical right edge of the OPTICAM Feature Manager until the cursor turns into the following symbol:

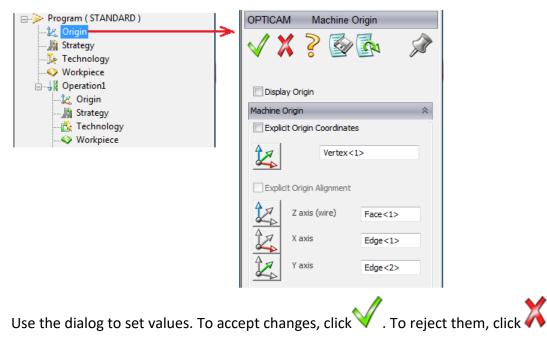
≟…↓∦ Operation1	

Click and hold the left mouse button and drag the cursor to the left or right. When the width is as you want it, release the left mouse button.

#### Working with the OPTICAM Feature Manager

#### Double-clicking a branch

Double-clicking a branch of the Feature Manager usually opens a dialog box.



#### **Right-clicking a branch**

Right-clicking a branch of the Feature Manager displays a context menu.

	New Operation	Ctrl+Alt+N
Origin 	Save Template	
	Load Template	
Vorkpiece	Operation Cutting Plan	Ctrl+Alt+P
Extruded1	Feature Recognition	
	New Feature	Ctrl+Alt+F
⊡	Delete Feature	
	 Disable Feature	
	Add Segment	
Corner Relief		
Pocket After Moves		

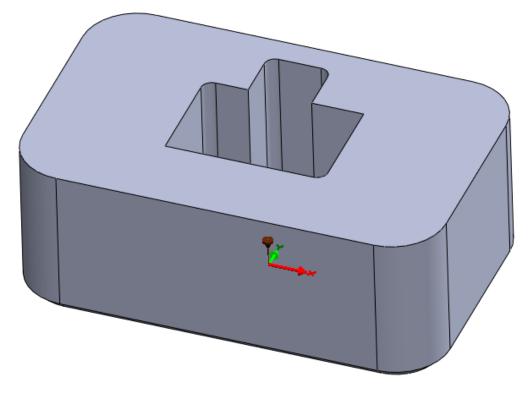
The displayed menus vary according to the selected branch. The example above shows the deletion of a feature.

#### The OPTICAM Menu

OPTICAM
▲ Operation
New Feature Manual Graphic Operation recognition
Solid simulati
▲ Postprocessor
Select a (beta) Post- postproces Processor file (program)
▲ Settings
Basic settings Color Start hole Feature recogniti
▲ Utilities
Geometry Python- (beta) (beta) parameters ShowUI Python-Base Python
🔺 Help
Help Online-Help TeamViewer OPTICAM

The OPTICAM menu on the top menu bar contains a range of setting functions that do not exist in the Feature Manager. It also offers the most important machining functions of the Feature Manager, although not all of them.

## **Example 1: Cylindrical Cut**



#### **Demonstrated in this Example**

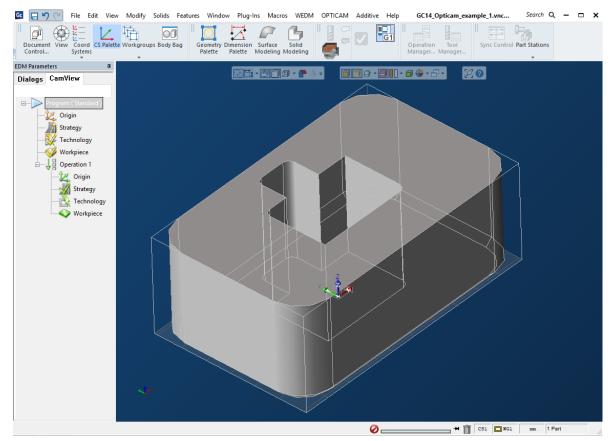
Opening a file: GC14\_Opticam\_example\_1 The OPTICAM Feature Manager Using the **Program** Dialog for Basic Settings Machine Origin Defining the Cutting Technology (Manual Input) Creating the Workpiece (Billet) Geometry Setting the Cutting Heights (Reference Plane Height and Secondary Plane Height) Setting the Cutting Strategy Manual Creation of the Cutting Machining Machining Simulation (Graphic Simulation) Further Functions of the OPTICAM "OPTICAM Feature Manager"

Creating the NC Program

## Open GC14\_Opticam\_example\_1

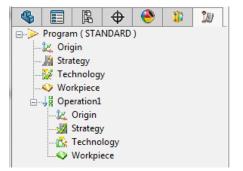
In GibbsCAM, open the example file **GC14\_Opticam\_example\_1.vnc**.

The selected model is loaded into GibbsCAM.



#### The OPTICAM Feature Manager

To the left of the workspace, you should see the OPTICAM Feature Manager. If you do not, then refer to <u>Getting Started</u> on page 0.

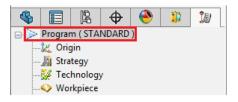


The OPTICAM Feature Manager is the central control element of OPTICAM. It allows you to program and modify machining operations and set machining parameters.

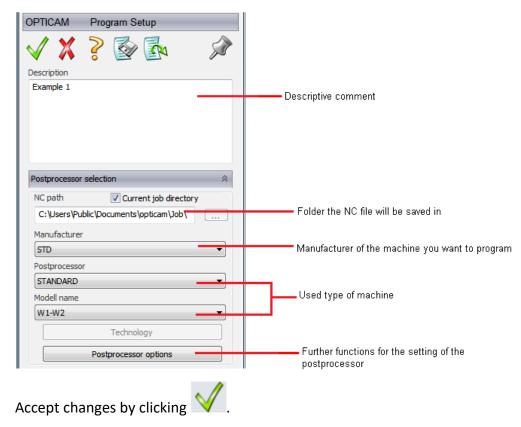
#### Using the Program Dialog to Set Defaults

As a first step, we define the basic settings. This means that we define the wire EDM machine for which the program will be created and where the NC output file will be placed; additionally, we define the start position of the program.

In the Feature Manager, double-click the branch **Program (STANDARD)**.

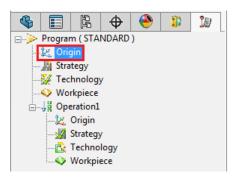


This opens the dialog for the definition of the program default settings. Please fill in the dialog as follows:



#### Defining the Machine Origin

To define the machine origin, double-click the **Origin** branch in the Feature Manager.



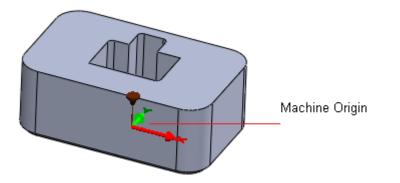
This opens the dialog for the definition of the machine origin.

	1 Origin		
🔽 Display	y origin		
Origin Explici	t origin coordinates		*
	Vertex		
Explici	t origin alignment		
2	Z axis (wire)	Face	
	X axis	Edge	
	Y axis	Edge	
Offset orig	jin		*
X 0.0mm	Y 0.0mm	Z 0.0mm	

The origin is graphically displayed by a symbol. The Z-axis of the origin is symbolized by a graphic of the wire guide.



Currently, the machine origin is in the center of the workpiece (see following figure).



Using the **Machine Origin** dialog, you can move the origin to any other position.

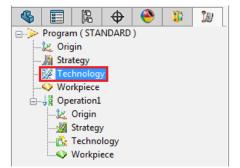
However, in Example 1, we want to accept the predefined origin. (Subsequent examples will explain the different possibilities of setting machine origins.

Close the Machine Origin dialog by clicking

#### Defining the Cutting Technology (Manual Input)

In the next step, we will define with which cutting technology the workpiece is to be machined.

Double-click the branch (Program) Technology in the OPTICAM Feature Manager.



This opens the dialog for the definition of the cutting technology.

OPTICAM Tee	chnology		
✓ X STD	2		
Filters	_	*	
🔀 🗆 Induc	le user tech in search		
User Tech name Wire diameter	0.25mm		
Wire type	Soft Brass	<b>-</b>	
Material	Steel	- (-	Selecting cutting technology from database
Height	10.0mm	•	
Number of cuts	3	•	
RA	0.0µm	-	
Outputs		*	
Records found	1		
Cut	Offset		
1 2	0.205mm 0.136mm		List of the cutting technology selected in the database
3	0.136mm		
Modify technology		*	
	chnology made in cuts ted tech in cuts editor		Modification of the cutting technology selected in the databas or
	Cuts editor		Manual input of cutting technology

You can either select the parameters of the cutting technology from a database or enter them manually.

In the first few exercises, we will enter the cutting technology manually.

Click the Cuts editor button to open a dialog where you can manually enter the cutting technology.

Cuts																	
🗸 🗶 🏅																	
Show / hide data	- Cuts d	ata															
Show all Hide all	Ove	erwrite i	machin	e techn	ology	6	lear data	from u	iser teo	h	Save	user te	ch		R	eset	
Cuts no.	C	Of	G	Of	G	Feedrate	Wir	W	C	Fr	Cl	Fe	Sp	A	Su	Pr	R
<ul> <li>Ø offset</li> <li>Ø Generator register</li> <li>Ø Generator setting</li> <li>Ø Feedrate</li> <li>Ø Wire dameter</li> <li>Ø Comment</li> <li>Ø Frequency reduction</li> <li>Ø Freadrate limit</li> <li>Ø Speed</li> <li>Ø Application</li> <li>Ø Precision</li> <li>Ø Rough cut</li> </ul>	V       0.         I       0.         I       0.         I       0.         I       0.         I       1.         I       1.	0	-1	-1	DEF	10.000000	0.25	DEF	DEF	10	0	0	0	0	0	0	No

Activate the input fields by selecting the option <a>Overwrite machine technology</a>.

Cuts data	9										
Verwrite machine technology					Clear data f	rom user tech	Save use	r tech	Reset		
Cut	Offset	Generat	Offset	Generat	Feedrate	Wire diameter	Wire name	Comment	Frequency reduction	Cle	
<b>V</b> 01	0 mm	-1	-1	DEF	10.0000	0.25 mm	DEF	DEF	100	0 n	

To machine the geometries with **1 cut**, please set the dialog as follows:

Cuts data								
Overwrit	n	Reset						
Cuts no.	Offset	Generator register	Offset register	Generator s	Feedrate	Wire diameter	Wire name	Com
<b>V</b> 01	0.131 mm	501	1	DEF	10.000000 mm/min	0.25 mm	DEF	DEF
			<b>1</b>			. <b>.</b>		_

Accept changes by clicking V. The system will go back to the **Technology** dialog.

Close this dialog as well by clicking V.

## Creating the Workpiece (Billet) Geometry

In the next dialog, you can define the geometry of the workpiece (billet).

Double-click the branch (Program) Workpiece in the OPTICAM Feature Manager.

4		ľ.	\$	۲	1	圓
	Progran 🎸 Orig 🕅 Stra	jin	NDARD	)		
	u.	hnology kpiece	·			
	- <u>1</u> 2	ration1 Origin				
	🔂	Strategy Techno Workpi	logy			

Fill in the dialog as follows:

🌯 🗐 🛱	🕀 🕙	1	
OPTICAM Work	piece		
🗸 🗶 🏅	<b>N</b>	Ŵ	
<ul> <li>Use box around sol</li> <li>Use specific solid</li> <li>Use STL file</li> </ul>	ids	*	— Method of workpiece (billet) geometry creation
Extra in X-	1.0mm		
Extra in Y-	1.0mm		
Extra in Z-	0.0mm		
Extra in X+	1.0mm		Allowance on the workpiece (billet) geometry
Extra in Y+	1.0mm		
Extra in Z+	0.0mm		7
			D
Solid body		<u> </u>	┘ ── Selection of the solid body for the workpiece (billet)
STL file		X	Selection of the STL file for the workpiece (billet)

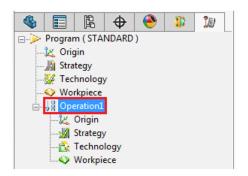
In the selected method, the workpiece (billet) is derived from the 3D model you want to machine. The system does this by creating a theoretical box which encloses the 3D model. Additionally, we define an allowance of 1 mm for both the x- and the y-axis.

Accept changes by clicking

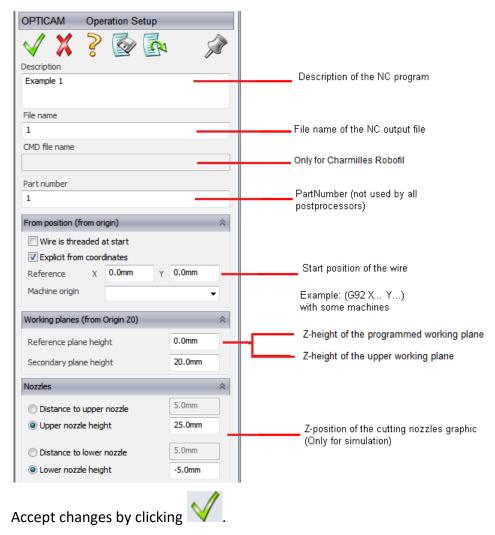
## Setting the Cutting Heights (Reference Plane Height and Secondary Plane Height)

The following dialog sets among other things the name of the NC output file as well as the Z-height of the Reference and the Secondary Plane Height.

Double-click the branch **Operation1** in the OPTICAM Feature Manager.



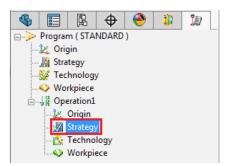
In the field **Description**, you can enter a comment to the program. In the field **FileName**, the name of the NC output file is set. Additionally, you set the general **Start Position** and the height of the working planes (**Reference plane height / Secondary plane height**).



#### Setting the Cutting Strategy

In the next dialog, you set the strategy with which the workpiece is to be machined.

Double-click the branch (Operation) Strategy in the OPTICAM Feature Manager.



The geometry is supposed to be machined in a way that at the end of the first cut a machine stop is carried out and the bridge is cut.

Set the dialog as follows:

OPTICAM Operation Strategy
🗸 💥 ? 🐼 🗗 🔗
🔘 Use program strategy
Our operation strategy
Use feature strategy
Feature sequence strategy 🔅
Feature order from feature list
Smallest features first
<ul> <li>Smallest reatures last</li> <li>Shortest path between features</li> </ul>
Ignore pocket in ordering
Feature with pocketing first Feature with pocketing last
- · · ·
Collar before taper
Taper before collar
Internal before external features
External before internal features
Ignore internal / external in ordering
Cut sequence strategy 🔗
Cut sequence strategy $\&$
Do all rough cuts together first
Do all rough cuts together first
Do all rough cuts together first Interweave rough cuts Do all trim cuts at the end
Do all rough cuts together first Do all rough cuts Do all trim cuts at the end Interweave final cuts
Do all rough cuts together first Interweave rough cuts Do all trim cuts at the end Interweave final cuts
Do all rough cuts together first Interweave rough cuts Do all trim cuts at the end Interweave final cuts Reverse cuts when possible Reverse first bridge cut
Do all rough cuts together first Interweave rough cuts Do all trim cuts at the end Interweave final cuts Reverse cuts when possible Reverse first bridge cut Bridge cut strategy Cut bridges at end of operation Stop only on first bridge cut
Do all rough cuts together first Interweave rough cuts Do all trim cuts at the end Interweave final cuts Reverse cuts when possible Reverse first bridge cut Bridge cut strategy Cut bridges at end of operation Stop only on first bridge cut Cut bridges at end of each feature
Do all rough cuts together first Interweave rough cuts Do all trim cuts at the end Interweave final cuts Reverse cuts when possible Reverse first bridge cut Bridge cut strategy Cut bridges at end of operation Stop only on first bridge cut Cut bridges at end of each feature Cut bridges at end of FIRST CUTS
Do all rough cuts together first Interweave rough cuts Do all trim cuts at the end Interweave final cuts Reverse cuts when possible Reverse first bridge cut Bridge cut strategy Cut bridges at end of operation Stop only on first bridge cut Cut bridges at end of each feature Cut bridges at end of FIRST CUTS Stop for bridge removal on first cut
Do all rough cuts together first Interweave rough cuts Do all trim cuts at the end Interweave final cuts Reverse cuts when possible Reverse first bridge cut Bridge cut strategy Cut bridges at end of operation Stop only on first bridge cut Cut bridges at end of each feature Cut bridges at end of FIRST CUTS
<ul> <li>Do all rough cuts together first <ul> <li>Interweave rough cuts</li> </ul> </li> <li>Do all trim cuts at the end <ul> <li>Interweave final cuts</li> <li>Reverse cuts when possible</li> <li>Reverse first bridge cut</li> </ul> </li> <li>Bridge cut strategy <ul> <li>Cut bridges at end of operation <ul> <li>Stop only on first bridge cut</li> </ul> </li> <li>Cut bridges at end of each feature</li> <li>Cut bridges at end of FIRST CUTS <ul> <li>Stop for bridge removal on first cut</li> <li>Don't cut bridges</li> </ul> </li> </ul></li></ul>

Accept changes by clicking  $\bigvee$ .

#### Creating the Cutting Machining

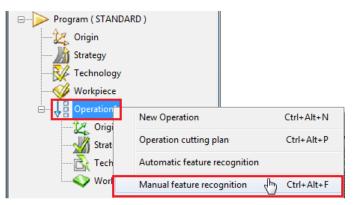
With OPTICAM it is possible to create the cutting machining automatically or by manually selecting faces or model edges.

#### Manual Creation of the Cutting Machining

Initially, we want to show you how to machine a single geometry by manually selecting its faces with the mouse.

Right-click the branch **Operation1** in the OPTICAM Feature Manager.

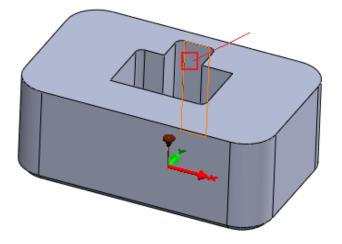
In the context menu, click Manual feature recognition.



In the **Manual Feature Recognition** dialog, activate the option **Manual with automatic connection**. After selecting this option, you click on a face and the system automatically finds all faces that can be wire cut and that are connected with the selected face.

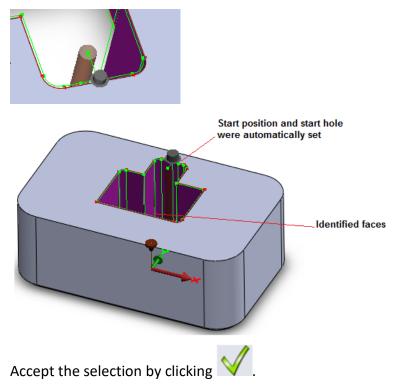
OPTICAM Manual Feature Recognition
🔨 🗙 ? 🛛 🔊
No Face selected
Select a single Face from which to make the Feature.
Clear Selection End Selection
Selection mode
Manual with automatic connection
Use Advanced Face Checking Manual with automatic connection (by colours)
Manual face selection
Manual edge selection
Body Outline Feature

Click on a face of the internal aperture.

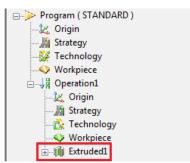


The system automatically identifies all faces belonging to the selected aperture and allocates the programmed cutting technology (1 cut). In addition, the start hole is positioned in front of the selected face and the start position in the center of the selected face.

**User advice:** The **start position** is in the center of the selected face and the **start hole** is perpendicular to and in front of the selected face (see below).



For every selected aperture, **OPTICAM** creates a **separate feature** in the OPTICAM Feature Manager. As only one aperture has been selected, there should also be only 1 feature:



If you click on a feature in the OPTICAM Feature Manager, OPTICAM highlights the geometry of the selected object and additionally displays the tool paths, the bridge, and the start hole.

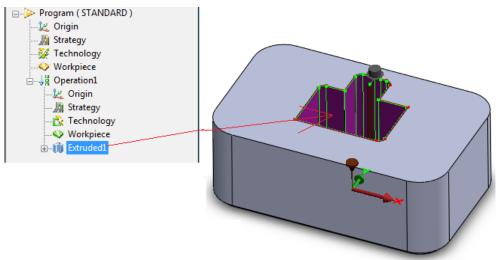
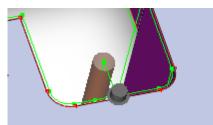


Diagram of the tool paths and the start hole.



## Machining Simulation (Graphic Simulation)

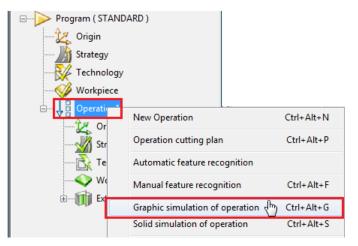
In the following, we will check the machining operations through a simulation. **OPTICAM** has two simulation forms:

**Graphic Simulation** simulates the tool paths WITHOUT depicting the material removal.

**Solid Simulation** simulates the tool paths and depicts the material removal.

Right-click the branch **Operation1** in the OPTICAM Feature Manager.

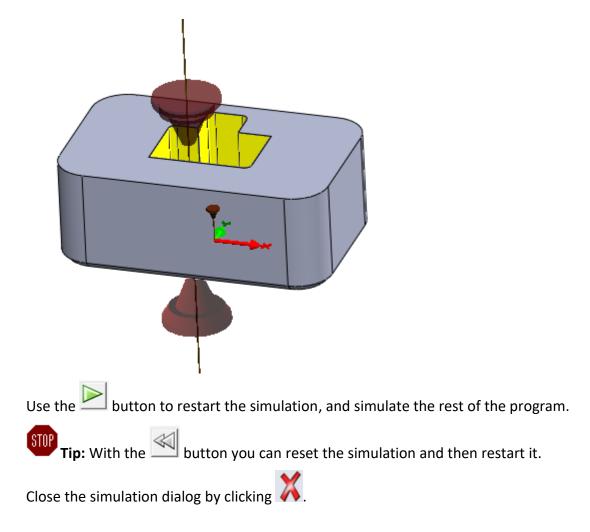
In the context menu, select Graphic simulation of operation.



A dialog opens that allows you to control the simulation:

OPTICAM Simulation Control		
* ? & A	Ŵ	
Simulation controls	\$	
Don't stop simulation at M01		
Speed Control		
	<u> </u>	
Cutting information	*	
Axis coordinates		
Click ⋗ to start the si	mulation.	Use <b>Speed Control</b> to control the simulation sp
Speed Control		

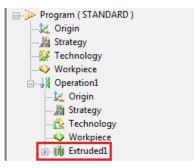
At the end of the first cut, the simulation should stop as a machine stop (e.g. M01) is programmed before the cutting off of the bridge.



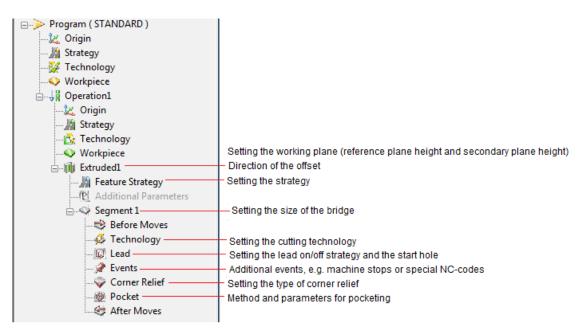
## Further Functions of the OPTICAM Feature Manager

With the OPTICAM Feature Manager, you can influence and modify all cutting parameters (e.g. the start hole position, the lead on/off, the used cutting technology ...).

Each programmed geometry has a separate feature in the OPTICAM Feature Manager.



Clicking the + symbol in front of a feature **Extruded** opens the selected feature so that all cutting parameters are displayed in a tree structure.



If you want to modify for example the parameters of the **Lead on/off**, you have to Double-click the branch - [G] Lead.

If you want to modify the **cutting technology**, Double-click the branch <sup>4</sup> Technology</sup>.

In this first example, no modification of the cutting parameters shall be carried out; the following exercises will inform you in detail about the modification and adjustment of cutting parameters.

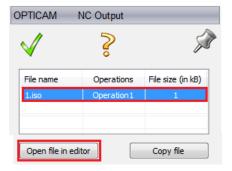
#### Creating the NC Program

At the end of this exercise, we create the NC program.

Right-click the branch **Operation1** in the OPTICAM Feature Manager and select **Output operation NC file**.

Program ( STAND/     Origin     Strategy     Technology     Workpiece	ARD )	
Operation Corice Stra	New Operation Operation cutting plan	Ctrl+Alt+N Ctrl+Alt+P
	Automatic feature recognition	
Wo	Manual feature recognition	Ctrl+Alt+F
	Graphic simulation of operation	Ctrl+Alt+G
	Rebuild program	Ctrl+Alt+B
	Output operation NC file 🕁	

In the background, the NC program for the selected machine is created. Afterwards, a dialog for the editing of the NC file will be opened in the OPTICAM Feature Manager.



Click the NC file name and afterwards the

Open file in editor button. A text editor displaying the just created NC program will be opened:

File Edit Format View Help	
%N001 X+.000 Y+.000 Q+.000 R+.000 G92	
N002 G01 X-1.001 Y+7.586 M62	
N003 P50	
N004 G01 X-3.122 Y+9.707 G42	
N005 G02 X-2.415 Y+10.000 I+.707 J707	
N006 G01 X+1.585	
N007 G02 X+2.585 Y+9.000 I+.0000000000000 J-1.000	
N008 G01 Y+5.000	
N009 G01 X+7.500	
N010 G01 Y-4.000	=
N011 G02 X+6.500 Y-5.000 I-1.000 J+.000	
N012 G01 X-7.500 N013 G01 Y+4.000	
N013 G01 Y+4.000 N014 G02 X-6.500 Y+5.000 I+1.000	
N014 G02 X-0.500 1+5.000 1+1.000	
N015 G01 X+8.785 M00	
N017 G01 Y+9,000	
N018 G02 X-3.122 Y+9.707	
N019 G01 X-1.708 Y+8.293 G40	
N020 M63	
N021 M02	-
	•
4	⊫ ≜

Close the editor elization close the dialog **NC-OUTPUT** as well:

#### Saving the OPTICAM Program

At the end, you save your work.



