MERRY
X-MAS

YOUR

DEX-
TEAM

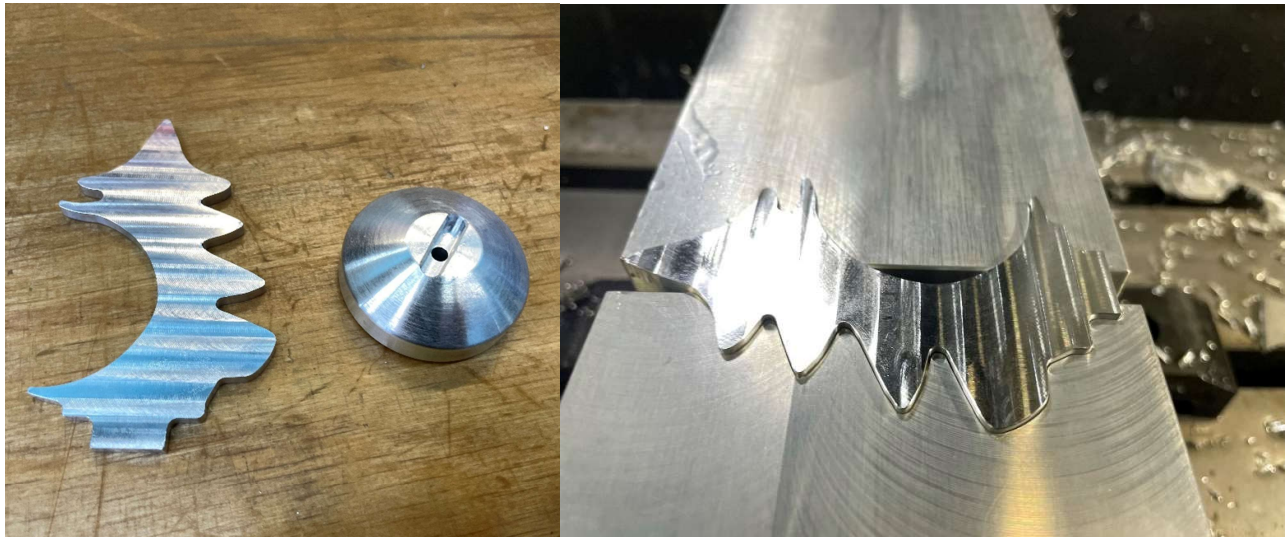Bauble holder

siemens.de/cnc4you

## Christmas bauble holder

The 2021 CNC4you Christmas workpiece focuses on small Christmas baubles (those decorative balls) that often go unnoticed when hanging on a large Christmas tree. However, with this Christmas bauble holder, the size relationships have been selected so that when hanging in your tree, these small Christmas ornaments really come into their own. If desired, a personalized text can be engraved on the holder – ideally after the milled part has been colored by anodizing or painting to ensure good legibility of the engraving.

The bauble holder comprises a turned part and a milled part. Fixtures are required to allow the part to be milled on all sides and for subsequent engraving – and the production description will also explain how these fixtures are fabricated.



*Milled part (= bauble holder with tree contour) and turned part (= base) for the Christmas workpiece 2021*

*The finished milled part in the second contour-compliant clamping.*

All of the information required for the machining – such as tool data, machining plans and NC programs – are subsequently listed.

www.siemens.de/cnc4you

**Table of contents**

# 1   Safety note

Handling machines involves dealing with a multitude of risks. When fabricating the Christmas workpiece 2021, it is crucial that the usual operational safety regulations are carefully complied with.

# 2   Preliminary comment

The following description addresses technicians who are familiar with CNC machines and have experience or knowledge about SINUMERIK CNC controls. All of the technology data listed here correspond to the machines, tools, materials, job plans and drawings used to fabricate this bauble holder. When it comes to replicating this workpiece this data is mainly just a guideline due to the wide diversity of resources available in other workshops. Having said that, in most cases it should be possible to simply replicate this Christmas workpiece.