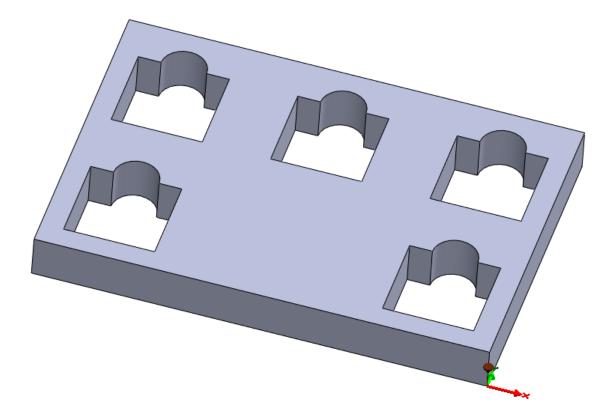
User advice: In addition to the GibbsCAM file GC14\_Opticam\_example\_1.vnc, a second file containing the OPTICAM machining information for the current program will be saved. This OPTICAM file has the file extension .wire.opticam.

Close the file GC14\_Opticam\_example\_1.vnc.

File	691	Tion	Medly	Sellett	Fee
•	File				
	2	[			
	Open	I	New	Close	2

This exercise is now completed.

## Example 2: Multiple Cylindrical Cuts

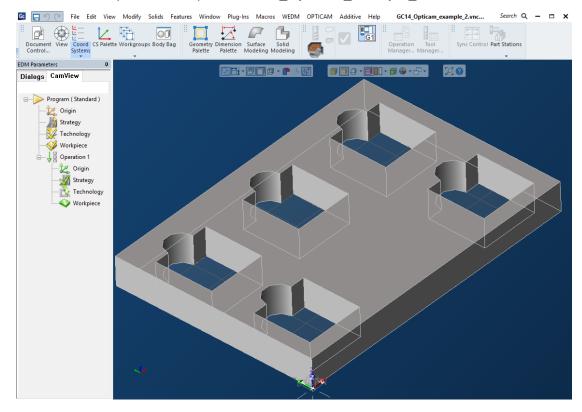


#### **Demonstrated in This Example**

Opening a file: GC14\_Opticam\_example\_2 Using the **Program** Dialog for Basic Settings Defining the Machine Origin Defining the Cutting Technology (Manual Input) Creating the Workpiece (Billet) Geometry Setting the Cutting Heights (Reference Plane Height and Secondary Plane Height) Setting the Operation Strategy Manual Creation of the Cutting Machining Machining Simulation (Graphic Simulation) Machining Simulation (Solid Simulation) Modifying the Operation Strategy Modifying the Length of the Lead on/off Modifying Various Machining Features at the Same Time Creating the NC Program Checking the NC Program at a Later Time

## *Open GC14\_Opticam\_example\_2*

In GibbsCAM, open the sample file **GC14\_Opticam\_example\_2.vnc**.



## Using the Program Dialog for Basic Settings

As a first step, we define the basic settings. This means that we define the wire EDM machine for which the program will be created and where the NC output file will be placed; additionally, we define the start position of the program.

Double-click the branch **Program (STANDARD)** in the OPTICAM Feature Manager to open the dialog for the definition of the program default settings. Fill in the dialog as shown to the right:

Accept changes by clicking 💙

OPTICAM	Program Setup
Description	2 🔊 🖗 🔇
Example 2	
	1
Postprocessor s	election 🕆
NC path	Current job directory
C:\Users\Publ	ic\Documents\opticam\Job\
Manufacturer	
STD	▼
Postprocessor	
STANDARD	▼
Modell name	
W1-W2	▼
	Technology
	Postprocessor options

### Defining the Machine Origin

In the next step, the position of the machine origin will be placed at the lower right corner of the model.

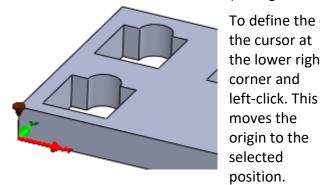
Double-click the branch (**Program**) **Origin** in the OPTICAM Feature Manager to open the dialog for the definition of the machine origin.

OPTICAM Origi	n
🗸 🗶 🏅 (	s 🔊 🖗
Display origin	
Origin	*
Explicit origin coord	inates
Ve	rtex
Explicit origin alignment	nent
Z axis (wire	) Face
X axis	Edge
Y axis	Edge
Offset origin	*
х ү	Z
0.0mm 0.0n	nm 0.0mm

The origin is graphically displayed by a symbol. The Z-axis of the origin is symbolized by a graphic of the wire guide.

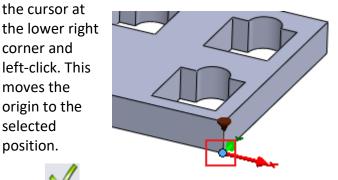
Currently, the machine origin is on the left side at the bottom of the workpiece

(see figure at left).



Close the Machine Origin dialog by clicking 💙

To define the origin at the lower **right** corner, put



## Defining the Cutting Technology (Manual Input)

In the next step, we will define with which cutting technology the workpiece is to be machined.

🎢 Strategy

> Workpiece

🕌 Operation1

Double-click the branch (Program) Technology in the OPTICAM Feature Manager.

This opens the dialog for the definition of the cutting technology.

			te Origin
OPTICAM Tec	hnology		
×/ ¥	2		
<b>V</b>	5	P	
STD			
510			
Filters		*	
🔀 🗆 Include	e user tech in search		
User Tech name		-	
Wire diameter	0.25mm	•	
Wire type	Soft Brass	•	
Material	Steel	<b>-</b>	Selecting cutting technology from database
Height	10.0mm	•	
Number of cuts	3	•	
RA	0.0µm	-	
Outputs		*	
Records found	1		
Cut	Offset		
1	0.205mm		List of the cutting technology selected in the database
2	0.136mm		List of the catting technology selected in the database
3	0.136mm		
Modify technology		*	
Use modified tec	hnology made in cuts		
Take over select	ed tech in cuts editor		Modification of the cutting technology selected in the database
	Cuts editor		or Manual input of cutting technology
	Cuts editor		manadi inpat of catting technology

You can either select the parameters of the cutting technology from a database or enter them manually.

In the first few exercises, we will enter the cutting technology manually. You can do this as follows:

Click the

Cuts editor

button. A dialog opens where you can manually

enter the cutting technology.

/ 💥 🎅 w / hide data	Cuts data								
Show all Hide all	Overwrite	e machine t	echnology	Dear data	from user tech	Save user to	ech	Reset	
Cuts no.	Cuts no.	Offset	Generator re	Offset reg	Generator setti	Feedrate	Wire dia	Wire name	C
	☑ 01	0 mm	-1	-1	DEF	10.0000	0.25 mm	DEF	D
• V Offset register	02								
Generator setting	03								
	04								
Wire diameter	05								
 ── ── ── ── ── ── ── ── ── ── ── ── ──	06								
Comment     Frequency reduction	07								
	08								
Feedrate limit	09								
	10								
	11								
Surface finish	12								
Rough cut	13								
	14								
	15								
	16								
	17								
	18								
	19								
	20								

Activate the input fields by selecting the option <a>Overwrite machine technology</a>.

/ Overwrit	e machine	technology	Clear data from u	iser tech Save	user tech	Reset	
Cuts no.	Offset	Generator register	Offset register	Generator sett	Feedrate	Wire diam	V

To machine the geometries with **3 cuts**, please set the dialog as follows:

Cuts dat	ta												
V Over	writ	te machine teo	hnology	2		Clear d	lata fr	om use	er tech		Save user tech	Reset	
Cuts n	10.	Offset	Gene	rator re	gister	Offs	et reg	ister	Gener	at	Feedrate	Wire diame	Wire
<b>V</b> 01		0.2 mm		501			0		DE	F	10.000000 mm/min	0.25 mm	DE
<b>V</b> 02		0.16 mm		502			0		DE	F	10.000000 mm/min	0.25 mm	DE
<b>V</b> 03		0.131 mm		503			0		DE	F	10.000000 mm/min	0.25 mm	DE
04													

Accept changes by clicking V button. The system will go back to the **Technology** dialog.

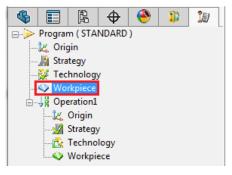
Close this dialog as well by clicking on 💜.



## Creating the Workpiece (Billet) Geometry

In the next dialog, you can define the geometry of the workpiece (billet).

Double-click the branch (Program) Workpiece in the OPTICAM Feature Manager.



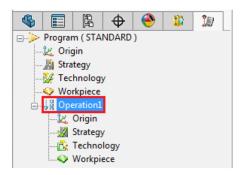
Fill in the dialog as follows:

OPTICAM Wo	orkpiece		
🗸 🗙 🏅		M	Ś
<ul> <li>Use box around</li> <li>Use specific solid</li> <li>Use STL file</li> </ul>			
Box			*
Extra in X-	0.0mm		
Extra in Y-	0.0mm		
Extra in Z-	0.0mm		
Extra in X+	0.0mm		
Extra in Y+	0.0mm		
Extra in Z+	0.0mm		
Solid body			*
STL file	_		*
Accept chang	es by o	clickin	g √

# Setting the Cutting Heights (Reference Plane Height and Secondary Plane Height)

The following dialog sets among other things the name of the NC output file as well as the Z-height of the Reference and the Secondary Plane Height.

Double-click the branch **Operation1** in the OPTICAM Feature Manager.



In the field **Description**, you can enter a comment to the program. In the field **FileName**, the name of the NC output file is set. Additionally, you set the general **Start Position** and the height of the working planes (**Reference plane height / Secondary plane height**).

OPTICAM	Op	peration	n Se	tup	)	
🗸 🗙	2	<b>N</b>			(	$\sim$
Description	•		E	-1-	1	
Example 2						_
Example 2						
File name						_
2						
CMD file name						
Part number						
2						
From position (	from	origin)				~
						-
Wire is thre						
Explicit from			_		0.0	-11
	Х	0.0mm		Y	0.0mm	
Machine origin 🗸						
Working planes	Ifro		70)			~
Working planes		in Ongin	20)	7	_	
Reference plane height 0.0mm						
Secondary pla	Secondary plane height 10.0mm					
Nozzles						*
O Distance to		er nozzle			5.0mm	
<ul> <li>Upper noza</li> </ul>					15.0mm	T I
e opper nozi		agine				
O Distance to	lowe	er nozzle			5.0mm	
O Lower noza	de he	ight			-5.0mm	f I
Group features						~
Group repe	eated	feature	s			
-						
STOP						
🤎 User	· ac	dvice	: C	0	NOT	act

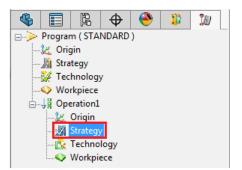
User advice: Do NOT activate the option "Group repeated Features".

Accept changes by clicking V

## Setting the Cutting Strategy

In the next dialog, you set the strategy with which the workpiece is to be machined. The geometry will be machined in a way that the bridge will be cut at the end of the first cut and afterwards the two trim cuts will be done in reverse cuts (forwards/backwards).

Double-click the branch (Operation) Strategy in the OPTICAM Feature Manager.



Set the dialog as shown on the right, and then accept

changes by clicking V

### Creating the Cutting Machining

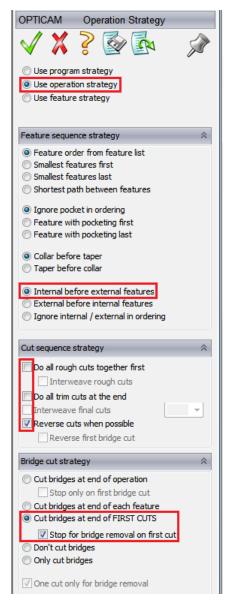
With OPTICAM it is possible to create the cutting machining automatically or by manually selecting faces or model edges.

#### Manual Creation of the Cutting Machining

Initially, we want to show you how to machine single geometries by manually selecting their faces with the mouse.

**Right-click** the branch **Operation1** in the OPTICAM Feature Manager.

In the context menu, click **Manual feature** recognition.



🖃 🕪 Program ( STANDAF	RD )				
Origin					
🛛 🐼 Technology					
🗄 🚽 🖥 Operation 🗖	New Operation	Ctrl+Alt+N			
Origi	New operation	CHIPACIN			
	Operation cutting plan	Ctrl+Alt+P			
	Automatic feature recognition				
	Manual feature recognition	Ctrl+Alt+F			

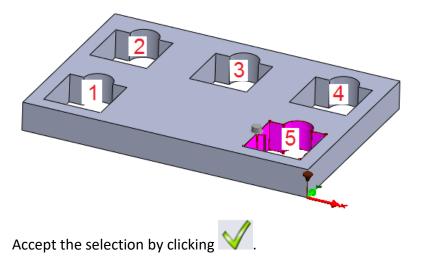
In the **Manual Feature Recognition** dialog, choose the option **Manual with automatic connection**.

After choosing this option, you can click on a face and the system will automatically find all faces that can be wire cut and are connected with the selected face.

OPTICAM Manual Feature Recognition
🗸 🗙 🏅 🔗 🖉
No Face selected
Select a single Face from which to make the Feature.
-
Clear Selection
End Selection
Selection mode
Manual with automatic connection
Use Advanced Face Checking
Manual with automatic connection (by colours)
Manual face selection
Manual edge selection
Body Outline Feature

Click successively on one face of each of the five apertures.

Click each time on the **external surface on the left** so that the machining operation will be started in the center of the selected surface.

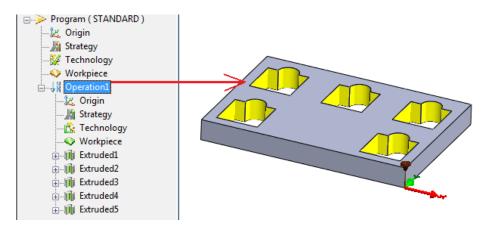


For each selected aperture, OPTICAM creates a separate feature in the OPTICAM Feature Manager. Because five apertures have been selected, the tree shows five features:

🗽 Origin
Workpiece
🦳 🗽 Origin
Technology
Vorkpiece
i Extruded1

User advice: If only one feature is shown, you have probably activated the option "Group repeated Features" in the dialog Operation1. This unites identical features into one feature.

If you click the branch **Operation1** in the OPTICAM Feature Manager, all geometry of all existing features will be highlighted.



If you click on one or various features in the OPTICAM Feature Manager, OPTICAM will highlight the geometries of the selected objects and additionally display the tool paths, the bridge and the start hole.

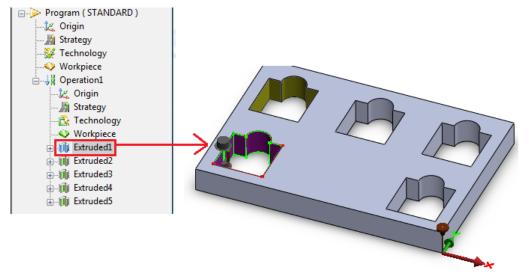
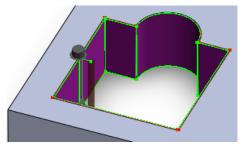


Diagram of the tool paths and the start hole:



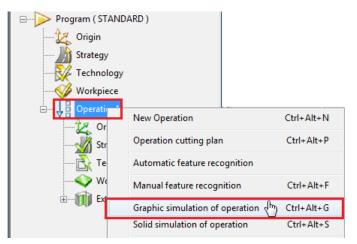
## Machining Simulation (Graphic Simulation)

In the following, we will check the machining operations through a simulation. **OPTICAM** has two simulation forms:

Graphic Simulation simulates the tool paths WITHOUT depicting the material removal.

**Solid Simulation** simulates the tool paths and depicts the material removal.

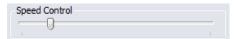
**Right-click** the branch **Operation1** in the OPTICAM Feature Manager. In the context menu, select **Graphic simulation of operation**.



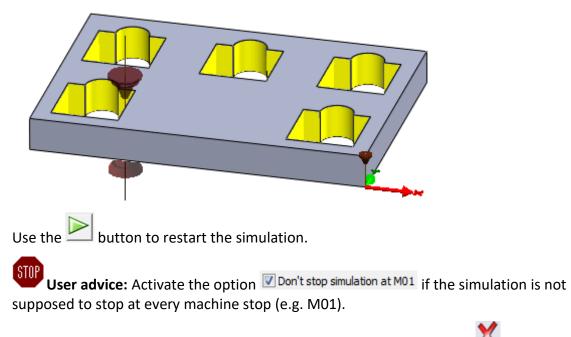
A dialog opens that allows you to control the simulation:

OPTICAM	Simulation Control	
×	? 🐼 ঝ	
Simulation con	trols	*
$\ll$		
Don't stop	o simulation at M01 trol	
Cutting inform	ation	*
Axis coordin	ates	
- 1		

Click loss of the simulation. Use **Speed Control** to control the simulation speed.



At the end of the first cut, the simulation should stop as a machine stop (e.g. M01) is programmed before the cutting off of the bridge.



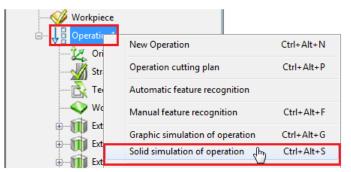
Simulate the complete program. Close the simulation dialog by clicking ቚ button.

## Machining Simulation (Solid Simulation)

You may have noticed that the **Graphic Simulation** does not depict the material removal, and the bridge is not clearly depicted either.

Therefore, we will now use the **Solid Simulation** which will give you a more detailed overview of the tool paths.

**Right-click** the branch **Operation1** in the OPTICAM Feature Manager. In the context menu, click **Solid simulation of operation**.



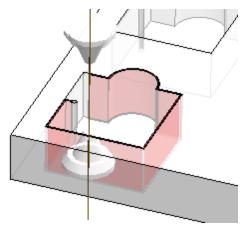
A dialog opens that allows you to control the solid simulation:

OPTICAM	Simulation Control	
×	? 🐼 ঝ	Ŵ
Simulation cont	rols	*
${\color{black}{}}$		
🔲 Don't stop	simulation at M01	
Speed Cont	rol	
Cutting informa	ation	*
Axis coordin	ates	

Click loss of the simulation. Use **Speed Control** to control the simulation speed.

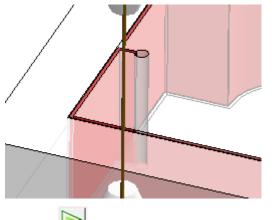


The simulation type "**Solid Simulation**" clearly depicts the material removal and the position of the start holes.



At the end of the first cut, the simulation should stop as a machine stop (e.g. M01) is programmed before the cutting off of the bridge.

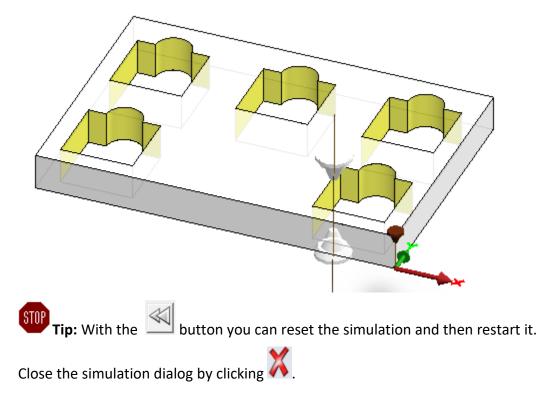
By extending the area around the start hole, you can clearly identify the bridge which has been created by the machine stop.



Use the button to restart the simulation.

**User advice:** Activate the option **On't stop simulation at M01** if the simulation is not supposed to stop at every machine stop (e.g. M01).

Simulate the complete program.



#### Modifying the Operation Strategy

Perhaps you remember that at the beginning of the program we set "**Cut bridges at end of FIRST CUTS**" and "**Stop for bridge removal on first cut**" as our cutting strategy.

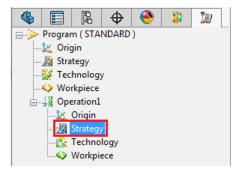
A disadvantage of this strategy is that the operator has to remove the slug after every main cut.



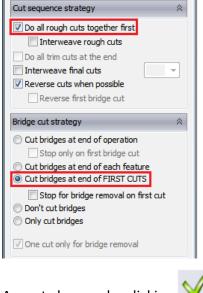
In many cases, it makes more sense to do **All Rough Cuts together first**, and then successively **cut all Bridges** and **do the Trim Cuts last**.

To set the above-mentioned strategy, proceed as follows:

Double-click the branch (Operation) Strategy in the OPTICAM Feature Manager.



Modify the strategy settings as follows:



Accept changes by clicking 💙 .

### Repeated Machining Simulation (Solid Simulation)

To check the newly set strategy, we will restart the Solid Simulation.

Right-click the branch Operation1 and select Solid simulation of operation.

Workpiece		
in Operation	New Operation	Ctrl+Alt+N
Str.	Operation cutting plan	Ctrl+Alt+P
	Automatic feature recognition	
	Manual feature recognition	Ctrl+Alt+F
€ 	Graphic simulation of operation	Ctrl+Alt+G
Ext	Solid simulation of operation 🖑	Ctrl+Alt+S

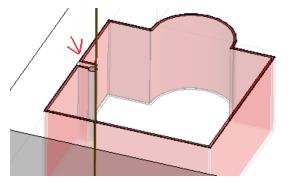
Use the button to start the simulation.

#### Please continue working independently...

Close the simulation dialog by clicking X button.

#### Modifying Start Hole Position and Length of Lead off

In the **Solid Simulation**, you can see that the Start hole is too close to the contour and the Lead off is too long (see following figure).

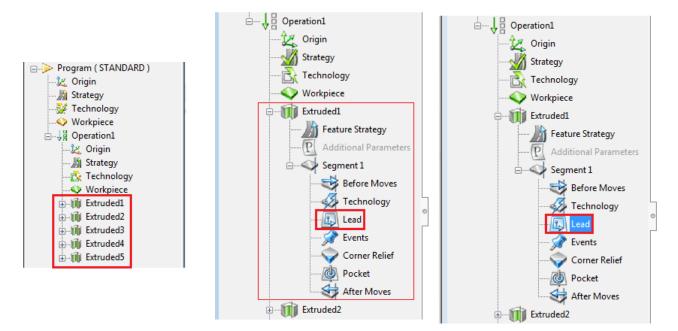


With the OPTICAM Feature Manager, you can influence and modify all cutting parameters. In this case, we want to modify the **Lead on/off parameters**, modify the start hole position and shorten the Lead off.

For each aperture, OPTICAM creates a separate feature in the OPTICAM Feature Manager.

Opening a feature leads to the display of all cutting parameters of the selected feature.

To modify the parameters of the **Lead on/off**, open the first feature of the OPTICAM Feature Manager and double-click the branch I lead of that feature.



This opens the **Lead on / off** dialog.

Click the field **Lead on / off** and modify the length of the **Lead On** to **5** and of the **Lead Off** to **0.6** mm.

Lead on/off					<b>—</b>
🗸 🗙 🏅 💈					
Starthole Endpoint Lead on/off	Lead On		Lead Off		
	<ul> <li>Line</li> <li>Arc</li> <li>Full Arc</li> <li>Meander</li> </ul>		◉ Line ◎ Arc ◎ Full arc		
	Length:	5.0mm	Length:	0.6mm	Copy L/O
	Angle:	0.0°	Angle:	0.0°	Copy L/O
	Extension:	0.0mm	Extension:	0.0mm	Copy L/O
	Arc radius:	0.3mm	Arc radius:	0.3mm	Copy L/O
	Number of Meanders	4			
	Meander width:	3.0mm			

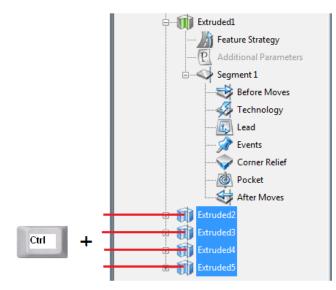
Accept changes by clicking 💙

But the modification of the lead off only extends to the selected feature. To adjust the lead off of the other four features, you would have to repeat the process four times.

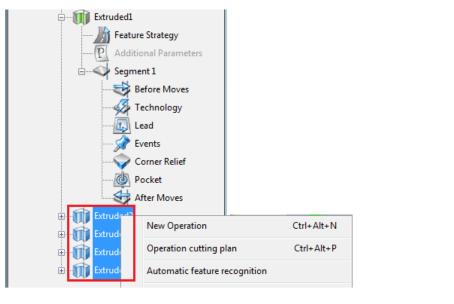
As this would be a bit laborious, OPTICAM offers the possibility to modify various features at the same time.

#### Modifying Various Machining Features at the Same Time

Holding down the **Ctrl** key, click successively on each of the four features in the OPTICAM Feature Manager that you have not yet modified.



Now right-click one of the four features and, on the context menu, select **Multiple edit > Edit lead parameters**.



Rebuild feature		
		Edit feature parameters
Rebuild operation		Edit feature strategy
Rebuild program	Ctrl+Alt+B	Edit segment parameters
Output feature NC file	Output feature NC file	
		Edit lead parameters 🗸 👆
Multiple edit		Edit pocket parameters
Delete operation		

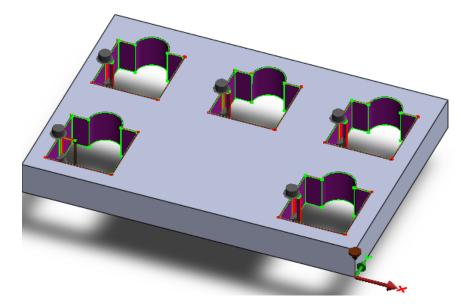
This opens the **Lead on/off** dialog.

Click the field dialog **Lead on/off** and modify the length of the **Lead On** to **5** and of the **Lead Off** to **0.6** mm.

Lead on/off						
🗸 🗙 🏅 🐼						
Starthole Endpoint Lead on/off	Lead On		Lead	d Off		
	<ul> <li>Line</li> <li>Arc</li> <li>Full Arc</li> <li>Meander</li> </ul>			● Line ◎ Arc ◎ Full arc		
	Length:	5.0mm	1	Length:	0.6mm	Copy L/O
	Angle:	0.0°		Angle:	0.0°	Copy L/O
	Extension:	0.0mm		Extension:	0.0mm	Copy L/O
	Arc radius:	0.3mm		Arc radius:	0.3mm	Copy L/O
	Number of Meanders:	4				
	Meander width:	3.0mm				

Accept changes by clicking V.

This time, the modification extends to **all** selected features.



### Repeated Machining Simulation (Solid Simulation)

To check the modified Lead off, we will restart the **Solid Simulation**.

Right-click the branch **Operation1** in the OPTICAM Feature Manager and, on the context menu, click **Solid simulation of operation**.

Workpiece		
Deratic	New Operation	Ctrl+Alt+N
Str.	Operation cutting plan	Ctrl+Alt+P
🔂 Te	Automatic feature recognition	
	Manual feature recognition	Ctrl+Alt+F
⊕	Graphic simulation of operation	Ctrl+Alt+G
	Solid simulation of operation 🖑	Ctrl+Alt+S

#### Please continue working independently...

Close the simulation dialog by clicking 👗 button.

#### Creating the NC Program

At the end of this exercise, we create the NC program.

**Right-click** the branch **Operation1** in the OPTICAM Feature Manager and select the command **Output operation NC file**.

🖃 🗝 🗩 Program ( STAND)	ARD )	
🗄 🙀 Operatio 🕇	New Operation	Ctrl+Alt+N
Oric		Chill Alto D
Stra	Operation cutting plan	Ctrl+Alt+P
💦 Tec	Automatic feature recognition	
	Manual feature recognition	Ctrl+Alt+F
∎ Extr	Graphic simulation of operation	Ctrl+Alt+G
	Rebuild program	Ctrl+Alt+B
	Output operation NC file 🛛 🖑	

In the background, the NC program for the selected machine is created. Afterwards, a dialog for the editing of the NC file will be opened in the OPTICAM Feature Manager.

Click the file name in the dialog and then the Open file in editor button.

OPTICAM	NC Output		
$\checkmark$	2	ý	
File name	Operations	File size (in kB)	
2.iso	Operation 1	5	
Open file in ea	ditor	Copy file	

A text editor opens which displays the just created NC program:

2.iso - Editor	
File Edit Format View Help	
%N001 X+.000 Y+.000 Q+.000 R+.000 G92 N002 G01 X-15.000 Y+25.000 M62 N003 P50	* 
N004 G01 Y+30.000 G42 N005 G02 X-10.000 Y+25.000 I+.0000000000000 J-5.000 N006 G01 X-5.000	
N007 G01 Y+5.000 N008 G01 X-25.000 N009 G01 Y+25.000 N010 G01 X-20.000	
N011 G02 X-15.993 Y+29.900 I+5.000 J+.0000000000000 N012 G01 X-15.874 Y+29.312 G40 N013 M63	
N014 G01 X-15.000 Y+60.000 M62 N015 P50 N016 G01 Y+65.000 G42	
N017 G02 X-10.000 Y+60.000 I+.0000000000000 J-5.000 N018 G01 X-5.000 N019 G01 Y+40.000	
N020 G01 X-25.000 N021 G01 Y+60.000	-
Close the editor	
Close the dialog <b>NC-OUTPUT</b> as well	
	•

Checking the NC Program at a Later Time

## You can also examine the newly created NC program without having to create an NC file every time. You can do this as follows:

Select the menu order Tools \ OPTICAM \ Post-Processing \ Edit NC File.

Tools Window Help 🖈		-		
SOLIDWORKS Applications	×			
Xpress Products	•			_
OPTICAM	►	Operation	►	
Defeature		Utilities	►	
Serventure 유한 Export To AEC		Post-Processing	•	Select a Post-Processor
	_	Python	►	Create an Output NC File
Select		Settings	×	Edit NC File 🔓
Regularities Augustication		Help	►	Neutral Format Output
Box Selection		Contacting Manage		Contacting Manage
9 Lasso Selection		Customize Menu		Customize Menu

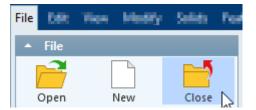
This opens the most recently created NC file in an editor.

#### Saving the OPTICAM Program

At the end, you should save your work.

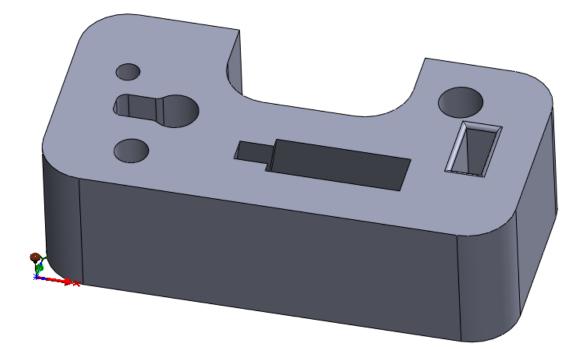
**User advice:** In addition to the GibbsCAM file **GC14\_Opticam\_example\_2.vnc**, a second file containing the OPTICAM machining information for the current program will be saved. This OPTICAM file has the file extension .**wire.opticam**.

Close the file GC14\_Opticam\_example\_2.vnc.



This exercise is now completed.

## Example 3: Taper, Variable Taper

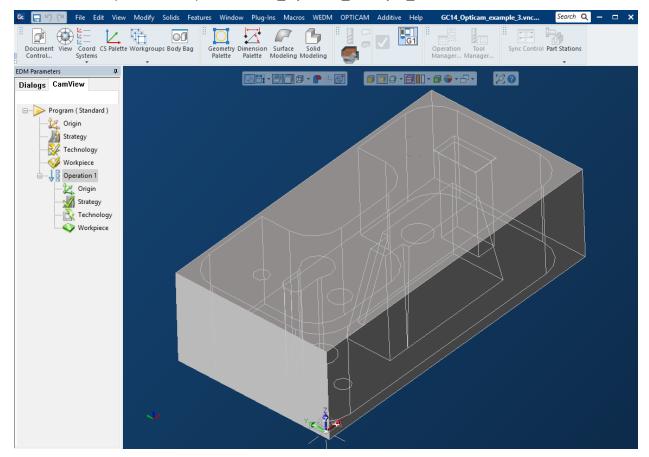


#### **Demonstrated in This Example**

Opening a file: GC14\_Opticam\_example\_3 Positioning the Machine Origin in the Center of an Edge Defining the Cutting Technology (Technology from Database) Creating the Workpiece (Billet) Geometry Setting the Cutting Heights (Reference Plane Height and Secondary Plane Height) Setting the Cutting Strategy Automatic Creation of the Cutting Machining through Feature Recognition Setting the Position of the Start Hole and the Length of the Lead off Adjusting the Size of the Bridge Machining Simulation (Solid Simulation) Depiction of Slugs during the Simulation Creating the NC Program

### *Open GC14\_Opticam\_example\_3*

In GibbsCAM, open the sample file **GC14\_Opticam\_example\_3.vnc**.

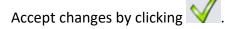


#### Using the Program Dialog for Basic Settings

As a first step, we define the basic settings again.

Double-click the branch **Program (STANDARD)** in the OPTICAM Feature Manager to open the dialog for the definition of the program default settings.

Fill in the dialog as shown to the right:



OPTICAM Pr	ogram Setup
🗸 🗶 i	2 🛃 🔊
Description Example 3	
Example 0	
Post-Processor Sel	ection 🕆
NCPath	Current Job Directory
C:\Users\Public\[	Documents\opticam\Job\
Manufacturers	
STD	
Post-Processor	
STANDARD	
Modell-Name	
W1-W2	▼
	Technology
	Post-Processor Options

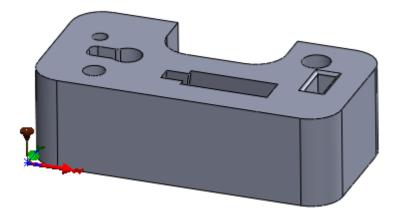
#### Positioning the Machine Origin in the Center of an Edge and Reversing the Direction of the Z-Axis

In the next step, we define the position of the machine origin which is to be placed in the center of the model's leading edge this time.

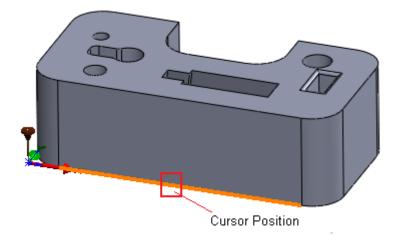
Double-click (Program) Origin to open the dialog to define the machine origin.

OPTICAN	A Origin		
1	🕻 ? 遂	<b>C</b> N	Ŵ
🔽 Displa	y origin		
Origin			~
Explici	t origin coordinates		
	Vertex		
Explici	t origin alignment		
12	Z axis (wire)	Face	
1/2	X axis	Edge	
12	Y axis	Edge	
011			<u>^</u>
Offset orig	gin		~
X 0.0mm	Y 0.0mm	Z 0.0mm	

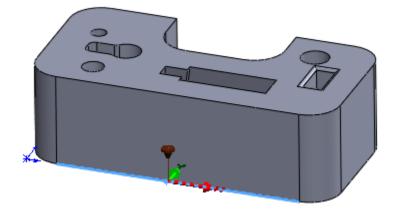
Currently, the machine origin is on the left side at the bottom of the workpiece (see following figure).



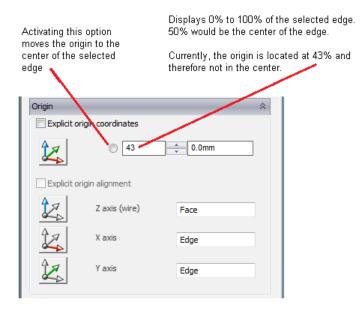
To position the origin in the center of the model's lower leading edge, position the cursor approximately in the center of the model's lower leading edge and click with the left mouse button.



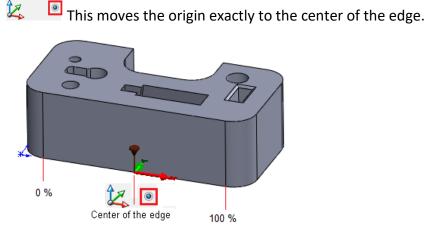
This moves the origin on the selected edge. However, it is unclear whether the new origin is exactly in the center of the edge.



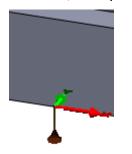
Looking at the dialog **Machine Origin** will help us (example).



The origin is not exactly in the center of the selected edge, but 43% away from the origin of the edge. If you changed the value to 50%, the origin would be in the center of the edge. But it is easier to activate the option Origin 🔽

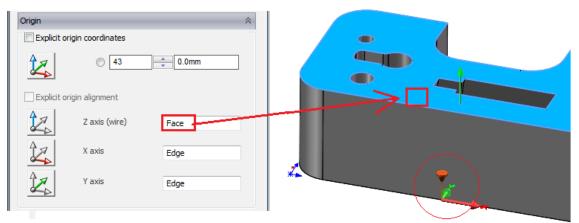


However, it may happen that the Z-axis of the origin points in the wrong direction.



But the nozzle icon along the Z-axis of the origin must point in the positive Z-direction.

To reverse the direction of the origin, position the cursor in the dialog box Z axis (wire), and click on a plane face on which the Z-axis of the origin is to be aligned.



Thus, the direction of the Z-axis is reversed.

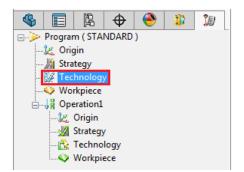
Close the dialog Machine Origin by clicking

### Defining the Cutting Technology (from Database)

In the next step, we will define with which cutting technology the workpiece is be machined.

Double-click the branch (**Program**) **Technology** in the OPTICAM Feature Manager to open the dialog for the definition of the cutting

technology.



You can either select the parameters of the cutting technology from a database or enter them manually.

In the first few exercises, you have entered the cutting technology manually. However, in this example the technology is to be loaded from the Technology Database.

You can do this as follows:

Select suitable technology parameters from the listboxes Wire Diameter, Wire Type, Material, and Height, as follows:

OPTICAM T	echnology	
STD X	?	
Filters		*
Inclu	de user tech in search	
User Tech name		-
Wire diameter	0.25mm	•
Wire type	Brass	•
Material	Steel	•
Height	10.0mm	•
Number of cuts	1	•
RA	0.0µm	•
Outputs		~
Records found		
Cut	Offset	
1	0.0mm	
Modify technology	/	~
	technology made in cuts ected tech in cuts editor	
	Cuts editor	

Filters	\$
Include 🕅	user tech in search
User Tech name	<b></b>
Wire Diameter	0.25mm 🔻
Wire Type	Soft Brass 🔹
Material	Steel 🔻
Height	30.0mm 🔻
Number of Cuts	3
RA	0.0µm -
Outputs	
Records found	
Cut	Offset
1	0.205mm
2	0.136mm
3	0.136mm

In the dialog area **Records found** the selected cutting technology will be displayed.

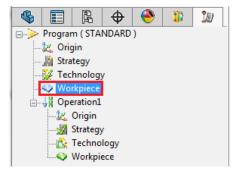
**User advice:** The input fields of the technology database vary according to the selected postprocessor and often only contain a few example technologies. For most wire EDM machines, complete technology databases are optionally available.

Accept the selection of the technology parameters by clicking  $\searrow$ 

#### Creating the Workpiece (Billet) Geometry

In the next dialog, you can define the geometry of the workpiece (billet).

Double-click the branch (Program) Workpiece in the OPTICAM Feature Manager.



The workpiece (billet) is to be derived from the solid body; additionally, no allowance values are to be defined.

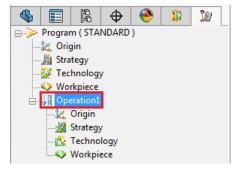
Fill in the dialog as follows:

OPTICAM Wo	rkpiece		
🗸 🗙 🏅	<b>S</b>	CPU	À
<ul> <li>Use box around s</li> <li>Use specific solid</li> <li>Use STL file</li> </ul>	olids		
Box			*
Extra in X-	0.0mm		
Extra in Y-	0.0mm		
Extra in Z-	0.0mm		
Extra in X+	0.0mm		
Extra in Y+	0.0mm		
Extra in Z+	0.0mm		
Solid body	_	_	♦
STL file	_	_	*
Accept chang	es by o	clickin	ig √

## Setting the Cutting Heights (Reference Plane Height and Secondary Plane Height)

The following dialog sets among other things the name of the NC output file as well as the Z-height of the Reference and the Secondary Plane Height.

Double-click the branch **Operation1** in the OPTICAM Feature Manager.



Fill in the fields Description, FileName and PartNumber as follows:

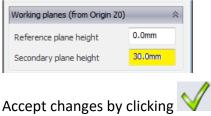
OPTICAM	Operation Setup
🗸 🗙	? 🐼 💁 🔗
Description	
Example 3	
FileName	
3	
CMD FileName	
PartNumber	
3	

In this example, the **Secondary plane height** is to be identified in the model.

Position the cursor in the input field **Secondary plane height.** 

Working planes (from Origin Z0)	*		e e e		RAN
Reference plane height	0.0mm		70		
Secondary plane height	10.0mm				
		**		5	

Click on an edge (a plain face or a vertex) on the top level of the model. OPTICAM calculates the Z-height of the selected element and passes the value on to the dialog box Secondary plane height.

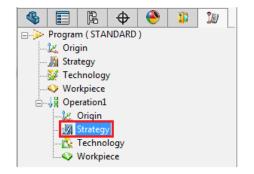


#### Setting the Cutting Strategy

In the next dialog, you can define with which strategy the workpiece is to be machined.

Double-click the branch (Operation) Strategy in the OPTICAM Feature Manager.

The geometries are to be processed in a way that the Bridges are Cut at the End of the Operation. The main cut and the 2 trim cuts are to be done in Reverse Cuts (forwards/backwards).



#### Set the dialog as follows:

OPTICAM Operation Strategy
🗸 🕺 🖗 🖗 🔗
Use program strategy
Our operation strategy
Use feature strategy
Feature sequence strategy 🔅
Feature order from feature list
Smallest features first
Smallest features last
Shortest path between features
Ignore pocket in ordering
Feature with pocketing first
Feature with pocketing last
Collar before taper
Taper before collar
Internal before external features
External before internal features
Ignore internal / external in ordering
Cut sequence strategy 🔅
Do all rough cuts together first
Do all rough cuts together first
Do all rough cuts together first
Do all rough cuts together first Interweave rough cuts Do all trim cuts at the end
Do all rough cuts together first Interweave rough cuts Do all trim cuts at the end Interweave final cuts
Do all rough cuts together first Interweave rough cuts Do all trim cuts at the end Interweave final cuts V Reverse cuts when possible
Do all rough cuts together first  Interweave rough cuts Do all trim cuts at the end Interweave final cuts  Reverse cuts when possible Reverse first bridge cut
□ Do all rough cuts together first         □ Interweave rough cuts         □ Do all trim cuts at the end         □ Interweave final cuts         ☑ Reverse cuts when possible         □ Reverse first bridge cut
Do all rough cuts together first Interweave rough cuts Do all trim cuts at the end Interweave final cuts Reverse cuts when possible Reverse first bridge cut Bridge cut strategy Cut bridges at end of operation
<ul> <li>Do all rough cuts together first</li> <li>Interweave rough cuts</li> <li>Do all trim cuts at the end</li> <li>Interweave final cuts</li> <li>Reverse cuts when possible</li> <li>Reverse first bridge cut</li> </ul> Bridge cut strategy <ul> <li>© Cut bridges at end of operation</li> <li>© Stop only on first bridge cut</li> </ul>
<ul> <li>Do all rough cuts together first</li> <li>Interweave rough cuts</li> <li>Do all trim cuts at the end</li> <li>Interweave final cuts</li> <li>Reverse cuts when possible</li> <li>Reverse first bridge cut</li> </ul> Bridge cut strategy <ul> <li>Cut bridges at end of operation</li> <li>Stop only on first bridge cut</li> <li>Cut bridges at end of each feature</li> </ul>
<ul> <li>Do all rough cuts together first         <ul> <li>Interweave rough cuts</li> <li>Do all trim cuts at the end</li> <li>Interweave final cuts</li> </ul> </li> <li>Reverse cuts when possible         <ul> <li>Reverse cuts when possible</li> <li>Reverse first bridge cut</li> </ul> </li> <li>Bridge cut strategy         <ul> <li>Cut bridges at end of operation</li> <li>Stop only on first bridge cut</li> <li>Cut bridges at end of each feature</li> <li>Cut bridges at end of FIRST CUTS</li> </ul> </li> </ul>
<ul> <li>Do all rough cuts together first         <ul> <li>Interweave rough cuts</li> <li>Do all trim cuts at the end</li> <li>Interweave final cuts</li> </ul> </li> <li>Reverse cuts when possible         <ul> <li>Reverse first bridge cut</li> </ul> </li> <li>Bridge cut strategy         <ul> <li>Cut bridges at end of operation</li> <li>Stop only on first bridge cut</li> <li>Cut bridges at end of each feature</li> <li>Cut bridges at end of FIRST CUTS             <ul> <li>Stop for bridge removal on first cut</li> </ul> </li> </ul></li></ul>
<ul> <li>Do all rough cuts together first <ul> <li>Interweave rough cuts</li> <li>Do all trim cuts at the end</li> <li>Interweave final cuts</li> </ul> </li> <li>Reverse cuts when possible <ul> <li>Reverse first bridge cut</li> </ul> </li> <li>Bridge cut strategy <ul> <li>Cut bridges at end of operation</li> <li>Stop only on first bridge cut</li> <li>Cut bridges at end of each feature</li> <li>Cut bridges at end of FIRST CUTS</li> <li>Stop for bridge removal on first cut</li> <li>Don't cut bridges</li> </ul> </li> </ul>

Accept changes by clicking  $\bigvee$ .

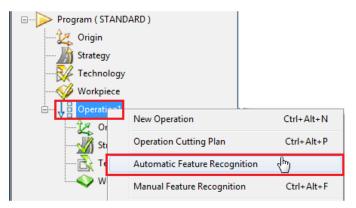
#### Creating the Cutting Machining

As you probably know from the first examples, with OPTICAM it is possible to create the cutting machining automatically or by manually selecting faces or model edges.

Because all internal apertures are to be machined in this example, the cutting machining will be automatically created by the system.

#### Automatic Creation of the Cutting Machining

Right-click the branch **Operation1** in the OPTICAM Feature Manager and, on the context menu, click **Automatic Feature Recognition**.



The dialog **Automatic Feature Recognition** opens. To machine only the internal apertures, set the dialog as follows:



In order to set what exactly the Feature Recognition is supposed to recognize, click the

in the dialog.

Feature recognition settings	button

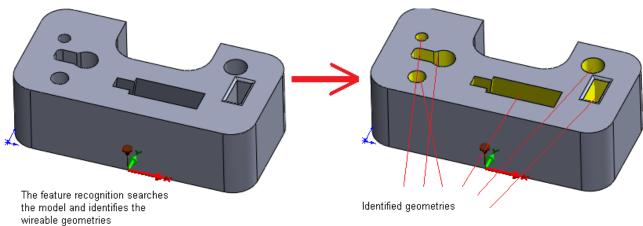
Options		~
Use colour list		
Choose list:		]
		]
		2
	Manage lists	J
	Start hole settings	]
Fe	ature recognition settings	

A dialog containing setting parameters for the **Feature Recognition** opens.

Make sure that the dialog looks as follows:

🗸 🗙 💲 🐼 🖬	р.	
Basic settings	Feature types	General settings
Colour settings Start hole settings	Extruded	Group repeated features
Feature recognition settings	Cylinder	Check for collars and tapers
	Cone	Ignore when multiple start holes found
	Constant taper	Advanced feature recognition (slower)
	Variable taper	Do not use faces with small area as start face
	V Four axis	Area: 0.0mm <sup>2</sup>
	Inclined extruded	Automatically apply templates
	Inclined cylinder	Use start hole settings
	Inclined cone	Cut wire between features
		Recognize variable taper as four axis
		Max. angle: 45.0°
	Select / deselect all	Select / deselect all

The system will now search the solid body for all geometries that can be wire cut (feature recognition) and create a machining suggestion with the cutting parameters previously set.



For each geometry that can be wire cut, OPTICAM creates a separate feature in the OPTICAM Feature Manager. As six geometries have been identified, there should also be six features:

🗄 🐙 🖥 Operation1
Origin
Strategy
Technology
Extruded1
🕂 🗤 🔟 Cylinder2 - d = 9.2123mm
🐑 🍿 Cylinder3 - d = 4.9442mm
Four axis4
Constant taper5
🗄 🥡 Constant taper6

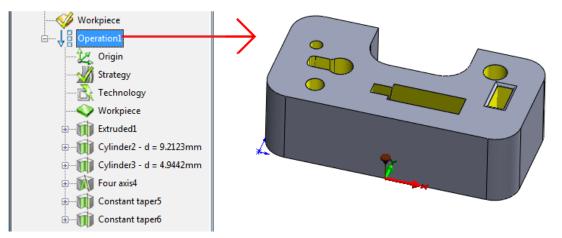
**User advice:** Please note that OPTICAM distinguishes between the identified geometries and divides them into categories:

- Extruded = Cylindrical cut on any feature
- **Cylinder** = Cylindrical round hole
- **Cone** = Tapered round hole
- **Constant Taper** = Constant taper (can be output to the NC data as a taper)
- **Variable Taper** = Taper changes within the feature (can be output as a variable taper)
- Four Axis = Upper and lower plain are different (NC output as a four axis)
- Inclined Extruded, Cylinder and Cone = Features, type Extruded, Cylinder and Cone, introduced into the model diagonally and at an angle.

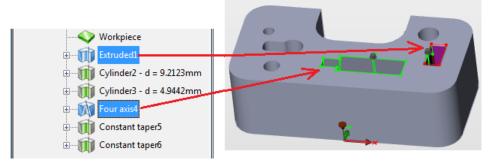
The geometry differentiation is very important for the NC output as the necessary NC output is automatically identified.



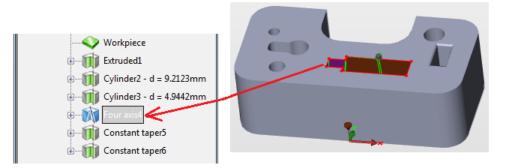
If you click the branch **Operation1** in the OPTICAM Feature Manager, the geometries of all existing features will be highlighted.