The program for the turned part was generated and tested on a CNC turning machine with C / Y axes and counterspindle. The machine was equipped with a SINUMERIK 828D with the ShopTurn user interface. The programs for the milled parts were generated and tested on a 3-axis milling machine equipped with a CNC SINUMERIK 828D and ShopMill. SINUMERIK Operate V4.95 was installed on both machines. A Y axis is not required for turning – only the C axis is used.

Generally, the program can be simply adapted to other SINUMERIK versions, for example, to other SINUMERIK Operate software releases. A simulation and necessary changes, for example the zero points and the clamping depth in the counterspindle clamping jaws, should always be performed.

All CAD drawings, programs and machining descriptions for the workpieces can be downloaded at no charge from **www.siemens.de/cnc4you**

Here you can find the following files and formats for your workpiece:

- NC programs (ShopTurn, ShopMill)

## 3  Workpiece, blanks/bill of materials

- Round aluminum bar Ø 50 mm

  Approximately 22 mm of material is required to fabricate the base (turned part). When estimating the material, the area required to clamp the workpiece must also be taken into consideration. The sample workpiece was machined with an unclamped length of 100 mm.

- Aluminum block, 95 mm x 65 mm x 8 mm, to machine the milled part (bauble holder in the contour of a tree)

- 4 aluminum blocks, each 100 mm x approx. 75 mm[*] x 50 mm – to fabricate the fittings to machine the front and rear sides of the milled part

- 2 blocks of soft clamping material (ABS plastic or similar), each 100 mm x approx. 75 mm[*] x 50 mm, as clamping jaws when engraving (only required for engraving colored workpieces with sensitive surfaces).

[*] Please adapt the width of the blocks to the clamping equipment at your machine; two blocks each are required for the clamping and these are machined together; see the photographs for the description of the milling program "1_SPANNUNG.MPF" and "2_SPANNUNG.MPF".

# 4 Machines and machining plans

CNC turning machine:

- To machine the base
- Type: DOOSAN 2600SY
- CNC: SINUMERIK 828D with ShopTurn V 4.95
- ShopTurn machining plan: WEIHNACHTEN2021.MPF


**CNC milling machine:**

- To fabricate the bauble holder in a tree contour and the fixtures
- Type: Mazak VTC-530-C 3-axis milling machine
- CNC: SINUMERIK 828D with ShopMill V 4.95
- ShopMill machining plans:
    - 1_SPANNUNG.MPF
    - 2_SPANNUNG.MPF
    - KONTUR_SEITE_1.MPF
    - KONTUR_SEITE_2.MPF
    - GRAV_AUSFR_SPANN.MPF
    - GRAV.MPF


*Note: Several of the machining plans and NC programs use the "Machining residual material" SINUMERIK option. If the machine tool does not have this option (for example, on the demonstration milling machine in SinuTrain), then right from the start use the smallest tool that fits the contour and delete program lines that contain "Residual material pocket". See also the notes in Section 7.*

# 5 Tools used

Notice: When inserting tools in the tool revolver, ensure that
a) there is adequate clearance for the driven tools and
b) there is sufficient clearance between adjacent tools and the clamping jaws of the spindle and counterspindle!

## 5.1 Tools for the turning machine

| Tool/short name | Description |
|---|---|
| SCHRUPP_HS | Outer roughing turning tool with a roughing plate, roughing tool, main spindle |
| SCHL35_HS | Outer turning tool with a finishing plate, finishing tool, main spindle |
| SPIBO_4_VHM_ALU | 4 mm twist drill, main spindle |
| STICHEL_D04_ALU | 4 mm stylus, main spindle, to chamfer |
| FRAESER_D04_ALU | 4 mm milling tool, driven tool, main spindle |
| STECHER_3MM_HS | 3 mm parting tool, main spindle |
| SCHRUPP_GS | Outer turning tool with a roughing plate, counterspindle |
| SCHLICHT_GS | Outer turning tool with a finishing plate, counterspindle |

## 5.2 Tools for the milling machine

| Tool/short name | Description |
|---|---|
| FRAESER_D03_ALU | 2.5 mm diameter milling tool for aluminum |
| ALU_SF_D06 | 6 mm diameter end mill cutter for aluminum |
| FRAESER_D16_ALU_PLAN | 16 mm diameter face milling cutter for aluminum |
| STICHEL_D4 | 4 mm diameter stylus/centering tool/chamfer |
| ALU_D63 | 60 mm diameter face milling cutter for aluminum |
| ALU_KUGEL_D2 | 2 mm diameter ballhead cutter for engraving |
| STAHL_D02 | 2 mm outer diameter milling tool |

# 6 Fabricating the "Christmas bauble holder"

## 6.1 Machining steps at the turning machine

1. Approach the machine reference point.
2. Read-in the machining plan: WEIHNACHTEN2021.MPF
3. Read-in the tool list WEIHNACHTEN2021_TMZ.INI
4. Measure the tools, enter in the tool list.
5. Insert the tools in the magazine.
6. Clamp the workpiece, observe the unclamped length of 101 mm or appropriately adapt in the part program.
7. Set the workpiece zero by scratching.
8. Check the work offsets programmed in the part program and if required adapt to the machine configuration – the same is true for the clamping depth in the counterspindle.
9. Perform the simulation.
10. Start fabrication, work through the machining plan.
11. Remove the workpiece

## 6.2 Machining steps at the milling machine
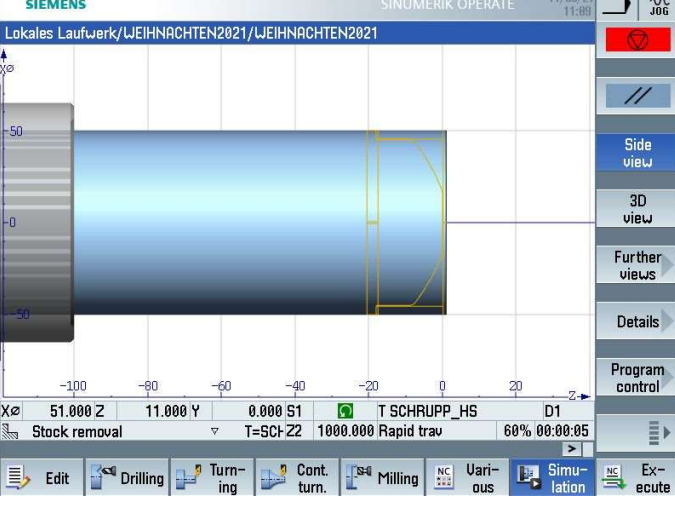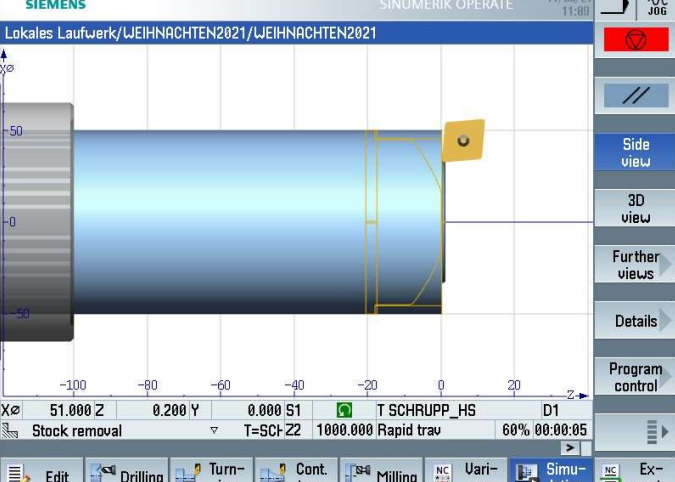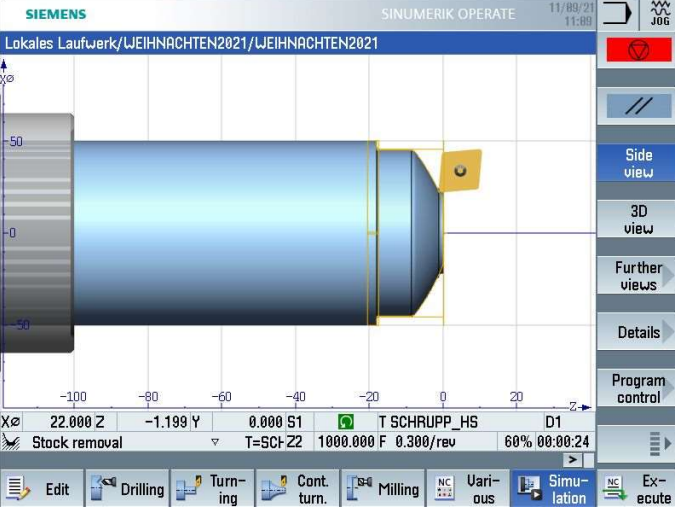
### 6.2.1 Machining the fixtures for the 1st and 2nd clamping