If you click on one or various features in the OPTICAM Feature Manager, OPTICAM will highlight the geometries of the selected feature(s) and additionally display the tool paths, the bridge, and the start hole.



However, it also works the other way round: If you click on a feature in the solid model, the corresponding entry will be highlighted in the OPTICAM Feature Manager.

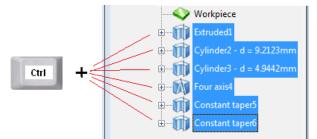


# Setting the Start Hole Position and the Length of the Lead off

Using the OPTICAM Feature Manager, you can influence and modify all cutting parameters. In our case, we want to change the lead on / lead off parameters and the position of the start hole and shorten the lead off.

For each aperture, OPTICAM creates a separate feature in the OPTICAM Feature Manager.

Holding down the **Ctrl** key, and click successively each of the six features:



Now right-click one of the six features and, on the context menu, click **Multiple edit > Edit lead parameters** to open the **Lead on / off** dialog.

Workpiece			
Cylinde	New Operation	Ctrl+Alt+N	
Image: Cylinde         Image:	Operation cutting plan	Ctrl+Alt+P	
En Four ax	Automatic feature recognition		
En Constai	Manual feature recognition	Ctrl+Alt+F	
	Delete feature	Ctrl+Del	
	Rebuild program	Ctrl+Alt+B	
	Output feature NC file		
	Multiple edit	۲.	Edit feature parameters
	Delete operation		Edit feature strategy Edit segment parameters
			Edit technology parameters
		r	Edit lead parameters
			Edit pocket parameters

.....

On the left-hand side, click the feature **Lead on / off** and modify the length of the **Lead On** to **3** mm and of the **Lead Off** to **1** mm.

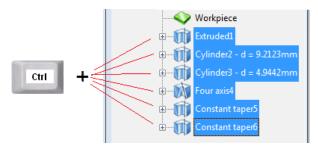
Lead on/off					
🗸 🗶 🏅					
Start hole Endpoint	Lead on		Lead off	]	
Lead on/off	3				
	<ul> <li>Line</li> </ul>		Line		
	Arc		C Arc		
	C Full Arc		🔘 Full arc		
	Meander				
	Length:	3.0mm	Length:	1.0mm Copy L/O	
	Angle:	0.0°	Angle:	0.0° Copy L/O	
	Extension:	0.0mm	Extension:	0.0mm Copy L/O	
	Arc radius:	0.3mm	Arc radius:	0.3mm Copy L/O	
	Number of	4			
	Meander width:	3.0mm			
	Cut hole at start	:	Cut hole	e at end	
	Hole diameter:	0.75mm	Hole	0.75mm	
		A			

Accept changes by clicking V. The modification applies to all selected features.

#### Adjusting the Size of the Bridge

Now we want to check the size of the bridge and adjust it, if necessary.

Holding down the **Ctrl** key, successively click each of the six features in the OPTICAM Feature Manager.

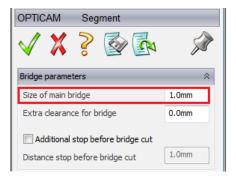


Now right-click one of the six features and, on the context menu, click **Multiple edit >** Edit segment parameters.

Workpiece			
Et Cylinc	New Operation	Ctrl+Alt+N	
🕀 📆 Cylinc	Operation cutting plan	Ctrl+Alt+P	
🕀 🖳 Four a	Automatic feature recognition		
⊕ • • • • • • • • • • • • • • • • • • •	Manual feature recognition	Ctrl+Alt+F	
	Delete feature	Ctrl+Del	
	Rebuild program	Ctrl+Alt+B	
	Output feature NC file		
	Multiple edit	•	Edit feature parameters
	Delete operation		Edit feature strategy Edit segment parameters
		L	Edit technology parameters
			Edit lead parameters
			Edit pocket parameters

The dialog Segment opens.

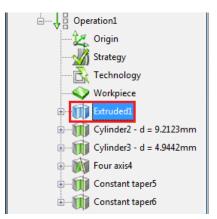
If necessary, change the Size of main bridge to 1.0 mm.



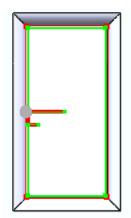
#### Checking the Changes

Since you have changed the **lead on / lead off** and the **size of the bridge**, you should check these changes graphically.

Click the feature **Extruded1** in the OPTICAM Feature Manager.



The figure below shows how the tool path graphic of the selected feature is highlighted in the solid body:



#### Machining Simulation (Solid Simulation)

Right-click the branch **Operation1** and, on the context menu, click **Solid simulation of operation**.

🖃 🕪 Program ( STANDA	ARD )	
🕰 Origin		
🗄 🕌 Operation1 —		
Ori	New Operation	Ctrl+Alt+N
Stra	Operation cutting plan	Ctrl+Alt+P
Tec	Automatic feature recognition	
₩o 	Manual feature recognition	Ctrl+Alt+F
Ext	Graphic simulation of operation	Ctrl+Alt+G
⊡ Cyl	Solid simulation of operation 🖞	Ctrl+Alt+S

A dialog opens that allows you to control the solid simulation:

OPTICAM	Simulation Contr	rol
×	? 🗟 🗗	
Simulation contr	ols	*
$\langle \langle \rangle$		
Don't stop	simulation at M01 ol	
Cutting informa	tion	*
Axis coordina	tes	

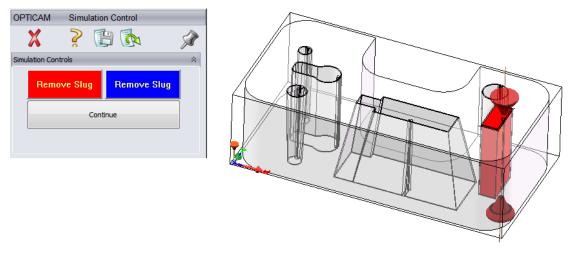
Click loss to start the simulation. Use **Speed Control** to control the simulation speed.

Speed Control	
·	_

The simulation type **"Solid Simulation"** clearly depicts the material removal and the position of the start holes.

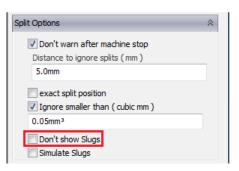
#### Depiction of Slugs during the Simulation

If the bridge is cut, normally a slug will be created. The solid simulation can visualize this slug and displays the button **Remove Slug**. The slug will be displayed in red.

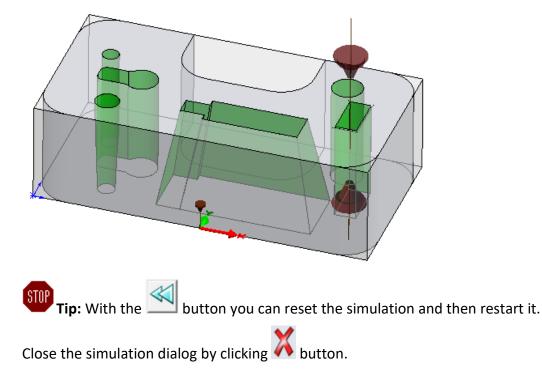


**User advice**: In the field **Split Options** in the simulation dialog you can set if a slug is to be displayed or not.

If you want to see the slug, you have to DEACTIVATE the option **Don't show Slugs**.



The following figure shows the complete program.



#### Creating the NC program

At the end of this exercise, we create the NC program.

**Right-click** the branch **Operation1** in the OPTICAM Feature Manager and select the command **Output operation NC file**.

🖃 🕪 Program ( STANDA	ARD )	
Origin		
	New Operation	Ctrl+Alt+N
Stra	Operation cutting plan	Ctrl+Alt+P
Tec	Automatic feature recognition	
Wo	Manual feature recognition	Ctrl+Alt+F
⊞∭ Extr	Graphic simulation of operation	Ctrl+Alt+G
		<b>C 1 1 1 1</b>
	Rebuild program	Ctrl+Alt+B
	Output operation NC file 🕁	

In the background, the NC program for the selected machine is created. Afterwards, a dialog for the editing of the NC file will be opened in the OPTICAM Feature Manager.

(	Click the NC	file name	e and then the	Open file in editor	button.
	OPTICAM	NC Output			
	$\checkmark$	2	s an		
	File name	Operations	File size (in kB)		
	3.iso	Operation1	8		
	Open file in ed	itor	Copy file		

A text editor opens which displays the just created NC program:

🗿 3.iso - Editor	
File Edit Format View Help	
%N001 X+.000 Y+.000 Q+.000 R+.000 G92 N002 G01 X-38.287 Y+25.708 M62 N003 P50	
N004 G01 X-40.287 G42 N005 G01 Y+32.413 N006 G01 X-33.894 N007 G01 Y+19.002	
N008 G01 X-40.287 N009 G01 Y+24.708 M00 N010 G01 Y+25.708	
N011 G01 X-38.287 G40 N012 P50 N013 G01 X-40.287 G41 N014 G01 Y+19.002	
N015 G01 X-33.894 N016 G01 Y+32.413 N017 G01 X-40.287	
N018 G01 Y+25.708 N019 G01 X-38.287 G40 N020 P50	
N021 G01 X-40.287 G42	▼ 1.1

Close the editor 💷 🔜.			
	OPTICAM	NC-OUTPUT	
Close the dialog <b>NC-OUTPUT</b> as wel	$\checkmark$	Ş	<i>S</i>

#### Saving the OPTICAM Program

At the end, you should save your work.

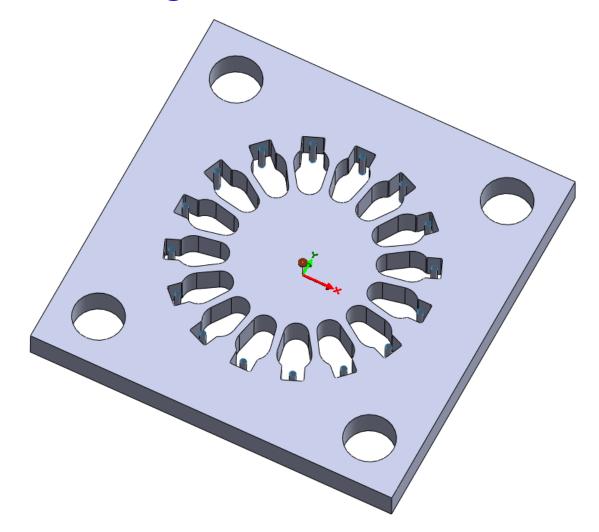
**User advice:** In addition to the GibbsCAM file **GC14\_Opticam\_example\_3.vnc**, a second file containing the OPTICAM machining information for the current program will be saved. This OPTICAM file has the file extension \*.wire.opticam.

Close the file GC14\_Opticam\_example\_3.vnc.



This exercise is now completed.

## Example 4: Automatic Start Hole Recognition

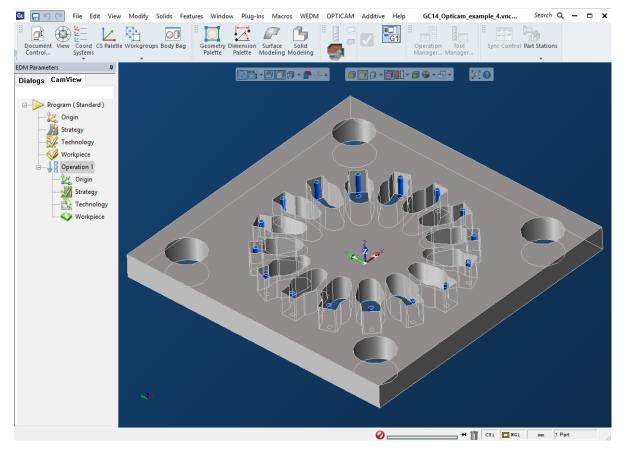


#### **Demonstrated in This Example**

Opening a file: GC14\_Opticam\_example\_4 Defining the Machine Origin Defining the Cutting Technology (Technology from Database) Setting the Cutting Strategy Automatic Creation of the Cutting Machining through Feature Recognition Automatic Start Hole Recognition Grouping Repeated Features Adjusting the Length of the Lead off

### *Open GC14\_Opticam\_example\_4*

In GibbsCAM, open the example file GC14\_Opticam\_example\_4.vnc.

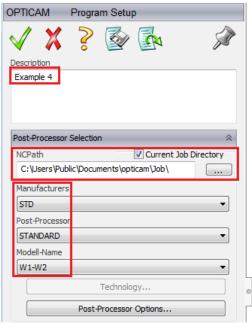


#### Using the Program Dialog for Basic Settings

As before, double-click the branch **Program** (STANDARD) to open the dialog for the definition of the program default settings.

Fill in the dialog as shown to the right:

Accept changes by clicking 💙

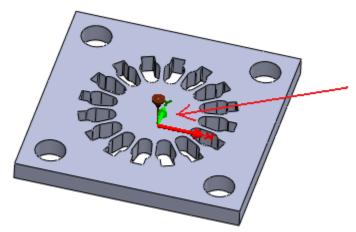


#### Defining the Machine Origin

In the next step, the position of the machine origin will be defined. In this example, the origin will be placed at the lower left corner of the model.

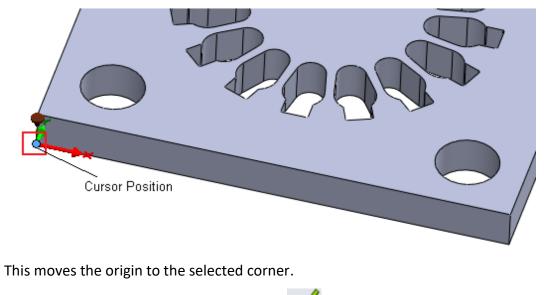
Double-click the branch (**Program**) Origin to open the dialog for the definition of the machine origin.

Currently, the machine origin is in the center of the workpiece.



	A Origin	<b>A</b> 5	
Display     Origin     Explici	y origin t origin coordinates	_	*
2	Vertex		
Explici	t origin alignment		
Za	Z axis (wire)	Face	-
$\mathbb{Z}$	X axis	Edge	
	Y axis	Edge	
Offset orig	gin	_	~
X 0.0mm	Y 0.0mm	Z 0.0mm	

To move the origin to the lower left corner of the model, position the cursor at the lower left corner of the model and click with the left mouse button.

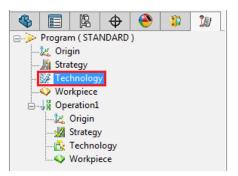


Close the Machine Origin dialog by clicking

### Defining the Cutting Technology (from Database)

In the next step, we will define with which cutting technology the workpiece is to be machined.

Double-click the branch (Program) Technology in the OPTICAM Feature Manager.



This opens the dialog for the definition of the cutting technology:

OPTICAM Tech	nnology
STD X	?
Filters	*
Include	user tech in search
User Tech name	<b></b>
Wire diameter	0.25mm 🔻
Wire type	Brass
Material	Steel 🔻
Height	10.0mm 👻
Number of cuts	1
RA	0.0µm -
Outputs	*
Records found	
Cut	Offset
1	0.0mm
Modify technology	*
Use modified tech	
	Cuts editor

You can either select parameters of the cutting technology from a database or enter them manually. As in the last exercise, we want to load the technology from the Technology Database.

Select suitable technology parameters from the listboxes Wire Diameter, Wire Type, Material and Height.

Filters	*		
Include	user tech in search		
User Tech name	· · · · · · · · · · · · · · · · · · ·		
Wire Diameter	0.25mm 🔻		
Wire Type	Soft Brass 🔹		
Material	Steel 🔻		
Height	10.0mm 🔻		
Number of Cuts	3 🔻		
RA	0.0µm 🔻		
	Π		
Outputs	<b>↓</b> ↓		
Records found	V		
Cut	Offset		
1	0.205mm		
2	0.136mm		
3	0.136mm		

In the dialog area **Records found** the selected technology will be displayed.

STOP User advice: The input fields of the technology database vary according to the selected postprocessor and often only contain a few example technologies. For most wire EDM machines, complete technology databases are **optionally** available.

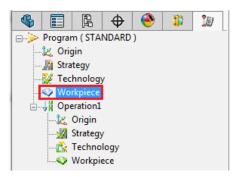
Accept the selection of the technology parameters by clicking  $\bigvee$ .



### Creating the Workpiece (Billet) Geometry

In the next dialog, you can define the geometry of the workpiece (billet).

Double-click the branch (Program) Workpiece in the OPTICAM Feature Manager.



The workpiece (billet) is to be derived from the solid body; additionally, no allowance values are to be defined.

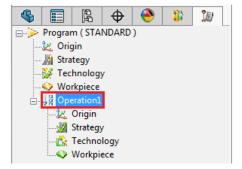
Fill in the dialog as follows:

OPTICAM Wo	kpiece	
🗸 🗶 🏅	Ø 🗖	
<ul> <li>Use box around s</li> <li>Use specific solid</li> <li>Use STL file</li> </ul>	olids	
Box		*
Extra in X-	0.0mm	
Extra in Y-	0.0mm	
Extra in Z-	0.0mm	
Extra in X+	0.0mm	
Extra in Y+	0.0mm	
Extra in Z+	0.0mm	
Solid body		*
STL file		*
Accept chang	es by clic	king 🗸

# Setting the Cutting Heights (Reference Plane Height and Secondary Plane Height)

The following dialog sets (among other things) the name of the NC output file and the Z-height of the Reference and the Secondary Plane Height.

Double-click the branch **Operation1** in the OPTICAM Feature Manager.



Fill in the fields Description, File name, Part number and Position as follows:

OPTICAM	Operation Setup	*
🗸 🗶	? 🐼 💁 🔗	
Description		
Example 4		
File name		
4		
CMD file name		
		E
Part number		
4		
From position (f	rom origin) 🔗	
Wire is thre	aded at start	
Explicit from	n coordinates	
Reference	χ 0.0mm γ 0.0mm	
Machine origin	<b></b>	

Identify the Secondary plane height in the model. You can do this by selecting an element (an edge, plain face or a vertex) which is located at the desired height.

Position the cursor in the input field Secondary plane height.

Working planes (from Origin Z0)		*		
Reference plane height	0.0mm			
Secondary plane height	10.0mm	4		
Nozzles		*	-	

Click an edge or a vertex on the top level of the model. OPTICAM calculates the Z-height of the selected element and passes the value to the dialog box **Secondary plane height.** 

Working planes (from Origin Z0) Reference plane height	0.0mm		
Secondary plane height	10.0mm		
Nozzles		~	,

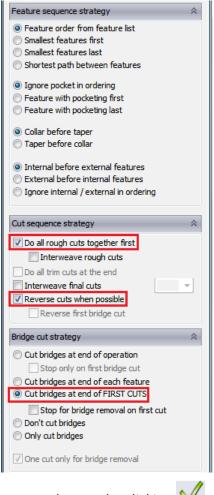
### Setting the Cutting Strategy

In the next dialog, you can define with which strategy the workpiece is to be machined.

Double-click the branch **(Operation) Strategy** in the OPTICAM Feature Manager.

The geometries are to be processed in a way that All Rough Cuts Are Done together first and then all Bridges Are Cut. In the end, the two Trim Cuts are to follow in Reverse Cuts (forwards/backwards).

Set the dialog as follows:



E ß Ð 17 圓 🖃 🕑 Program ( STANDARD ) - 🗶 Origin 🕼 Strategy - 💥 Technology .... Vorkpiece 🖳 Origin Strategy 🔆 Technology Workpiece

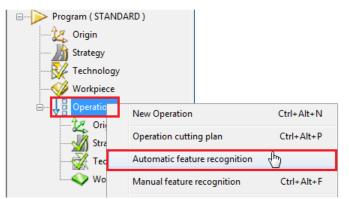
Accept changes by clicking V.

#### Creating the Cutting Machining

With OPTICAM it is possible to create the cutting machining automatically or by manually selecting faces or model edges. In this example, all internal apertures are to be machined. The cutting machining is to be automatically created by the system.

#### Automatic Creation of the Cutting Machining

Right-click the branch **Operation1** in the OPTICAM Feature Manager and, on the context menu, click **Automatic feature recognition**.



The dialog **Automatic Feature Recognition** will be displayed. To machine **exclusively the internal apertures**, set the dialog as follows:



In order to set what exactly the Feature Recognition is supposed to recognize, click the

	bui
Options	~
🔲 Use colour list	
Choose list:	]
	1
Manage lists	
Start hole settings	
Feature recognition settings	

Feature recognition settings

button in the dialog.

A dialog containing setting parameters for the **Feature Recognition** will open.

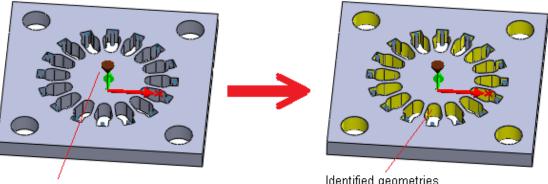
Make sure that the dialog looks as follows:

Basic settings Colour settings Start hole settings Feature recognition settings	Feature types V Extruded Cylinder Cylinder Cone Constant taper V ariable taper Four axis Inclined extruded Inclined cylinder V Inclined cone	General settings Group repeated features Check for collars and tapers Check for collars and tapers C Ignore when multiple start holes found Advanced feature recognition (slower) Do not use faces with small area as start face Area: 1.0mm <sup>2</sup> Automatically apply templates Use start hole settings Cut wire between features Recognize variable taper as four axis Max. angle: 39.0°
	Select / deselect all	Select / deselect all

Accept changes by clicking V. Close the Feature Recognition dialog:



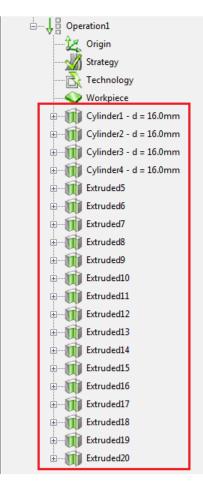
The system will now search the solid body for all geometries that can be wire cut (feature recognition) and create a machining suggestion with the cutting parameters previously set.



The feature recognition searches the model for wireable geometries

Identified geometries

For each aperture that can be wire cut, OPTICAM creates a separate feature in the **OPTICAM Feature Manager.** 



#### STOP

**User advice:** Please note that OPTICAM distinguishes between the identified geometries and divides them into categories:

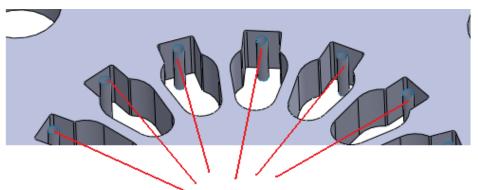
In this case, OPTICAM has identified and machined 16 cylindrical apertures (Extruded 5-20) and 4 cylindrical holes (Cylinder 1-4).

**User advice:** If only two features exist, you have probably activated the option **"Group repeated features"** in the **Feature Recognition** dialog, which unites identical features into one feature.

#### Automatic Start Hole Recognition

OPTICAM feature recognition is able to identify start holes in a 3D model and to use them as threading position for the cutting machining.

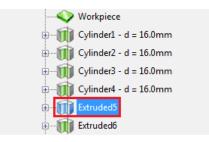
To take advantage of automatic start hole recognition, the start holes in the 3D model have to be drawn as "surface cylinders" (in GibbsCAM terminology, "Extruded Circles"). This is the case in this example.



Start holes, drawn as "cylinders"

#### Adjusting the Lead on/off

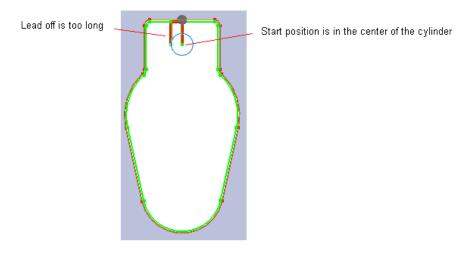
Click the feature **Extruded5** in the OPTICAM Feature Manager.



The tool paths of the selected feature are highlighted in the model.

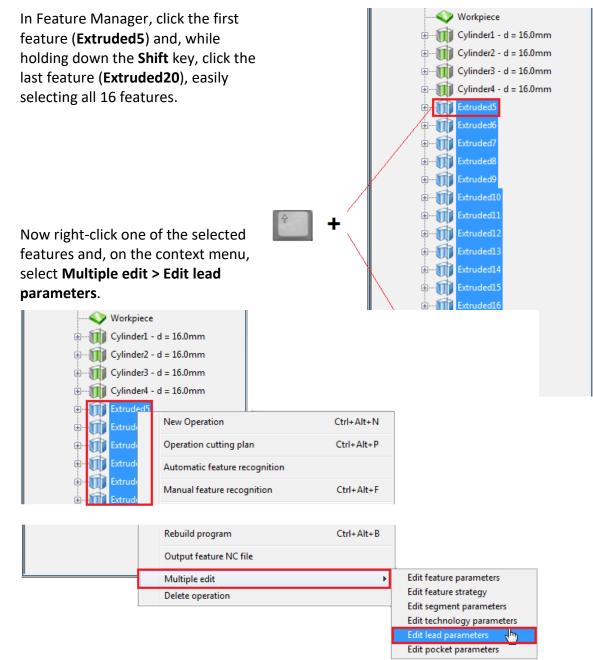
If you extend the tool paths and look at them more closely, you will note several things:

The start position is in the center of the cylinder. This is the result of the automatic start hole recognition of the OPTICAM Feature Recognition.



The lead off is too long and should be shortened. In the following, we will shorten the lead off.

#### Shortening the Length of the Lead off



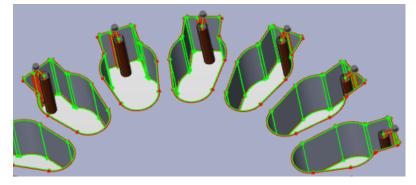
This opens the **Lead on/off** dialog.

On the left-hand side, click the feature **Lead on/off** and modify the length of the **Lead Off** to **0.5** mm.

Lead on/off					×
🗸 🗙 🏅 💈	s				
Starthole	Lead On		Lead Off		
Endpoint Lead on/off					
	Ine		<ul> <li>Line</li> </ul>		
	Arc		Arc		
	Full Arc		Full arc		
	Meander				
	Length:	2.2385mm	Length:	0.5mm	Copy L/O
	Angle:	0.0°	Angle:	0.0°	Copy L/O
	Extension:	0.0mm	Extension:	0.0mm	Copy L/O
	Arc radius:	0.3mm	Arc radius:	0.3mm	Copy L/O
	Number of Meanders:	4			
	Meander width:	3.0mm			

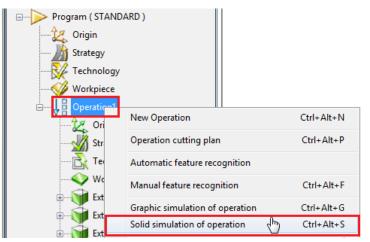
Accept changes by clicking  $\checkmark$ .

The adjustment of the lead off is applied to all selected features.



#### Machining Simulation (Solid Simulation)

Right-click the branch **Operation1** and, on the context menu, click **Solid simulation of operation**.



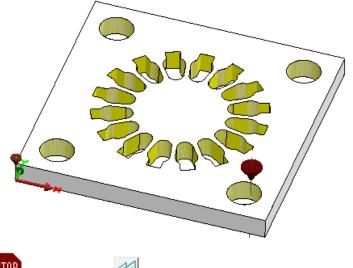
A dialog opens that allows you to control the solid simulation:

OPTICAM	Simulat	ion Control	
×	?	<b>1</b>	Ŵ
Simulation contr	ols		*
$\leqslant$			
Don't stop		t M01	
Cutting informa	tion		*
Axis coordina	ites		

Click location click control to start the simulation. Use **Speed Control** to control the simulation speed.

Speed Control	

Simulate the complete program.



Tip: With the button you can reset the simulation and then restart it. Close the simulation dialog by clicking X.

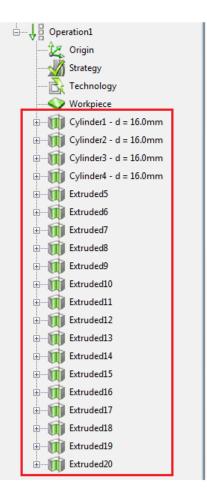
### **Grouping Repeated Features**

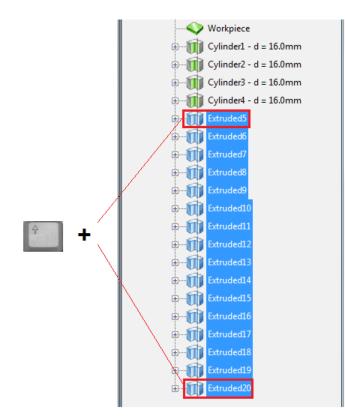
In the Feature Manager, a separate feature is created for each identified aperture. This can sometimes lead to a lot of features.

To prevent this effect, it is possible to unite several features into one object afterwards.

To demonstrate the procedure, we will unite the features Extruded 5-20 into one feature:

To select all 16 features at the same time, hold down the **Shift** key and click the first feature (Extruded5) and the last feature (Extruded20).





Right-click one of the selected features and, on the context menu, click Group features.

	ece		
🗄 🔟 🕅 Cylinde	er1 - d = 16.0mm		
🖽 🔟 Cylinde	er2 - d = 16.0mm		
🗄 🔟 🕅 Cylinde	er3 - d = 16.0mm		
🕀 🔟 Cylinde	er4 - d = 16.0mm		
🕀 🕕 Extrude	ed5		
Extrud	New Operation	Ctrl+Alt+N	
Extrud	Operation cutting plan	Ctrl+Alt+P	
	Solid simulation of feature	Ctrl+Alt+S	
⊕∭ Extrud ⊕∭ Extrud	Redo not possible Undo Automatic feature recognition	Ctrl+Alt+Z	
	- 0	Curr Ait 2	
L	Group features ( <sup>m</sup> ) Match collars and tapers		
This unites the sele	ected features into one feat	ture.	

**User advice:** You do not have to manually group the features via the Feature Manager if you activate the option Group repeated features in the Settings dialog.



Settings		
🗸 🗶 🤶 🐼	L	
Basic settings Colour settings Start hole settings	Feature types	General settings

## Creating the NC program

As we have already practiced in the preceding examples, at the end of this exercise we create the NC program.

Right-click the branch **Operation1** in the OPTICAM Feature Manager and, on the context menu, click **Output operation NC file**:

🖃 🕪 Program ( STAND)	ARD )	
🛛 🥁 Technology		
	New Operation	Ctrl+Alt+N
Stra	Operation cutting plan	Ctrl+Alt+P
	Automatic feature recognition	
	Manual feature recognition	Ctrl+Alt+F
	Graphic simulation of operation	Ctrl+Alt+G
	Rebuild program	Ctrl+Alt+B
	Output operation NC file Im	
	Output operation NC file	

### Saving the OPTICAM Program

At the end, you should save your work.

STOP

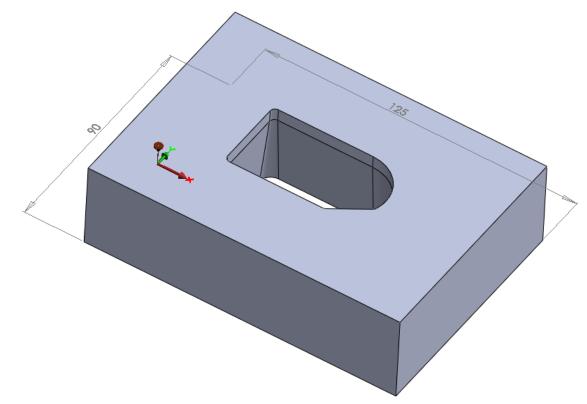
User advice: In addition to the GibbsCAM file GC14\_Opticam\_example\_4.vnc, a second file containing the OPTICAM machining information for the current program will be saved. This OPTICAM file has the file extension .wire.opticam.

Close the file GC14\_Opticam\_example\_4.vnc.

File	693	Tion	Medly	Selett	Fee
•	File				
	2				
(	Open	1	Vew	Close	

This exercise is now completed.

## **Example 5: Collar Machining**

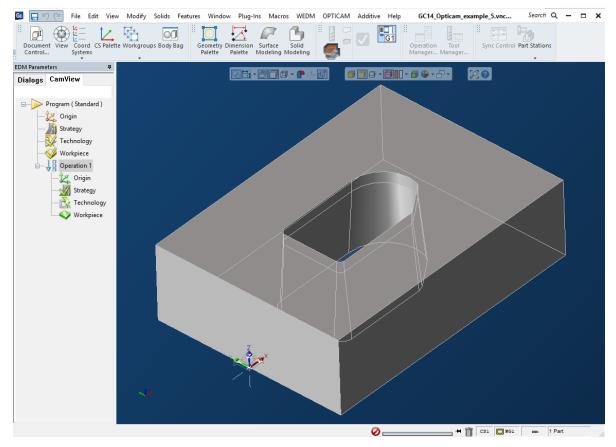


#### **Demonstrated in This Example**

Opening a file: GC14\_Opticam\_example\_5 Using the **Program** Dialog for Basic Settings Defining the Machine Origin Defining the Cutting Technology (Technology from Database) Creating the Workpiece (Billet) Geometry Setting the Cutting Heights (Reference Plane Height and Secondary Plane Height) Setting the Cutting Strategy Automatic Creation of Collar Machining through Feature Recognition Adjusting the Cut Sequence (Taper in Front of Cylindrical Section) Modifying the Start and the Threading Position Machining Simulation (Solid Simulation) Adjusting the Number of Cuts and the Technology of the Tapered Section Adjusting the Size of the Bridge Creating the NC Program

### Open GC14\_Opticam\_example\_5

In GibbsCAM, open the example file GC14\_Opticam\_example\_5.vnc.



### Using the Program Dialog for Basic Settings

Double-click the branch Program (STANDARD) in the OPTICAM Feature Manager.

Fill in the dialog as shown to the right:

Accept changes by clicking V.

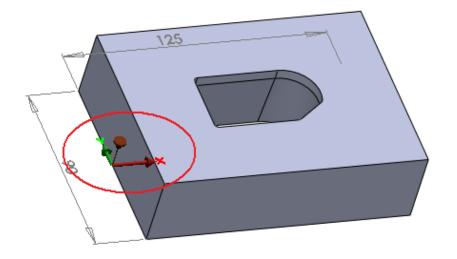


#### Defining the Machine Origin

In the next step, we will once more check the position of the machine origin. In this example, the origin is in the center of the lower left edge of the model.

As this is okay, you do not need to adjust the position.

OPTICAM	Progra	am Setu	р		
🗸 🗙	2	<b>N</b>			
Description					
Example 5					
Post-Processo	r Selectio	n			~
NCPath		-	Curren	t Job Dire	ctory
C:\Users\Pu	blic\Docu	ments\op	ticam\Job\		
Manufacturer	s				
STD					-
Post-Processo	or				
STANDARD					
Modell-Name					
W1-W2					-
	Technology				
	Post-Processor Options				



## *Defining the Cutting Technology (from Database)*

Now we will define the cutting technology the workpiece is to be machined with

Double-click the branch **(Program) Technology** to open the dialog for the definition of the cutting technology.

You can either select the parameters of the cutting technology from a database or enter them manually.

We want to load the technology from the Technology Database. You can do this as follows:

Select suitable technology values from the listboxes Wire Diameter, Wire Type, Material, Height and Number of Cuts.

OPTICAM Tecl	nnology	
V 🗙	2	
▼ <b>*</b>	•	/~
STD .		
510		
Filters		*
Include	e user tech in search	
User Tech name		~
Wire Diameter	0.25mm	•
Wire Type	Soft Brass	• • •
Material	Steel	•
Height	10.0mm	•
Number of Cuts		
RA	0.0µm	•
Outputs		*
Records found		
Cut	Offset	
1	0.205mm	
2	0.136mm 0.136mm	
Modify Technology		~
Use modified Tec	hnology made in Cuts ed tech in Cuts Editor	
	Cuts Editor	

Filters				
Include user tech in search				
User Tech name	· · · · · · · · · · · · · · · · · · ·			
Wire Diameter	0.25mm 🔻			
Wire Type	Soft Brass 🔹			
Material	Steel 🔻			
Height	40.0mm 🔻			
Number of Cuts	3			
RA	0.0µm 🔻			
Outputs Records found				
Cut	Offset			
1	0.205mm			
2	0.136mm			
3	0.136mm			

The selected technology is displayed in the dialog area Records found.

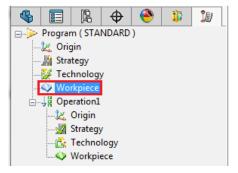
**User advice:** The input fields of the technology database vary according to the selected postprocessor and often only contain a few example technologies. For most wire EDM machines, complete technology databases are optionally available.

Accept the technology selection by clicking 💙

#### Creating the Workpiece (Billet) Geometry

In the next dialog, you can define the geometry of the workpiece (billet).

Double-click the branch (Program) Workpiece in the OPTICAM Feature Manager.



Again, the workpiece (billet) is to be derived from the solid body; additionally, no allowance values are to be defined.

Fill in the dialog as follows:

OPTICAM W	orkpiece			
🗸 X 🏅	' 🐼 🔂 🔗			
Ose box around				
Use specific solid           Use STL file	1			
Box	*			
Extra in X-	0.0mm			
Extra in Y-	0.0mm			
Extra in Z-	0.0mm			
Extra in X+	0.0mm			
Extra in Y+	0.0mm			
Extra in Z+	0.0mm			
Solid body 🛛 🕹				
STL file 🛛 🕹				
A				
Accept chang	ges by clicking 💙			

## Setting the Cutting Heights (Reference Plane Height and Secondary Plane Height)

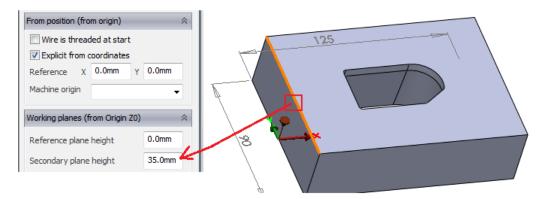
The following dialog sets among other things the name of the NC output file as well as the Z-height of the Reference and the Secondary Plane Height.

Double-click the branch **Operation1** in the OPTICAM Feature Manager, and fill in the fields **Description**, **File name** and **Part number** as follows:

OPTICAM	Operation Setup	
🗸 🗙 🤇		$\sim$
Description		
Example 5		
File name		
5		
CMD file name		
Part number		
5		

Identify the Secondary Plane Height in the model. You can do this by selecting an element (an edge, a plane face or a vertex) which is located at the desired height.

Position the cursor in the input field **Secondary plane height**.



Click an element on the top level of the model. OPTICAM calculates the Z-height of the selected element and passes the value to the **Secondary plane height** dialog box.

Please note that the **nozzle distances** in the lower dialog area (important for the simulation) have also been adjusted.

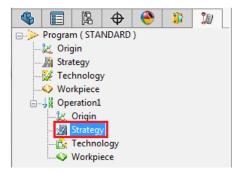
Working planes (from Origin Z0	)
Reference plane height	0.0mm
Secondary plane height	35.0mm
Nozzles	*
O Distance to upper nozzle	5.0mm
Opper nozzle height	40.0mm
O Distance to lower nozzle	5.0mm
Our Lower nozzle height	-5.0mm

#### Setting the Cutting Strategy

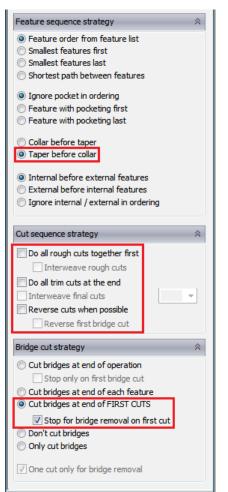
In the next dialog, you can define with which strategy the workpiece will be machined.

Double-click the branch **(Operation) Strategy** in the OPTICAM Feature Manager.

The internal aperture is to be machined in a way that **at the End of the Main Cut** there will be a **Machine Stop for the Removal of the Bridge**. Afterwards, the 2 Trim Cuts are to follow.



Set the dialog as follows:



Please note that due to the setting **Taper before Collar**, the tapered part of the collar machining will be cut before the cylindrical part.

Accept changes by clicking 💊

#### Creating the Cutting Machining

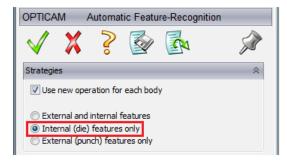
In this example, only the **internal aperture**, the collar machining, which consists of a tapered and a cylindrical section, will be machined.

#### Automatic Creation of the Cutting Machining

Right-click the branch **Operation1** in the OPTICAM Feature Manager and, on the context menu, click **Automatic feature recognition**.

🖃 🕪 Program ( STAND	ARD)		
🛁 🏒 Origin			
🛛 🤯 Technology			
🗄 🗝 🙀 Operatio	New Operation		Ctrl+Alt+N
📈 Ori			
	Operation cuttin	g plan	Ctrl+Alt+P
	Automatic featur	re recognition	ſ
	Manual feature r	ecognition	Ctrl+Alt+F

The dialog Automatic Feature Recognition is displayed. To machine exclusively the internal aperture, set the dialog as follows:



In order to set what exactly the Feature Recognition is supposed to recognize, click the

Feature recognition settings	button in the dialog.
Options	*
🔲 Use colour list	
Choose list:	•
Manage lists	
Start hole settings	
Feature recognition settings	

Feature recognition settings

A dialog containing setting parameters for the **Feature Recognition** opens.

Make sure that the dialog looks as follows:

Settings		
🗸 🗙 🍃 🐼 🗗		
Basic settings Colour settings Start hole settings Feature recognition settings	Feature types V Extruded Cylinder Cone Constant taper Variable taper Four axis Inclined extruded Inclined cylinder Inclined cone	General settings Genera
	Select / deselect all	Max. angle: 39.0°

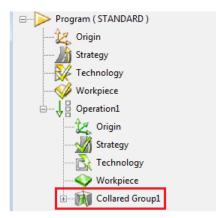
User advice: You have to activate the option Check for collars and tapers; if this option is not activated, the collar machining will be split into *two* features (cylindrical and tapered part).

Accept changes by clicking V.



The system will now search the solid body for all geometries that can be wire cut (feature recognition) and create a machining suggestion with the cutting parameters previously set.

The collar machining geometry is automatically identified and listed in the OPTICAM Feature Manager.



#### Modifying the Start and the Threading Position

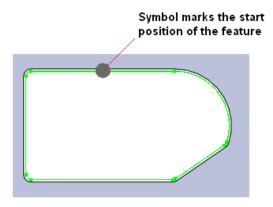
Click the Collared Group1 in the OPTICAM Feature Manager.



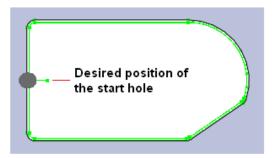
The cutting path and the start position of the selected object are highlighted in the model.

If you extend the feature and look at it more closely, you will note several things.

The start position (which is marked by a symbol) is in an unfavorable position. Additionally, the start hole should have a larger distance to the cutting contour.

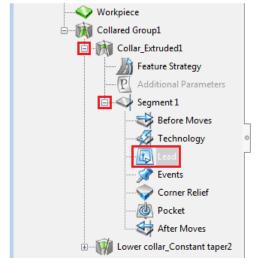


The following figure shows the desired start position and the start hole in front of the cutting contour.



The lead off is too long and should be shortened. In the following, we will shorten the lead off.

#### Adjusting the Start and the Threading Position



Open **Collared Group1** and double-click the branch 🚇 Lead.

This opens the **Lead on/off** dialog.

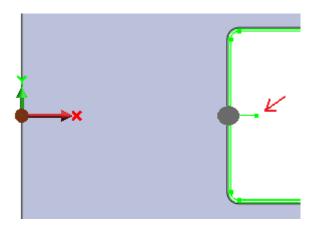
On the left-hand side, click the feature **Starthole**.

To enter the coordinates of the start hole directly or "catch" them in the model, you have to activate the option **Explicit starthole position**.

Lead on/off		<b>X</b>
🗸 🗙 🏅		
Starthole	Starthole position	On profile position
Endpoint Lead on/off	Starthole diameter: 1.0mm	Automatic on profile
	O Automatic starthole position	Automatic on edge
	CAD cylinder	🔘 Vertex or edge
	CAD cylinder: 320	Position: Select vertex or edge
	Explicit starthole position	
	Reference X: 40.0mm Y: 0.0mm	
	Secondary X: 40.0mm Y: 0.0mm	
	Miscellaneous	
	Vertical wire	
	Use starthole settings	
	Move trim cuts equally	
	Distance: 0.5mm	

Enter **X40** and **Y0** as the position of the start hole.

Note how the input modifies the start position and the position of the start hole:



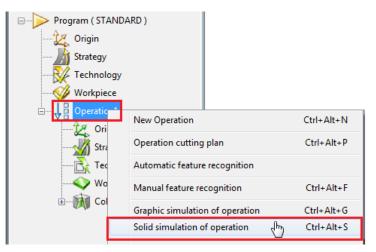
Click the feature **Lead on/off** and modify the length of the **Lead On** to **5** and of the **Lead Off** to **0.6** mm.

Lead on/off						
🗸 🗶 🏅						
Starthole Endpoint	Lead On	Lead Off				
Lead on/off						
	<ul> <li>Line</li> </ul>	Line				
	Arc	Arc				
	C Full Arc	🔘 Full arc				
	Meander					
	Length: 5.0mm	Length: 0.6mm Copy L/O				
	Angle: 0.0°	Angle: 0.0° Copy L/O				
	Extension: 0.0mm	Extension: 0.0mm Copy L/O				
	Arc radius: 0.3mm	Arc radius: 0.3mm Copy L/O				
	Number of Meanders: 4					
	Meander width: 3.0mm					
	Cut hole at start	Cut hole at end				
	Hole diameter: 0.75mm	Hole diameter: 0.75mm				

Accept changes by clicking 🧹.

#### Machining Simulation (Solid Simulation)

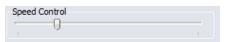
Right-click **Operation1** and, on the context menu, click **Solid simulation of operation**.



A dialog opens that allows you to control the solid simulation:

OPTICAM	Simulati	on Control	
×	? 💈		Ŵ
Simulation con	trols		*
$\ll$			
Don't stop	) simulation a trol	t M01	
Cutting inform	ation		*
Axis coordin	ates		

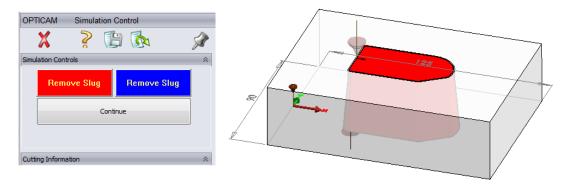
Click loss control to start the simulation. Use **Speed Control** to control the simulation speed.



Simulate the complete program.

#### Depiction of Slugs During the Simulation

If the bridge is cut, normally a slug will be created. The solid simulation can visualize this slug and displays the button **Remove Slug**. The slug will be displayed in red.

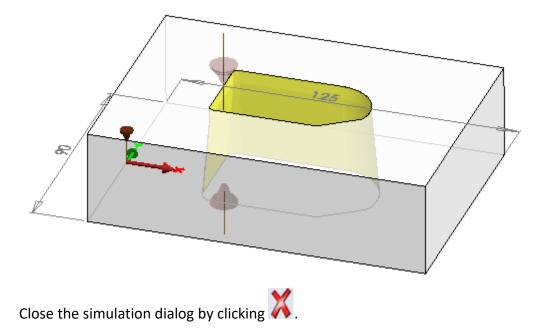


**User advice**: In the field **Split Options** in the simulation dialog you can set if a slug will be displayed or not.

If you want to see the slug, you have to *deactivate* the option **Don't show slugs**.

The following figure shows the final result of the simulation.

olit Options	*
Don't warn after machine stop Distance to ignore splits ( mm )	
5.0mm	
exact split position Ignore smaller than ( cubic mm )	
0.05mm <sup>3</sup>	
Simulate Slugs	



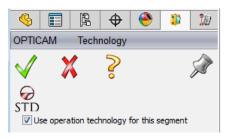
# Adjusting the Number of Cuts and the Technology of the Tapered Section

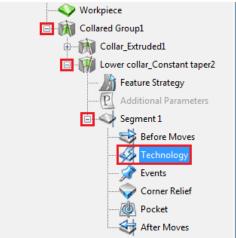
In the course of the simulation, you should have noticed that both the tapered and the cylindrical section were machined with three cuts. The fundamental reason for this is that we have previously selected a cutting technology with three cuts from the technology database. The selected technology is used for both objects.

In the following, we will adjust the technology of the tapered cut so that the taper is machined with only one cut.

Open the **Collared Group1** in the OPTICAM Feature Manager, then open the branch **Lower collar\_Constant taper2**, and then double-click the branch **Technology**.

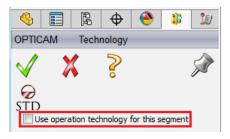
This opens the Technology dialog:





As the option **Use operation technology for this segment** is activated, the system uses the cutting technology previously set (3 cuts) for the machining of taper and collar.

If you *deactivate* the option **Use operation technology for this segment**, you can allocate your own technology to the selected taper.



Deactivate the option Use operation technology for this segment.

When the **Technology** dialog opens, click the Cuts editor button.

A dialog opens where you can manually enter the cutting technology.

Cuts data										
V Overv	write mach	nine technolog	У		Clear data f	rom user tech	Save use	r tech	Reset	
Cut	Offset	Generat	Offset	Generat	Feedrate	Wire diameter	Wire name	Comment	Frequency reduction	Cle
<b>V</b> 01	0 mm	-1	-1	DEF	10.0000	0.25 mm	DEF	DEF	100	0 n

To machine the geometries with **1 Cut**, set the dialog as follows:

Cuts data							
✓ Overwrite machine technology           Clear data from user tech         Save user tech         Reset							et
Cuts no.	Offset	Generator register	Offset register	Generat	Feedrate	Wire diameter	Wire nam
<ul><li>✓ 01</li><li>○ 02</li></ul>	0.136 mm	501	0	DEF	10.000000 mm	0.25 mm	DEF

Accept changes by clicking  $\checkmark$ . The system returns to the **Technology** dialog. Close this dialog as well by clicking  $\checkmark$ .

#### Adjusting the Size of the Bridge for the Cylindrical Section

As we do not need a bridge for the Cylindrical Section of the collar machining, we will change this.

Double-click the **Collared Group1** in the OPTICAM Feature Manager.

*De*activate the option **Stop on lower taper** in the dialog area **Collar control**. The cylindrical

part will now be executed without a bridge (machine stop).

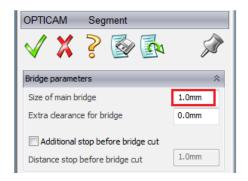


Accept changes by clicking Ň



Double-click the branch Segment<sup>1</sup>. This opens a dialog that lets you set the size of the bridge (distance of the stop point). Make sure that in the field **Size of main bridge** the value **1** is displayed, as shown to the right.

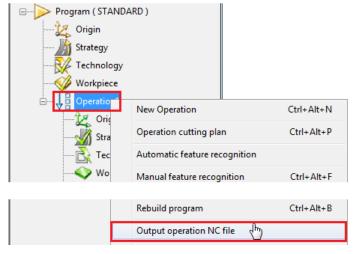
Accept changes by clicking





#### Creating the NC program

As we have already practiced in the preceding examples, at the end of this exercise we create the NC program.



Right-click **Operation1** and, on the context menu, click **Output operation NC file**.

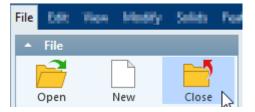
Please continue working independently...

#### Saving the OPTICAM Program

In the end, you should save your work.

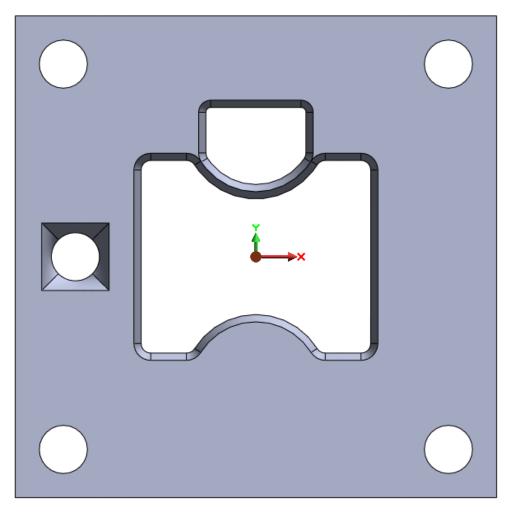
User advice: In addition to the GibbsCAM file GC14\_Opticam\_example\_5.vnc, a second file containing the OPTICAM machining information for the current program will be saved. This OPTICAM file has the file extension .wire.opticam.

Close the file GC14\_Opticam\_example\_5.vnc.



This exercise is now completed.

## **Example 6: Taper and Four Axes**



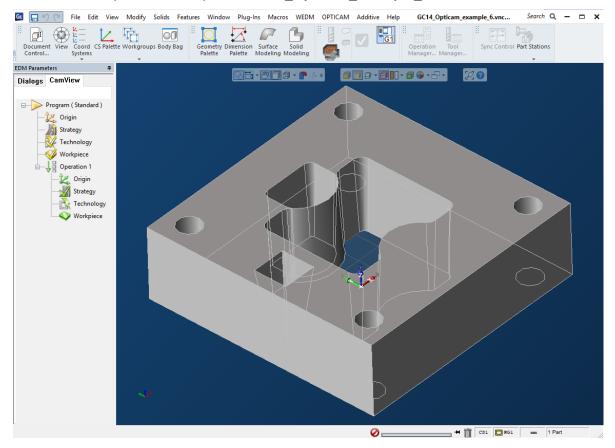
#### **Demonstrated in This Example**

Opening a file: GC14\_Opticam\_example\_6 Positioning the Machine Origin in the Center of the Hole Defining the Cutting Technology (Technology from Database) Creating the Workpiece (Billet) Geometry with Allowance Values Setting the Cutting Heights (Reference Plane Height and Secondary Plane Height)

- Setting the Cutting Strategy
- Automatic Creation of the Cutting Machining
- Hiding Certain Geometry Types
- Machining the External Geometry
- Modifying the Length of the Lead on/off for all Features
- Positioning the Start Hole in the Center of a Straight Line
- Adjusting the Size of the Bridge for the External Feature

### *Open GC14\_Opticam\_example\_6*

In GibbsCAM, open the example file GC14\_Opticam\_example\_6.vnc.

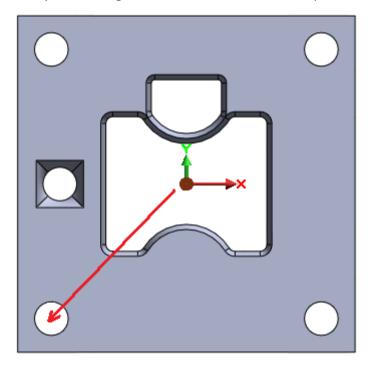


### Using the Program Dialog for Basic Settings

Double-click <b>Program (STANDARD)</b> and fill in the dialog as shown to the right:	OPTICAM Program Setup
	Description Example 6
Accept changes by clicking ✔ button.	Post-Processor Selection   NCPath  C:\Users\Public\Documents\opticam\NC/Standard/
	Manufacturers STD Post-Processor
	STANDARD V
	Modell-Name
	W1-W2     Technology
	Post-Processor Options

#### Positioning the Machine Origin in the Center of the Hole

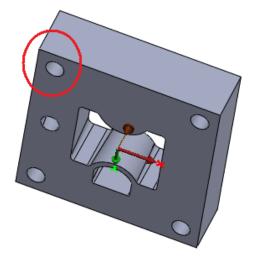
In the next step, we will once more check the position of the machine origin. In this example, the origin is in the center of the workpiece.

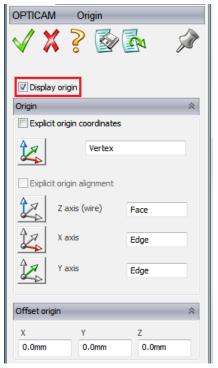


In this example, we want to move the origin to the center of the lower left hole.

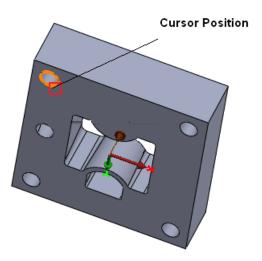
Double-click **(Program) Origin** to open the dialog for the definition of the machine origin.

Rotate the model in such a way that you can see the lower left hole from *below* (see following figure):

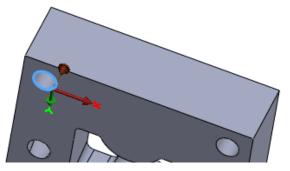




To move the origin to the center of the lower left hole, position the cursor on the model edge of the lower left hole and click with the left mouse button.



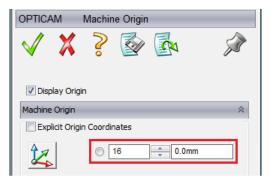
The origin moves to the selected edge, but is not in the center of the circle.



Looking at the Machine Origin dialog will help us (example).

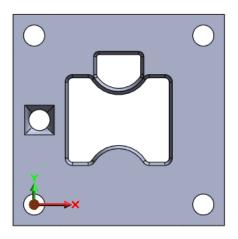
The origin is not in the center of the hole, but on the selected model edge, namely 16% away from the origin of the edge. (Note that, depending on where you click the edge, a different percentage than 16% will result.)

If you were to change the value to 50%, the origin would be in the center of the edge—



that is, 50% away from the origin of the edge, but still not in the center of the circle.

To move the origin to the center of the circle, choose the option 2 in the dialog, thus: 2 This moves the origin exactly to the center of the circle.



Close the dialog Machine Origin by clicking

#### Defining the Cutting Technology (from Database)

- Now we will define with which cutting technology the workpiece is to be machined.
- Double-click (**Program**) **Technology** to open the dialog to define cutting technology.
- You can either select the parameters of the cutting technology from a database or enter them manually.
- We want to load the technology from the Technology Database. You can do this as follows:
- Select suitable technology values from the listboxes **Wire Diameter**, **Wire Type**, **Material**, **Height** and **Number of Cuts**.

	*
de user tech in search	
	-
0.25mm	•
Soft Brass	•
Steel	•
10.0mm	•
3	•
0.0µm	•
	*
Offset	
0.205mm	
	Soft Brass Steel 10.0mm 3 0.0µm

Filters	\$
Include	user tech in search
User Tech name	<b></b>
Wire Diameter	0.25mm 🔻
Wire Type	Soft Brass
Material	Steel 🔹
Height	30.0mm 🔻
Number of Cuts	3
RA	0.0µm 👻
Outputs	<u>, </u> , , , , , , , , , , , , , , , , , ,
Records found	1
Cut	Offset
1	0.205mm
2	0.136mm
3	0.136mm

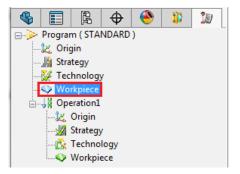
The selected technology will be displayed in the dialog area **Records found.** 

Accept the technology selection by clicking 💙

#### Creating the Workpiece Geometry with Allowance Values

In the next dialog, you can define the geometry of the workpiece (billet).

Double-click the branch (Program) Workpiece in the OPTICAM Feature Manager.



Again, we want to derive the workpiece (billet) from the solid body; however, this time we will provide the workpiece (billet) with allowance values.

Fill in the dialog as follows:

	Workpied	ce	À
<ul> <li>Use box arou</li> <li>Use specific s</li> <li>Use STL file</li> </ul>			*
Extra in X-	1.0mm	_	
Extra in Y-	1.0mm	_	
Extra in Z-	0.0mm	_	
Extra in X+	1.0mm	_	
Extra in Y+	1.0mm	_	
Extra in Z+	0.0mm		

Due to the inputs, the workpiece (billet) is displayed in the **simulation** with a lateral allowance of 1 mm.

Accept changes by clicking  $\checkmark$ .

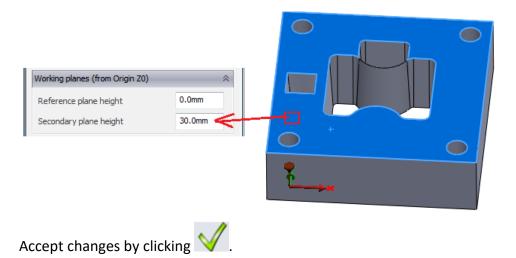
# Setting the Cutting Heights (Reference Plane Height and Secondary Plane Height)

The following dialog sets (among other things) the name of the NC output file and the Z-height of the Reference and the Secondary Plane Height.

Double-click **Operation1** and fill in the fields **Description**, **File name**, **Part number** and **Position** as follows:

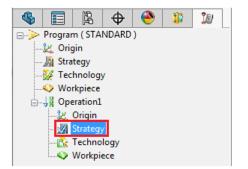
OPTICAM	Operation Setup
🗸 🗙	? 🐼 🗗 🔗
Description	
Example 6	
File name	
6	
CMD file name	
Part number	
6	
From position (f	rom origin) 🔗
🔲 Wire is thre	aded at start
Explicit from	coordinates
Reference	χ 0.0mm γ 0.0mm
Machine origin	

To identify the Secondary plane height in the model, position the cursor in the input field **Secondary plane height** and click the top face of the model. This passes the value on to the dialog box **Secondary plane height**.



#### Setting the Cutting Strategy

To define with which strategy the workpiece will be machined with, double-click the branch **Strategy** in the OPTICAM Feature Manager.



The geometries are to be machined in such a way that **the Bridges are Cut at the End of the Operation**. The main cut and the 2 trim cuts are to be done in reverse cuts (forwards/backwards).

Set the dialog as follows:

<ul> <li>View of the second se</li></ul>
<ul> <li>Use operation strategy</li> <li>Use feature strategy</li> <li>Feature sequence strategy</li> <li>Feature order from feature list</li> <li>Smallest features first</li> <li>Smallest features last</li> <li>Shortest path between features</li> <li>Ignore pocket in ordering</li> <li>Feature with pocketing first</li> <li>Feature with pocketing last</li> <li>Collar before taper</li> <li>Taper before collar</li> <li>Internal before external features</li> <li>External before internal features</li> </ul>
<ul> <li>Use feature strategy</li> <li>Feature sequence strategy</li> <li>Feature order from feature list</li> <li>Smallest features first</li> <li>Smallest features last</li> <li>Shortest path between features</li> <li>Ignore pocket in ordering</li> <li>Feature with pocketing first</li> <li>Feature with pocketing last</li> <li>Collar before taper</li> <li>Taper before collar</li> <li>Internal before external features</li> <li>External before internal features</li> </ul>
Feature sequence strategy          ● Feature order from feature list       Smallest features first         ○ Smallest features last       Shortest path between features         ● Ignore pocket in ordering       Feature with pocketing first         ● Feature with pocketing last          ● Collar before taper       Taper before collar         ● Internal before external features
<ul> <li>Feature order from feature list</li> <li>Smallest features first</li> <li>Smallest features last</li> <li>Shortest path between features</li> <li>Ignore pocket in ordering</li> <li>Feature with pocketing first</li> <li>Feature with pocketing last</li> <li>Collar before taper</li> <li>Taper before collar</li> <li>Internal before external features</li> <li>External before internal features</li> </ul>
<ul> <li>Smallest features first</li> <li>Smallest features last</li> <li>Shortest path between features</li> <li>Ignore pocket in ordering</li> <li>Feature with pocketing first</li> <li>Feature with pocketing last</li> <li>Collar before taper</li> <li>Taper before collar</li> <li>Internal before external features</li> <li>External before internal features</li> </ul>
<ul> <li>Smallest features last</li> <li>Shortest path between features</li> <li>Ignore pocket in ordering</li> <li>Feature with pocketing first</li> <li>Feature with pocketing last</li> <li>Collar before taper</li> <li>Taper before collar</li> <li>Internal before external features</li> <li>External before internal features</li> </ul>
<ul> <li>Shortest path between features</li> <li>Ignore pocket in ordering</li> <li>Feature with pocketing first</li> <li>Feature with pocketing last</li> <li>Collar before taper</li> <li>Taper before collar</li> <li>Internal before external features</li> <li>External before internal features</li> </ul>
<ul> <li>Ignore pocket in ordering</li> <li>Feature with pocketing first</li> <li>Feature with pocketing last</li> <li>Collar before taper</li> <li>Taper before collar</li> <li>Internal before external features</li> <li>External before internal features</li> </ul>
<ul> <li>Feature with pocketing first</li> <li>Feature with pocketing last</li> <li>Collar before taper</li> <li>Taper before collar</li> <li>Internal before external features</li> <li>External before internal features</li> </ul>
<ul> <li>Feature with pocketing last</li> <li>Collar before taper</li> <li>Taper before collar</li> <li>Internal before external features</li> <li>External before internal features</li> </ul>
<ul> <li>Collar before taper</li> <li>Taper before collar</li> <li>Internal before external features</li> <li>External before internal features</li> </ul>
<ul> <li>Taper before collar</li> <li>Internal before external features</li> <li>External before internal features</li> </ul>
<ul> <li>Internal before external features</li> <li>External before internal features</li> </ul>
External before internal features
<u> </u>
Ignore internal / external in ordering
Cut sequence strategy $\Leftrightarrow$
Do all rough cuts together first
Interweave rough cuts
Do all trim cuts at the end
Interweave final cuts
Reverse cuts when possible
Reverse first bridge cut
Bridge cut strategy 🔅
Out bridges at end of operation
Stop only on first bridge cut
Cut bridges at end of EIDST CLIFS
Cut bridges at end of FIRST CUTS
Stop for bridge removal on first cut
<ul> <li>Don't cut bridges</li> <li>Only cut bridges</li> </ul>
Only car bridges
One cut only for bridge removal

Accept changes by clicking 🧹.

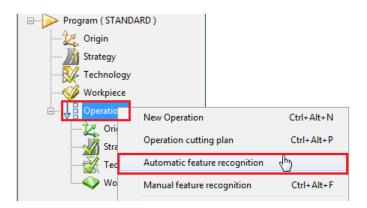
### Creating the Cutting Machining

We want to machine the external feature and the tapered apertures.

**User advice**: The four cylindrical holes have to remain unmachined.

#### Automatic Creation of the Cutting Machining - Hiding Certain Geometry Types

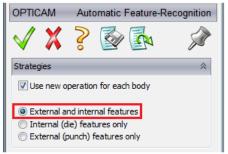
Right-click **Operation1** and, on the context menu, click **Automatic feature recognition**.



The **Automatic Feature Recognition** dialog opens. Because we want to machine the internal apertures *and* the external feature, set the dialog as follows:

In order to set what exactly the **Feature Recognition** is supposed to recognize, click the

Feature recognition settings



button in the dialog.

Settings		
<b>√ X</b> ? ⊗ ⊡		
Basic settings	Feature types	General settings
Colour settings Start hole settings	Extruded	Group repeated features
Feature recognition settings	Cylinder	Check for collars and tapers
	Cone	Ignore when multiple start holes found
	Constant taper	Advanced feature recognition (slower)
	Variable taper	Do not use faces with small area as start face
	V Four axis	Area: 1.0mm <sup>2</sup>
	Inclined extruded	Automatically apply templates
	Inclined cylinder	Use start hole settings
	Inclined cone	Cut wire between features
		Recognize variable taper as four axis
		Max. angle: 39.0°
	Select / deselect all	✓ Select / deselect all

**User advice:** The **Feature Recognition Settings** dialog has filters that let you exclude certain geometry types from the machining. To exclude the 4 cylindrical holes from the machining, you have to **deactivate** the option **Cylinder** (see figure above).

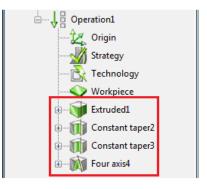
Accept changes by clicking 💊



Close the dialog Feature Recognition.

The system will now search the solid body for all geometries that can be wire cut (feature recognition) and create a machining suggestion with the cutting parameters previously set.

The tapered internal features and the external feature were automatically identified. Because we *deactivated* **Cylinder**, the four cylindrical holes remain unmachined, and the Feature Manager should display four features:

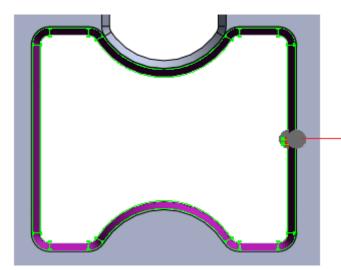


#### **Checking the Created Features**

The easiest way to check the created features is the visual check.

For this purpose, click on a feature in the OPTICAM Feature Manager. This highlights the cutting path belonging to the feature so that you can graphically check the start position of the feature, the number of cuts and the bridge.

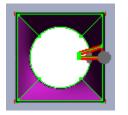
Click the feature is ConstantTaper<sup>3</sup> in the OPTICAM Feature Manager. The associated tool path is highlighted. The start position is marked by a symbol.



Symbol marks the start position of the feature

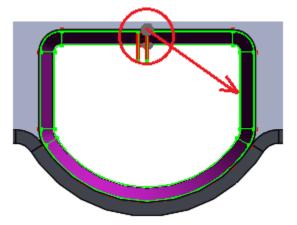
The visual check shows that position and size of the bridge are okay. However, you could shorten the length of the Lead off.

Click the feature in FourAxis4 in the OPTICAM Feature Manager.



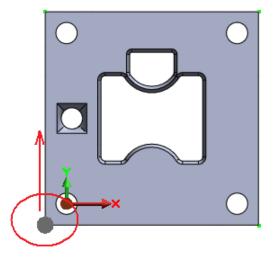
The visual check shows that position and size of the bridge are okay here as well. However, the position of the start hole is too close to the cutting feature and the length of the lead off should be shortened.

In Feature Manager, click the feature in ConstantTaper2.



Although the start position is okay, for practicing purposes it should be moved from the long straight line to the center of the short straight line on the right-hand side. Additionally, here as well the position of the start hole should be moved further away from the cutting feature, and the length of the lead off should be shortened.

To check the external feature: In Feature Manager, click the feature is **Extruded1**.

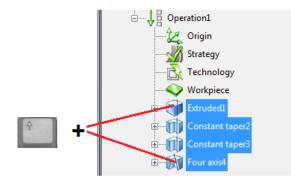


The start position is at the outside corner and should be moved to the center of the straight line. Additionally, the size of the bridge should be extended, the position of the start hole moved and the length of the lead off shortened.

#### Modifying the Length of the Lead on/off for all Features

First, we modify the length of the Lead on to 5 mm and shorten the Lead off to 0.5 mm for all features.

Hold down the **Shift** button and click the **first** and the **last** feature in the OPTICAM Feature Manager. This way you can very easily select all 4 features.



Now right-click one of the selected features and, on the context menu, click **Multiple edit > Edit lead parameters**.

Image: Constant state s	New Operation Operation cutting plan Automatic feature recognition	Ctrl+Alt+N Ctrl+Alt+P	
	Manual feature recognition Rebuild program	Ctrl+Alt+F Ctrl+Alt+B	
	Output feature NC file Multiple edit Delete operation	Þ	Edit feature parameters Edit feature strategy Edit segment parameters
			Edit technology parameters Edit lead parameters (h) Edit pocket parameters

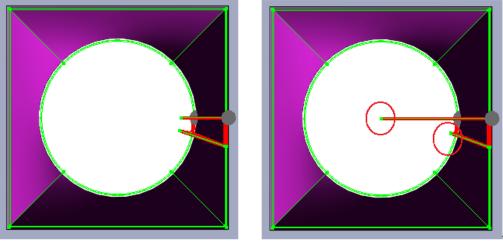
This opens the **Lead on/off** dialog.

On the left-hand side, click the feature **Lead on/off** and modify the length of the **Lead On** to **5** mm and of the **Lead Off** to **1** mm.

Lead on/off					<b>E</b>
🗸 🗙 🎅 🐼	CN I				
Starthole L Endpoint	.ead On		Lead Off		
Lead on/off	Ľ				
	Ine		Line		
	Arc		Arc		
	Full Arc		Full arc		
	Meander				
	Length:	5.0mm	Length:	1.0mm	Copy L/O
	Angle:	0.0°	Angle:	0.0°	Copy L/O
	Extension:	0.0mm	Extension:	0.0mm	Copy L/O
	Arc radius:	0.3mm	Arc radius:	0.3mm	Copy L/O
	Number of	4			
	Meander width:	3.0mm			
	Cut hole at start		Cut hole at er	nd	
	Hole diameter:	0.75mm	Hole diameter:	0.75mm	

Accept changes by clicking V.

The adjustment of the lead on/off extends to all selected features.

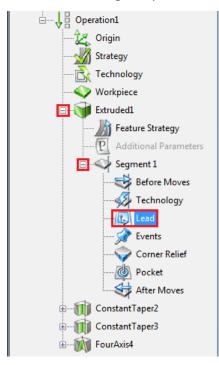


Before

Afterwards

#### Positioning the Start Hole in the Center of a Straight Line

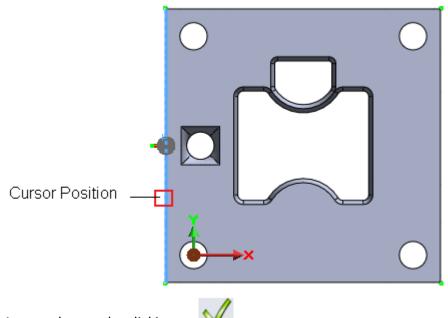
In the following, we will move the position of the start hole for the features Extruded and ConstantTaper2 to the center of a straight line. In Feature Manager, open the feature in the feature in the branch Lead.



In the **Lead on/off** dialog, choose the option **Automatic on edge**. This option lets you automatically move the start position to the center of a straight edge. click the left outer edge of the workpiece to move the start position to the center of the selected edge.

Lead on/off		
🗸 🗙 홏		
Starthole Endpoint	Starthole position	On profile position
Lead on/off	Starthole diameter: 1.0mm	Automatic on profile
	Automatic starthole position	Automatic on edge
	◯ CAD cylinder	◎ Vertex or edge
	CAD cylinder:	Position: Select vertex or edge
	Explicit starthole position	
	Reference X: 40.0mm Y: 0.0mm	
	Secondary X: 40.0mm Y: 0.0mm	
	Miscellaneous	
	Vertical wire	
	Use starthole settings	
	Move trim cuts equally	
	Distance: 0.5mm	

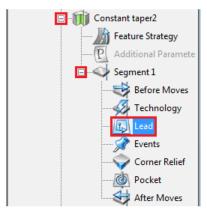
Note how the input modifies the start position and the position of the start hole:



Accept changes by clicking on 💜

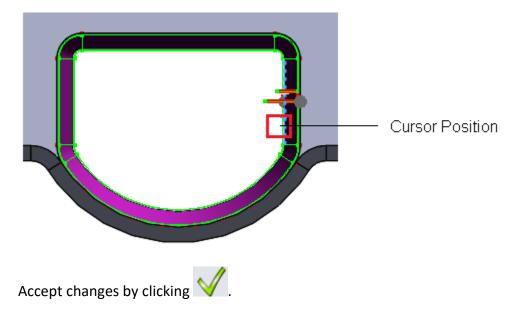
Repeat the process for the adjustment of the start hole position for the feature ConstantTaper2 where the position of the start hole is to be moved to the center of the top straight line.

In the Feature Manager, open the feature in Constant Taper2 and double-click Lead.



Again, choose option **Automatic on edge** in the dialog **Lead on/off**. Click the straight left edge of the feature to move the start position to the center of the selected edge.

Lead on/off		
🗸 🗶 🏅		
Starthole Endpoint	Starthole position	On profile position
Lead on/off	Starthole diameter: 1.0mm	Automatic on profile
	Automatic starthole position	Automatic on edge
	CAD cylinder	Vertex or edge
	CAD cylinder:	Position: Select vertex or edge



Note how the input modifies the start position and the position of the start hole:

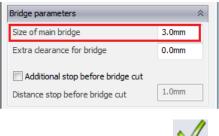
#### Adjusting the Size of the Bridge for the External Feature

As we need a wider bridge for the machining of the external feature, we will modify the size of the bridge to 3 mm.

In Feature Manager, open the feature **Extruded1** and double-click **Segment**.

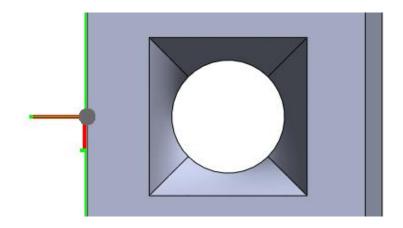


This opens a dialog where you can set the size of the bridge. Enter the value **3** in the field **Size of main bridge**.



Accept changes by clicking

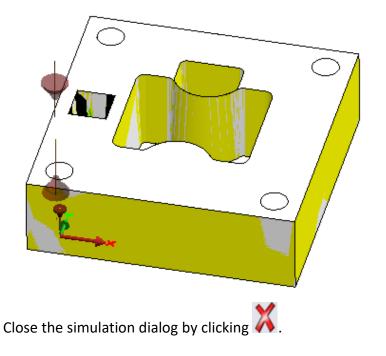
The following figure shows a magnification of the modified bridge.



### Machining Simulation (Solid Simulation)

Right-click **Operation1** and, on the context menu, click **Solid simulation of operation**.

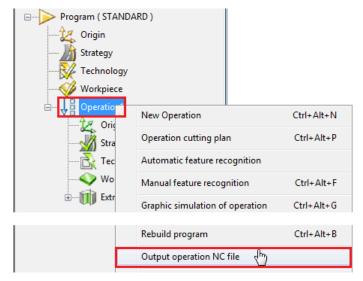
The following figure shows the final result of the simulation.



#### Creating the NC program

At the end of this exercise, we create the NC program again.

Right-click **Operation1** and, on the context menu, click **Output operation NC file**.



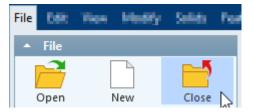
Please continue working independently...

#### Saving the OPTICAM Program

In the end, you should save your work.

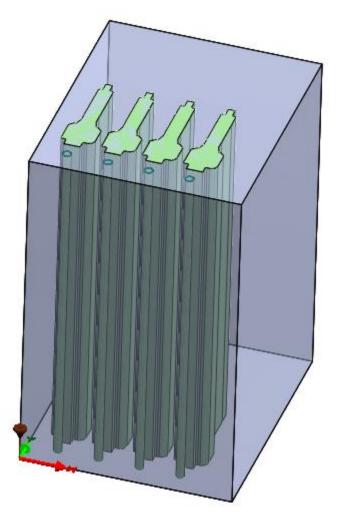
**User advice:** In addition to the GibbsCAM file **GC14\_Opticam\_example\_6.vnc**, a second file containing the OPTICAM machining information for the current program will be saved. This OPTICAM file has the file extension .**wire.opticam**.

Close the file GC14\_Opticam\_example\_6.vnc.



This exercise is now completed.

# Example 7: Machining Punches and Multiple Punches

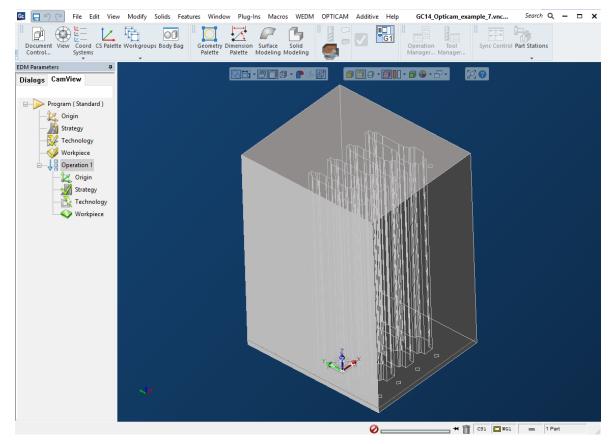


#### **Demonstrated in This Example**

Opening a file: GC14\_Opticam\_example\_7 Deriving the Workpiece (Billet) Geometry from the Existing Model Hiding the Solid Body Machining Punches / Multiple Punches Modifying the Feature Order

### *Open GC14\_Opticam\_example\_7*

In GibbsCAM, open the example file GC14\_Opticam\_example\_7.vnc.



#### Using the Program Dialog for Basic Settings

1 .	Program Setup	
🖌 🗶 -	🥐 🐼 👰	5
escription	•	
Example 7		
	. 1	
Post-Processor S		
NCPath	Current Jo	b Directory
Culticore/Dubli		
C: (Users (Publi	c\Documents\opticam\Job\	
Manufacturers	c \Documents \opticam \Job \	
	c\Documents\opticam\Job\	
Manufacturers	c\Documents\opticam\Job\	
Manufacturers STD	c (Documents (opticam (Job)	
Manufacturers STD Post-Processor	c (Documents (opticam (Job)	
Manufacturers STD Post-Processor STANDARD	c (Documents (opticam (Job)	
Manufacturers STD Post-Processor STANDARD Modell-Name	C(Documents opticam (Job)	

the dialog as shown to the right:

Double-click Program (STANDARD) and fill in

Accept changes by clicking V.



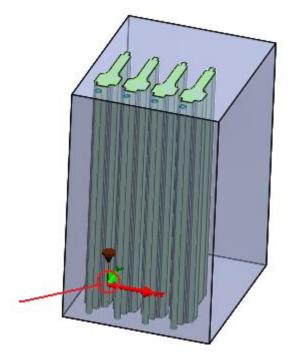
### Defining the Machine Origin

In this example, the origin is to be placed at the lower left edge of the model.

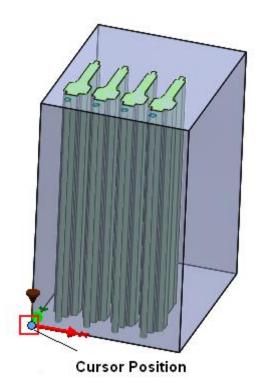
Double-click (Program) Origin to open the dialog to define the machine origin.

OPTICAN	A Origin			
1	🕻 ? 遂		S)	
🔽 Displa	y origin			
Origin			~	
Explici	t origin coordinate	s		
	Vertex			
Explici	t origin alignment			
Z	Z axis (wire)	Face		
1	X axis	Edge		
$\mathbb{Z}$	Y axis	Edge		
Offset origin 🔅				
X 0.0mm	Y 0.0mm	Z 0.0mm		

Currently, the machine origin is located at an undefined position.



To move the origin to the lower left corner of the center, position the cursor on the lower left corner of the model and click with the left mouse button.

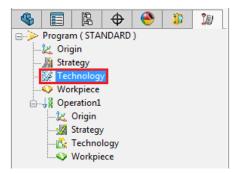


The origin is moved to the selected corner.

Close the dialog Machine Origin by clicking  $\bigvee$ 

#### Defining the Cutting Technology (from Database)

Double-click the branch (Program) Technology in the OPTICAM Feature Manager.



This opens the **Technology** dialog to define the cutting technology. In this case, we will load cutting technology from the Technology Database, as follows.

Select suitable technology parameters from the listboxes **Wire Diameter**, **Wire Type**, **Material** and **Height**.

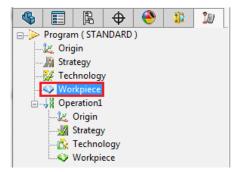
OPTICAM Te	echnology
V X	2
	•
STD	
Filters	*
🔀 🗆 Includ	le user tech in search
User Tech name	<b></b>
Wire Diameter	0.25mm 🔻
Wire Type	Soft Brass 🔹
Material	Steel 🔻
Height	50.0mm 🔻
Number of Cuts	3 🗸
RA	0.0µm 🔻
Outputs	× ×
Records found	V
Cut	Offset
1	0.205mm
2	0.136mm 0.136mm
3	0.130000

The selected cutting technology will be displayed in the dialog area **Records found**.

Accept the selection of the technology parameters by clicking  $\checkmark$ .

# Deriving the Workpiece (Billet) Geometry from the Existing Model

In Feature Manager, double-click the branch (Program) Workpiece.

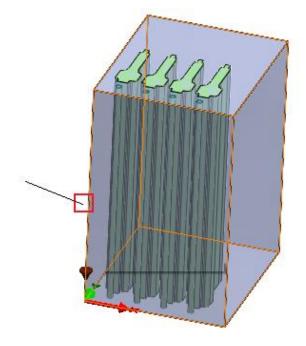


In the example file, the workpiece (billet) is predefined as a solid body.

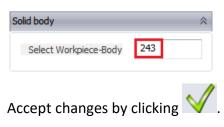
Choosing option Use specific solid activates the input field Solid body.

OPTICAM Workpiece	
√ ¥ ? ⊗₫	
<ul> <li>Use box around solids</li> <li>Use specific solid</li> <li>Use STL file</li> </ul>	
Box	*
Solid body	\$
Select Workpiece-Body	
STL file	*

Click the geometry of the workpiece.



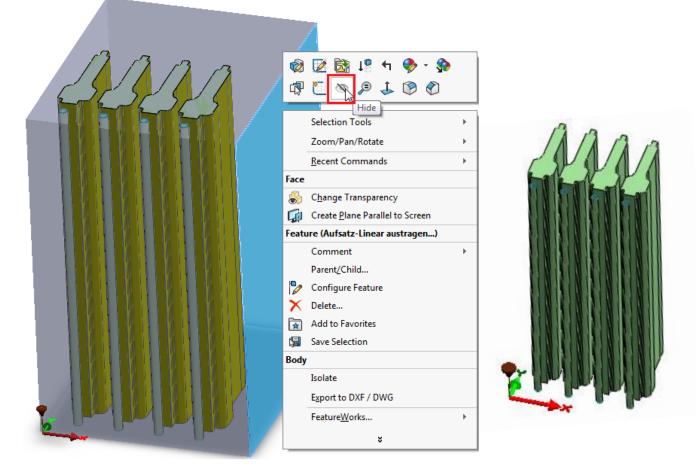
The name of the model is passed to the dialog.



#### *Hiding the Workpiece (Billet) Geometry*

As the geometry of the workpiece (billet) would be identified and machined as a geometry by the automatic feature recognition, it is recommendable to hide the workpiece (billet) geometry.

Right-click the geometry of the workpiece (billet) and, on the context menu, click **Hide**.



The model of the workpiece (billet) is hidden. The four punch geometries and the associated start holes remain.

#### Setting the Cutting Heights

The following dialog sets (among other things) the name of the NC output file and the Z-height of the Reference and the Secondary Plane Height.

Double-click **Operation1** and fill in the fields **Description**, **File name**, **Part number** and **Position** as follows:

OPTICAM	Operation Setup			
🗸 🗙	? 🐼 💀 🔗			
Description				
Example 7				
File name				
7				
CMD file name				
Part number				
7				
From position (f	rom origin) 🔅			
Wire is three	aded at start			
Explicit from coordinates				
Reference	χ 0.0mm γ 0.0mm			
Machine origin				

Identify the Secondary plane height in the model. To do this, position the cursor in the input field **Secondary plane height** and click an element (an edge, plane face or a vertex) on the top face of the model. OPTICAM calculates the Z-height of the selected element and passes the value on to the **Secondary plane height** dialog box.

From position (from orig	in)		~	
Wire is threaded at	start			
Explicit from coording	nates			
Reference X	0.0mm Y	0.0mm		
Machine origin		•		<b>A</b> . <b>a</b>
Working planes (from O	rigin Z0)		*	
Reference plane heigh	t	0.0mm		
Secondary plane heigh	it	41.0mm		OA BA BARANI
		•		
		$\checkmark$		
Accept change	s by clickin	ig 🤍 t	outton.	

#### Setting the Cutting Strategy

In the next dialog, you can define with which strategy the workpiece will be machined. The punches are to be machined individually, each one with 3 Cuts in Reverse Cuts (forwards/backwards). In the end, each Bridge is to be Removed with One Cut.

Double-click (Operation) Strategy and set the dialog as follows:

Cut sequence strategy 🔅	
Do all rough cuts together first	
Interweave rough cuts	
Do all trim cuts at the end	
Interweave final cuts	
Reverse cuts when possible	
Reverse first bridge cut	
Bridge cut strategy 🔅	
Out bridges at end of operation	
Stop only on first bridge cut	
Cut bridges at end of each feature	
Cut bridges at end of FIRST CUTS	
Stop for bridge removal on first cut	
On't cut bridges	
Only cut bridges	
One cut only for bridge removal	
Accept changes by clicking or	$\checkmark$

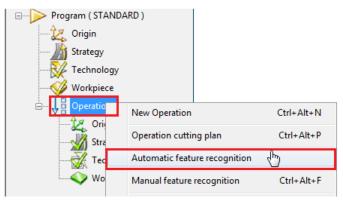
#### Creating the Cutting Machining

With OPTICAM it is possible to create the cutting machining automatically or by manually selecting faces or model edges.

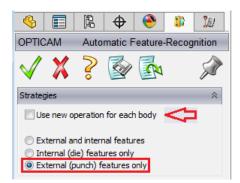
The 4 punches are to be machined automatically in this example. As the start holes exist as geometries, they will be automatically identified.

#### Automatic Creation of the Cutting Machining

Right-click **Operation1** and, on the context menu, click **Automatic feature recognition**.



The dialog **Automatic Feature Recognition** opens. Because we want to exclusively machine the punches, choose **External (punch) features only** as the strategy.



Note: Do *not* select **Use new operation for each body**. This would create a separate **Operation** (separate NC file) in the OPTICAM Feature Manager for each geometry.

To set even more precisely what exactly the Feature Recognition is supposed to

recognize, click the	Feature recognition settings	button.
Settings		
Image: Colour settings         Start hole settings         Feature recognition settings	Feature types         Image: Constant taper         Image:	General settings Group repeated features Group repeated feature recognition (slower) Group Do not use faces with small area as start face Area: 1.0mm <sup>2</sup> Automatically apply templates Group use start hole settings Cut wire between features Recognize variable taper as four axis Max. angle: 39.0°
	<ul> <li>Select / deselect all</li> <li>Cutting direction</li> <li>Outside features:         <ul> <li>Material to LEFT of cutting direction</li> <li>Material to RIGHT of cutting direction</li> <li>Cut on the reverse side of faces</li> </ul> </li> <li>Inside features:         <ul> <li>Material to LEFT of cutting direction</li> <li>Material to RIGHT of cutting direction</li> <li>Material to RIGHT of cutting direction</li> <li>Cut on the reverse side of faces</li> </ul> </li> <li>Open features:         <ul> <li>Material to LEFT of cutting direction</li> <li>Cut on the reverse side of faces</li> </ul> </li> <li>Open features:         <ul> <li>Material to RIGHT of cutting direction</li> <li>Material to RIGHT of cutting direction</li> <li>Cut on the reverse side of faces</li> </ul> </li> </ul>	Select / deselect all

**User advice:** Do **not** activate the option **Group repeated features**. Because the four punch geometries are identical, OPTICAM would unite the 4 punches into one feature in the OPTICAM Feature Manager. However, as we want to manipulate the feature order, we need 4 separate features in the OPTICAM Feature Manager.

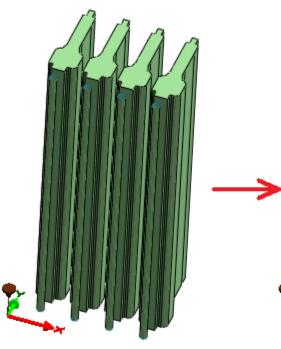
**User advice:** Activate the option **Material to RIGHT of cutting direction**. This option defines the direction (clockwise or counterclockwise) in which our punches will be machined. **Material to RIGHT of cutting direction** means *clockwise*.

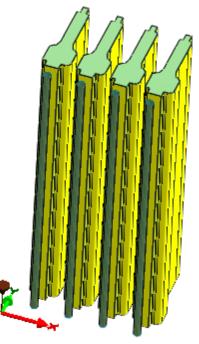
Accept changes by clicking



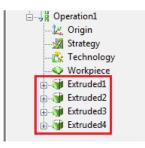
Close the dialog Feature Recognition: 💙

The system will now search the solid bodies for all geometries that can be wire cut (feature recognition) and create a machining suggestion with the cutting parameters previously set.



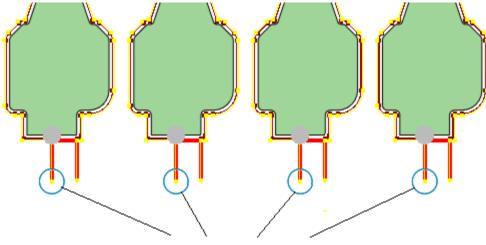


For each geometry that can be wire cut, OPTICAM creates a separate feature in the OPTICAM Feature Manager:



#### Automatic Start Hole Recognition

The OPTICAM feature recognition is able to identify start holes in a 3D model and to use them as threading position for the cutting machining. Start holes in the 3D model have to be drawn as GibbsCAM surfaces of the type Extruded Circle. As this is the case in this example, the start holes were automatically identified.

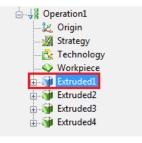


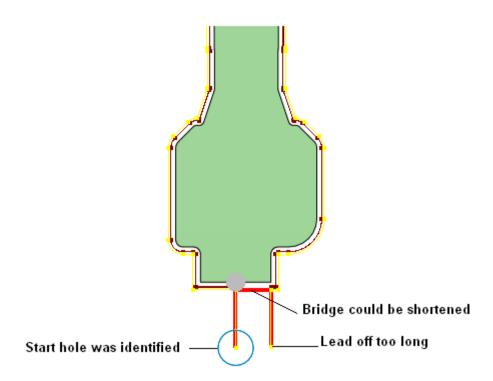
ldentified start holes

#### Adjusting the Lead on/off

Click the first feature in the OPTICAM Feature Manager. In the model, tool paths of the selected feature are highlighted.

If you extend the tool paths and look at them more closely, you will note several things. The start position is in the center of the cylinder. This is correct and the result of the automatic start hole recognition of the OPTICAM Feature Recognition.



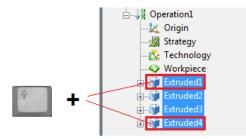


The lead off is too long and should be shortened. In the following, we will shorten the lead off.

The **Size of the Bridge** is slightly too big and could be adjusted.

### Shortening the Length of the Lead off

Holding down the **Shift** key, click the first feature and then the last feature in the OPTICAM Feature Manager. This way you can very easily select all four features.



Now right-click one of the selected features and, on the context menu, click **Multiple edit > Edit lead parameters**.

Operation1     Origin     Strategy     Technology     Workpiece     Extruded     Extrude     Extrude     Extrude     Extrude     Extrude     Extrude	New Operation Operation cutting plan Automatic feature recognition Manual feature recognition	Ctrl+Alt+N Ctrl+Alt+P Ctrl+Alt+F	
	Rebuild program	Ctrl+Alt+B	
	Multiple edit	•	Edit feature parameters Edit feature strategy
	Delete operation		Edit segment parameters
			Edit technology parameters
		I	Edit lead parameters
			Edit pocket parameters

This opens the Lead on/off dialog.

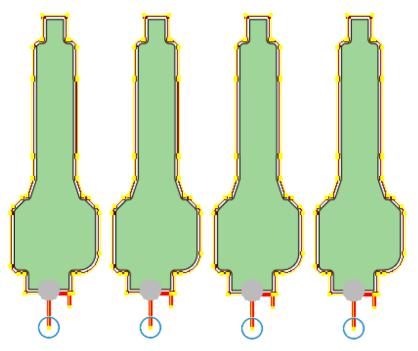
On the left-hand side, click **Endpoint** and choose option **Automatic lead off position**.

Lead on/off		
🗸 🗙 🏅		
Starthole	Endpoint position	On profile position
Endpoint Lead on/off	Endpoint diameter: 1.0mm	Automatic on profile
	Automatic lead off position	Automatic on edge
	CAD cylinder	⊘ Vertex or edge
	CAD cylinder: None	Position: Select vertex or edge
	Lead-Off: None	

Click Lead on/off and modify the length of the Lead Off to 0.6 mm.

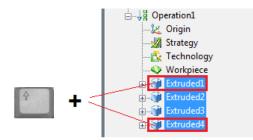
/ 🗙					
Starthole Endpoint	Lead On		Lead Off		
.ead on/off		2		2	
	Line		Line		
	Arc		Arc		
	C Full Arc		Full arc		
	Meander				
	Length:	1.8625mm	Length:	0.6mm	Copy L/O
	Angle:	0.0°	Angle:	0.0°	Copy L/O
	Extension:	0.0mm	Extension:	0.0mm	Copy L/O
	Arc radius:	0.3mm	Arc radius:	0.3mm	Copy L/O

Accept changes by clicking . The lead off adjustment is applied to all selected features.



# Adjusting the Size of the Bridges

To select all four features, click the first feature and then hold down the **Shift** key while clicking the last feature in the OPTICAM Feature Manager.

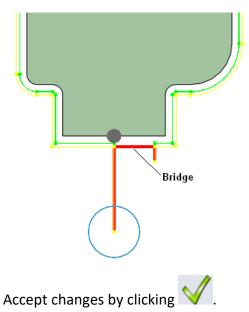


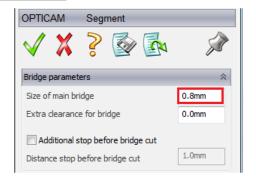
Now right-click one of the selected features and, on the context menu, click **Multiple edit > Edit segment parameters**.

Rebuild program	Ctrl+Alt+B	
Output feature NC file		
Multiple edit	+	Edit feature parameters
Delete operation		Edit feature strategy
•		Edit segment parameters 👆
		Edit technology parameters
		Edit lead parameters
		Edit pocket parameters

In the **Segment** dialog, modify the **Size of main bridge** from 1 mm to **0.8** mm.

The size of all bridges is adjusted to **0.8** mm. The following figure shows a magnification of the adjusted bridge:





#### Machining Simulation (Solid Simulation)

Right-click **Operation1** and, on the context menu, click **Solid simulation of operation**.

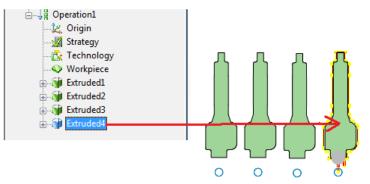
Program (STAND)	ARD )	
United Street	New Operation Operation cutting plan	Ctrl+Alt+N Ctrl+Alt+P
<u>ि</u> Te	Automatic feature recognition Manual feature recognition	Ctrl+Alt+F
⊕∭ Ext ⊕∭ Ext	Graphic simulation of operation Solid simulation of operation رالس	Ctrl+Alt+G Ctrl+Alt+S

### Modifying the Feature Order

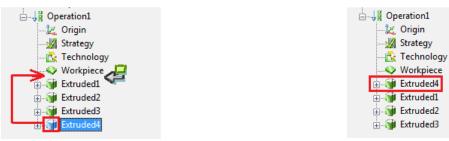
During the machining simulation it may happen that you do not like the cut sequence.

With the help of the OPTICAM Feature Manager, you can modify the cut sequence however you like, using drag-and-drop.

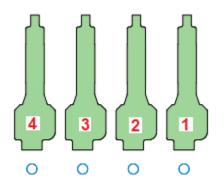
Click the last feature in the OPTICAM Feature Manager. The associated tool path graphic will be highlighted.



In the Feature Manager, left-click the symbol *w* in front of the feature *b struded*. Hold down the left mouse button and position the feature between the feature *w w struded*. Then release the mouse button.



The last operation is moved to the top. Move the remaining features until the punches are machined from the left to the right side in the order **4,3,2,1** (see following figure).



### Machining Simulation (Solid Simulation)

Check the adjusted feature order through a second **Solid Simulation**.

🖃 🕪 Program ( STAND/	ARD )	
🛵 Origin		
🗄 🛶 🙀 Operation1	New Occurrition	Ctrl+Alt+N
Ori	New Operation	Ctri+Alt+IN
Str.	Operation cutting plan	Ctrl+Alt+P
— 💦 Те	Automatic feature recognition	
	Manual feature recognition	Ctrl+Alt+F
€ Ext	Graphic simulation of operation	Ctrl+Alt+G
Ext	Solid simulation of operation 🖑	Ctrl+Alt+S

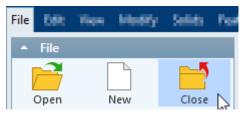
### Saving the OPTICAM Program

At the end, you should save your work.



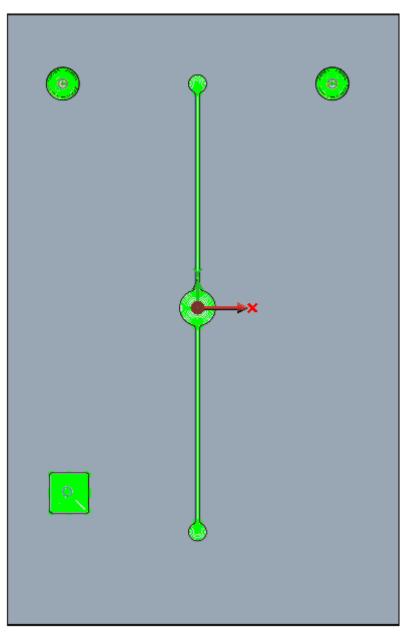
User advice: In addition to the GibbsCAM file GC14\_Opticam\_example\_7.vnc, a second file containing the OPTICAM machining information for the current program will be saved. This OPTICAM file has the file extension .wire.opticam.

Close the file GC14\_Opticam\_example\_7.vnc.



This exercise is now completed.

# **Example 8: Pocketing Apertures**

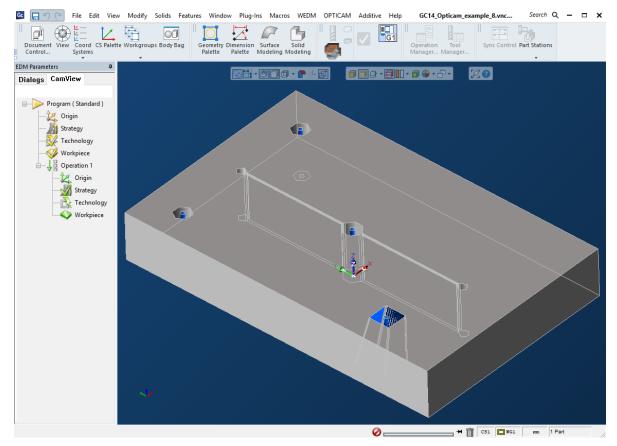


#### **Demonstrated in This Example**

Opening a file: GC14\_Opticam\_example\_8 Pocketing Cylindrical, Tapered and Four Axis Geometries Turning on the Display of Slugs (Solid Simulation)

# *Open GC14\_Opticam\_example\_8*

In GibbsCAM, open the example file GC14\_Opticam\_example\_8.vnc.



# Using the Program Dialog for Basic Settings

Double-click **Program (STANDARD)** and fill in the dialog as shown to the right:

Accept changes by clicking

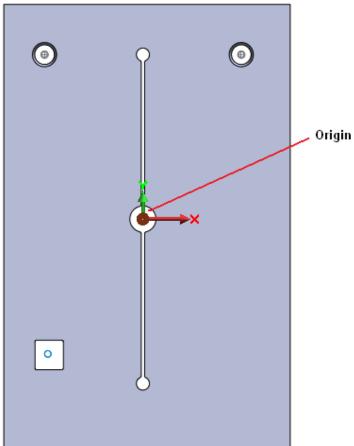


# Defining the Machine Origin

In this example, the origin is in the center of the center of the workpiece. As this is okay, we do not have to define an origin.

OPTICAM	Program Setup		
Description Example 8			
Postprocessor : NC path C:\Users\Pub	selection  Current job directory		
Manufacturer	1		
STD	•		
Postprocessor			
STANDARD	•		
Modell name			
W1-W2	<b>•</b>		
	Technology		
	Postprocessor options		

last saved: 2021-04-16 at 17:56



# *Defining the Cutting Technology (from Database)*

Double-click (**Program**) **Technology** to open the **Technology** dialog to define the cutting technology.

We will select the cutting technology from the Technology Database.

Select suitable technology parameters from the listboxes Wire Diameter, Wire Type, Material and Height.

PTICAM Tee	chnology	
	2	Â
. ilters		~
🔀 🗆 Indu	de user tech in search	
User Tech name		-
Wire diameter	0.25mm	-
Wire type	Brass	-
Material	Steel	•
Height	10.0mm	-
Number of cuts	1	•
RA	0.0µm	•
Outputs		*
Records found		
Cut	Offset	
1	0.0mm	
Modify technology 🔅		
Use modified technology made in cuts Take over selected tech in cuts editor		
	Cuts editor	

Filters 🕆		
🔀 🗆 Includ	e user tech in search	
User Tech name	<b>_</b>	
Wire diameter	0.25mm 🔹	
Wire type	Soft Brass 🔹	
Material	Steel 🔹	
Height	30.0mm 🔹	
Number of cuts	3	
RA	0.0µm 👻	
Outputs Records found	*	
Cut	Offset	
1	0.205mm	
2	0.136mm	
3	0.136mm	

The selected cutting technology will be displayed in the dialog area **Records found**.

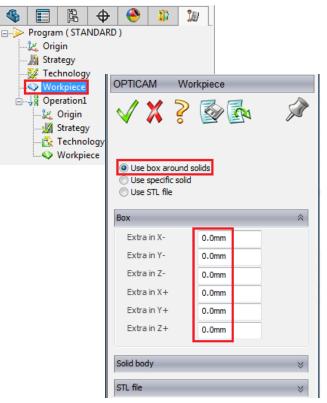
Accept the selection of the technology parameters by clicking 💊

# Creating the Workpiece (Billet) Geometry

In the next dialog, you can define the geometry of the workpiece (billet). The workpiece is to be derived from the solid body; additionally, no allowance values are to be defined.

Double-click (**Program**) Workpiece:, and then fill in the dialog as shown to the right

Accept changes by clicking V



# Setting the Cutting Heights

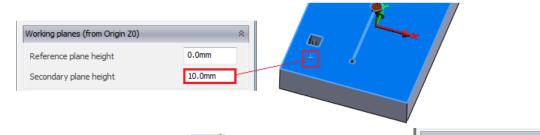
The following dialog sets the name of the NC output file and the Z-height of the Reference and the Secondary Plane Height.

Double-click **Operation1** and fill in the fields **Description**, **File name**, **Part number** and **Position** as shown to the right:

To identify the Secondary plane height in the model. Position the cursor in the input field **Secondary plane height** and click the top plane face of the model.

**OPTICAM** calculates the Z-height of the selected element and passes the value on to the dialog box **Secondary plane height**.

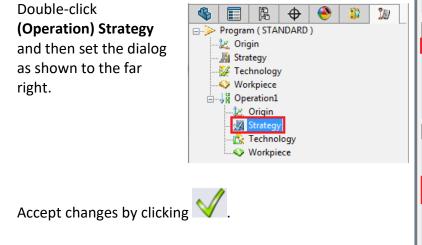
OPTICAM	Operation Setup
🗸 🗙	😵 💀 🔗
Description	
Example 8	
File name	
8	
CMD file name	
Part number 8	
From position (f	rom origin) 🔗
🔲 Wire is thre	eaded at start
Explicit from	n coordinates
Reference	χ 0.0mm γ 0.0mm
Machine origin	<b></b>



Accept changes by clicking 💙

# Setting the Cutting Strategy

In the next dialog, you can define with which strategy the workpiece will be machined. First, all apertures are to be roughed in succession. The trim cuts follow after.



- Feature sequence strategy
- Feature order from feature list
   Smallest features first
- Smallest features last
- Shortest path between features
  - Ignore pocket in ordering
  - Feature with pocketing first
  - Feature with pocketing last
  - Collar before taper
    Taper before collar
  - Taper before collar
  - Internal before external features
     External before internal features
  - Ignore internal / external in ordering

# Cut sequence strategy Cut sequence strategy Cut of the strategy Cut of the strategy Cut of the strategy of the



✓ One cut only for bridge removal

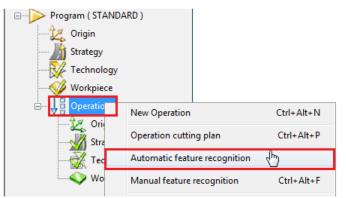
last saved: 2021-04-16 at 17:56

### Creating the Cutting Machining

In this example, the four internal apertures are machined with the automatic Feature Recognition. As the start holes exist as geometries, they will be automatically identified.

#### Automatic Creation of the Cutting Machining

Right-click **Operation1** and, on the context menu, click **Automatic feature recognition**.



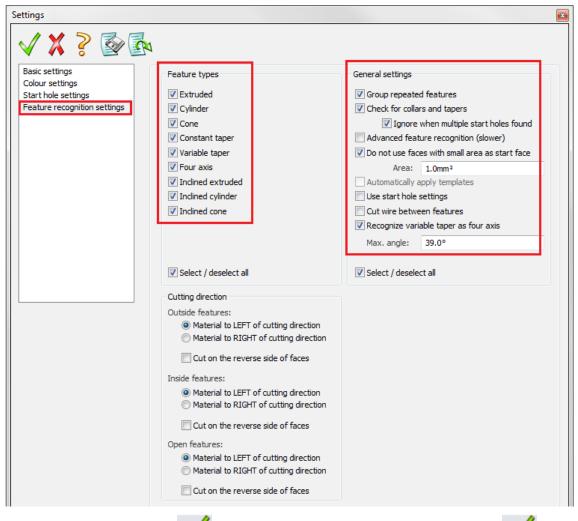
Set the Automatic Feature Recognition dialog as shown:



To set even more precisely what exactly the **Feature Recognition** is supposed to

recognize, click the Feature recognition settings button.

Set the dialog as follows:



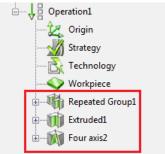
Accept changes by clicking 💙 . Then close the Feature Recognition dialog: 💙

The system will now search the solid body for all geometries that can be wire cut (feature recognition) and create a machining suggestion with the cutting parameters previously set.

For each geometry that can be wire cut, OPTICAM creates a separate feature in the Feature Manager:

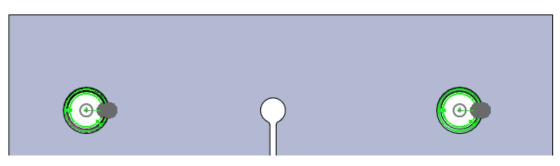
## Automatic Start Hole Recognition

Note how the OPTICAM feature recognition identifies start holes in a 3D model and uses them as threading position for the cutting machining.



Therefore, the start holes in the 3D model have to be drawn as GibbsCAM surfaces of the type Extruded Circle. As this is the case in this example, the start holes were automatically identified.

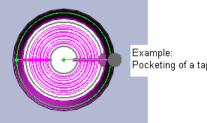
The following figure is a part of the upper area of the model and shows the start hole recognition for the two tapered holes.



# **Pocketing Apertures**

The apertures in this example have to be pocketed, instead of being machined with one or several cuts.

OPTICAM is able to machine cylindrical and tapered geometries as well as four axes by means of pocketing. The advantage of the pocketing strategy is that no slugs are formed



Pocketing of a tapered hole

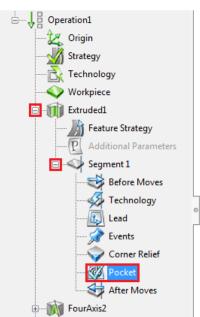
and the operator does not have to intervene to remove the slugs. However, the process only makes sense for smaller apertures as it leads to longer running times.

First, we will program the **pocketing** for the **cylindrical aperture** in the center of the model.

In Feature Manager, open the feature ill Extruded1 (the cylindrical aperture in the center) and double-click the branch 🖑 Pocket.

The **Pocketing** dialog opens. Choose the option **Pocket** with constant offset. The selected option is a strategy which is primarily used for the **pocketing of cylindrical** geometries.

By modifying the setting **Overlap % of wire diameter** to 60%, you set the distance of the tool paths.



Methods	*
<ul> <li>Don't pocket this feature</li> <li>Pocket with constant offset</li> <li>Pocket with variable offset</li> </ul>	
Parameters	*
60% Overlap % of wire diameter	
The pocket has been pre-milled	
1.0mm Pre-mill offset	

**User advice:** Do not define the value in the field **Overlap % of wire diameter** too big. When dealing with complex geometries, the definition of values of over 60% can lead to the formation of slugs. Use **Solid Simulation** to check the tool path for slugs.

Accept changes by clicking 💙

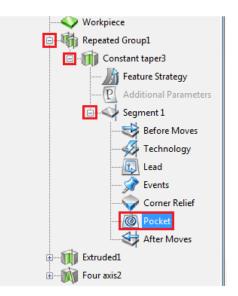
Next, you have to pocket the two tapered apertures.

In Feature Manager, open the feature Constant taper<sup>3</sup> (the two tapered apertures at the top) and double-click the branch Pocket.

The **Pocketing** dialog opens. Choose option **Pocket with variable offset**. This option is a strategy for the pocketing of Tapers and Four Axis Geometries.

Modify the setting **Overlap % of wire diameter** to **60**%. This sets the distance of the tool paths.

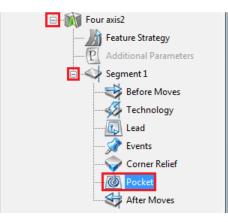
Methods	~	
<ul> <li>Don't pocket this feature</li> <li>Pocket with constant offset</li> <li>Pocket with variable offset</li> </ul>		
Parameters	~	
60% Overlap % of wire diameter		
The pocket has been pre-milled		
1.0mm Pre-mill offset		



Accept changes by clicking 💙

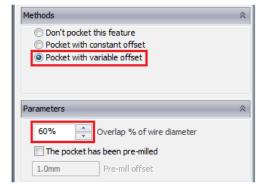
At the end, you have to pocket the four axis.

In Feature Manager, open the feature 🙀 FourAxis2 and double-click the branch 🖑 Pocket.



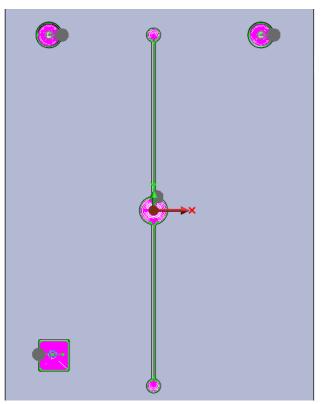
The **Pocketing** dialog opens. Choose option **Pocket with variable offset**. This option is a strategy for the pocketing of tapers and four axis geometries.

Modify the setting **Overlap % of wire diameter** to **60%**.



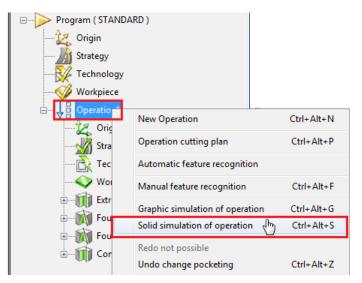
Accept changes by clicking 💊

The following figure shows what the tool paths should look like:



# Machining Simulation (Solid Simulation)

Right-click **Operation1** and, on the context menu, click **Solid simulation of operation**.

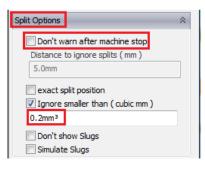


# Display of Slugs (Solid Simulation)

When dealing with pocketing, it is recommendable to turn on the display of slugs before starting the solid simulation. If slugs are formed, a warning is displayed there.

Open the field **Split Options** in the simulation dialog. *Deactivate* the option **Don't warn after machine stop**.

Then enter the value **0.2** mm<sup>3</sup> in the field **Ignore smaller than (cubic mm)**. This setting ignores slugs whose volume is smaller than 0.2 cubic mm.



# Creating the NC Program

Right-click **Operation1** and, on the context menu, click **Output operation NC file**.

Program ( STANDARD )		
🛴 Origin		
	ах	
	e	
🗄 🛃 Operatio	New Operation	Ctrl+Alt+N
Orig	Operation cutting plan	Ctrl+Alt+P
Tec	Automatic feature recognition	
	Manual feature recognition	Ctrl+Alt+F
€ Extr	Graphic simulation of operation	Ctrl+Alt+G
	Rebuild program	Ctrl+Alt+B
	Output operation NC file 🛛 🖑	

# Saving the OPTICAM Program

At the end, you should save your work.

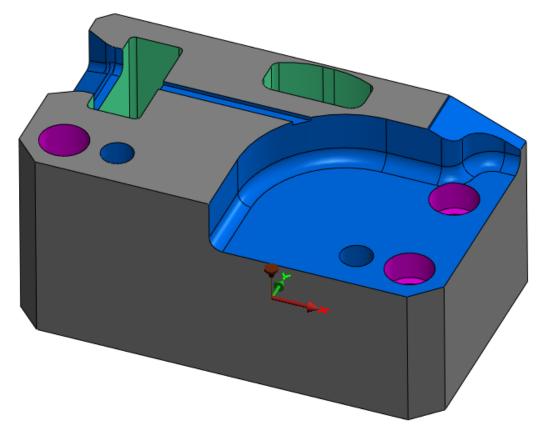
User advice: In addition to the GibbsCAM file GC14\_Opticam\_example\_8.vnc, a second file containing the OPTICAM machining information for the current program will be saved. This OPTICAM file has the file extension .wire.opticam.

Close the file GC14\_Opticam\_example\_8.vnc.

File	693	Tion	Madiy	Selfer	Fee
•	File				
	Open	1	New	Close	

This exercise is now completed.

# Example 9: Feature Recognition by Colors

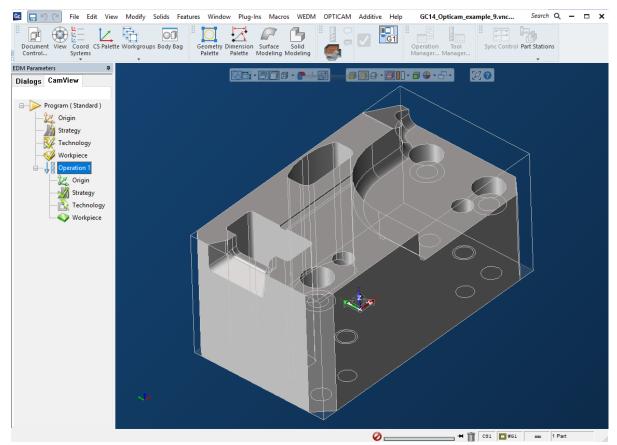


#### **Demonstrated in This Example**

Opening a file: GC14\_Opticam\_example\_9 Creating a Color Search List Recognizing Features by Their Colors

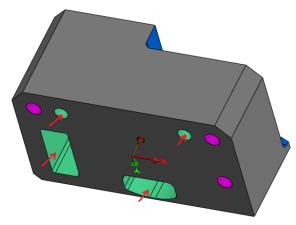
# *Open GC14\_Opticam\_example\_9*

In GibbsCAM, open the example file GC14\_Opticam\_example\_9.vnc.



The model contains several apertures that differ from each other in color. Many companies use this color distinction to mark the required machining process. In our case, all **light green faces** are to be **wire cut**, the **blue faces** are to be **milled** and the **purple faces** are to be **drilled**.

The following model shows the faces which are to be wire cut (see the four arrows).



# Using the Program Dialog for Basic Settings

OPTICAM

Description Example 9

NCPath

STD

Manufacturers

Post-Processor

Post-Processor Selection

C:\Users\Public\Documents\opticam\Job\

Program Setup

Current Job Directo

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•

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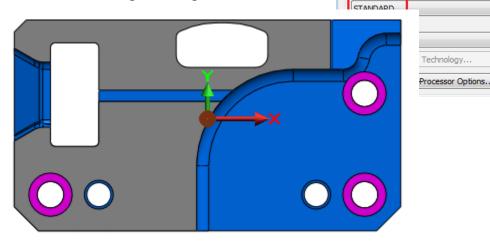
Double-click the branch **Program (STANDARD)** in the OPTICAM Feature Manager.

Fill in the dialog as shown to the right:

Accept changes by clicking

# Defining the Machine Origin

In this example, the origin is in the center of the center of the workpiece again. As this is okay, we do not have to change the origin.



# Defining the Cutting Technology (from Database)

Double-click (**Program**) **Technology** to open the **Technology** dialog to define the cutting technology. We will select the technology parameters from the technology database.

Select the appropriate technology parameters from the listboxes **Wire Diameter**, **Wire Type**, **Material** and **Height**.

The selected technology will be displayed in the dialog area **Records found**.

Accept the selection of the technology parameters by

clicking V

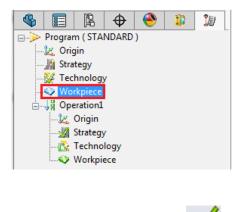
Filters		
Include user tech in search		
User Tech name		
Wire Diameter	0.25mm 🔻	
Wire Type	Soft Brass 💌	
Material	Steel 🔻	
Height	30.0mm 👻	
Number of Cuts	3 🔹	
RA	0.0µm 🔻	
Outputs	× کړ ک	
Records found		
Cut	Offset	
1	0.205mm	
2	0.136mm	
3	0.136mm	

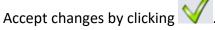
# Creating the Workpiece (Billet) Geometry

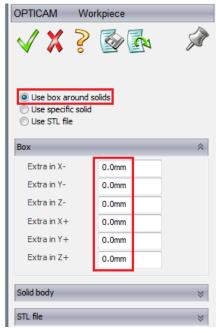
In the next dialog, you can define the geometry of the workpiece (billet). The workpiece is to be derived from the solid body; additionally,

no offset values are to be defined.

Double-click **(Program) Workpiece** and fill in the dialog as shown:







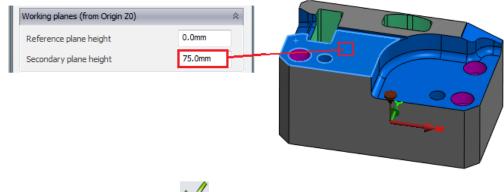
# Setting the Cutting Heights

Double-click **Operation1** and fill in the fields Description, File name, Part number and Position as follows:

OPTICAM	Operation Setup		
🗸 X	? 🐼 💁 🔗		
Description			
Example 9			
File name			
9			
CMD file name			
Part number			
9			
From position (f	rom origin) 🔗		
Wire is threaded at start			
Explicit from coordinates			
Reference	χ 0.0mm γ 0.0mm		
Machine origin	<b></b>		

To identify the Secondary plane height, position the cursor in the input field **Secondary plane height** and click on one of the top plane faces of the model.

OPTICAM calculates the Z-height of the selected element and passes the value to the dialog box **Secondary plane height**.

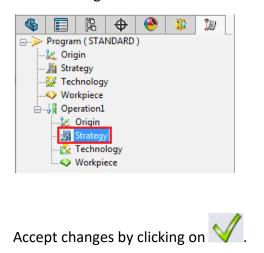


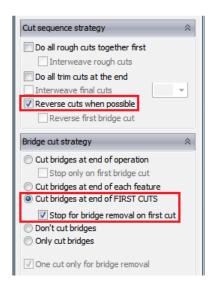
Accept changes by clicking  $\checkmark$ .

# Setting the Cutting Strategy

In the next dialog, you set the strategy for machining the workpiece. The bridge has to be removed directly after each rough cut, and immediately afterwards the trim cuts are to follow.

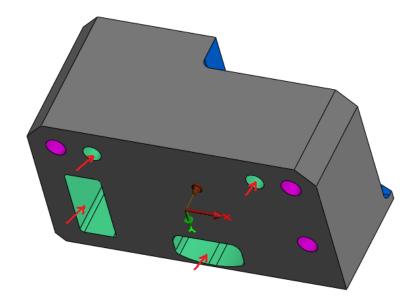
Double-click the branch (**Operation**) **Strategy** and set the dialog as shown:





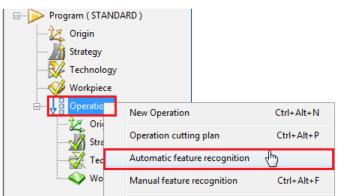
# **Recognizing Features by Their Colors**

In this example, we want the automatic feature recognition to recognize all light green faces and to machine only these faces. (The desired apertures are marked with arrows in the figure below).



# Creating a Color Search List

Right-click **Operation1** and, on the context menu, click **Automatic feature recognition**.



Initially, we will create a **color search list** in which we determine the color(s) to be recognized.

To create the <b>color search list</b> , select the	Manage lists	button.
Options   Use colour list Choose list:		
Manage lists           Start hole settings           Feature recognition settings		

In the **Color settings** dialog, for **List Title**, enter the name of the color list: **Light green**. Then click the button **Create new list**.

Settings	
🗸 🗙 🍃 🐼 🗖	
Basic settings	
Colour settings Start hole settings	Undo
Feature recognition settings	
	Available lists:
	List title: Light green
	agregion agregion
	Create new list
	Delete selected list

Now click on a light green face in the model.

The color of the desired face is passed on to the dialog and entered in the field **Colours** in List.

STOP

**User advice:** More faces with other colors could be selected to create a color search list with several colors.

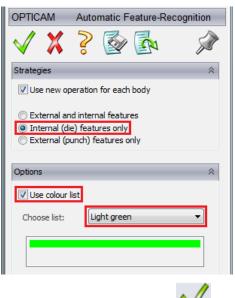
Colours in list:		H
Add new colour		
Delete selected colour		
Delete all colours	· · · · · · · · · · · · · · · · · · ·	

Accept the color settings by clicking 💙 .

The system returns to the dialog for the automatic feature recognition.

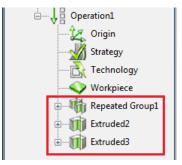
Select checkbox **Use colour list** so the system searches for colored faces only—in this case, only light green faces. Then, in the **Choose list** area, select the just-created list item: **Light green**.

Make sure that the dialog looks as follows:



Accept changes by clicking

The automatic feature recognition searches the solid body for all light green geometries which can be wire cut and creates a machining suggestion with the cutting parameters previously set. As always, OPTICAM creates a separate feature in Feature Manager for any geometry that can be wire cut:

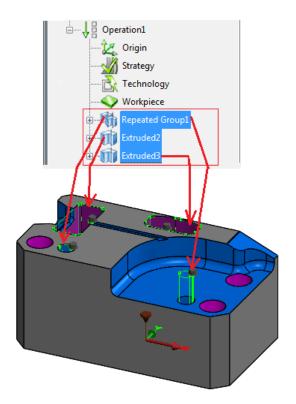


# Checking the Created Machining Features

The easiest way to check the created features is the visual check.

To do this, click the existing features in the Feature Manager that you want to check. This shows the tool paths belonging to the features highlighted so that we can check them graphically.

To select all four features, click the first feature and hold down the **Shift** key as you select the last feature. The corresponding tool path is highlighted.

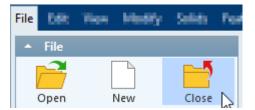


# Saving the OPTICAM Program

At the end, you should save your work.

**User advice:** In addition to the GibbsCAM file **GC14\_Opticam\_example\_9.vnc**, a second file containing the OPTICAM machining information for the current program will be saved. This OPTICAM file has the file extension .**wire.opticam**.

Close the file GC14\_Opticam\_example\_9.vnc.



This exercise is now completed.