1. Approach the machine reference point.
2. Read-in the machining plan: 1_SPANNUNG.MPF
3. Read-in the tool list TOOLS_TMZ.INI
4. Measure the tools, enter in the tool list.
5. Insert the tools in the magazine.
6. Clamp the workpieces (two aluminum blocks for the clamping fixtures for the first clamping).
7. Set the workpiece zero, using a probe or by probing using an appropriate device
8. Check the work offsets programmed in the part program and if required adapt to the machine configuration.
9. Perform the simulation.
10. Start fabrication, work through the machining plan.
11. Remove the workpieces, the two parts together constitute a clamping fixture
12. Repeat points 1 to 11 with two additional aluminum blocks and machining plan 2_SPANNUNG.MPF (machining the clamping fixture for the 2nd clamping of the workpiece itself).

### 6.2.2 Machining the first side of the "Christmas bauble holder" workpiece

1. Approach the machine reference point.
2. Read-in the machining plan: KONTUR_SEITE_1.MPF
3. When required: Read-in the tool list TOOLS_TMZ.INI
4. Measure the tools, enter in the tool list.
5. Insert the tools in the magazine.
6. Using the clamping fixtures, clamp the workpiece for the first clamping.
7. Set the workpiece zero by scratching.
8. Check the work offsets programmed in the part program and if required adapt to the machine configuration.
9. Perform the simulation.
10. Start fabrication, work through the machining plan.
11. Remove the workpiece

### 6.2.3 Machining the second side of the "Christmas bauble holder" workpiece

1. Approach the machine reference point.
2. Read-in the machining plan: KONTUR_SEITE_2.MPF
3. When required: Read-in the tool list TOOLS_TMZ.INI
4. When required: Measure the tools, enter in the tool list.
5. When required: Insert the tools in the magazine.
6. Using the clamping fixtures, clamp the workpiece for the second clamping.

7. Set the workpiece zero by scratching.

8. Check the work offsets programmed in the part program and if required adapt to the machine configuration.

9. Perform the simulation.

10. Start fabrication, work through the machining plan.

11. Remove the workpiece

### 6.2.4 Machining the soft clamping fixture for engraving

1. Approach the machine reference point.

2. Read-in the machining plan: GRAV_AUSFR_SPANN.MPF

3. When required: Read-in the tool list TOOLS_TMZ.INI

4. When required: Measure the tools, enter in the tool list.

5. When required: Insert the tools in the magazine.

6. Clamp the workpieces (two blocks of soft clamping material) with somewhat of a clearance

7. Set the workpiece zero, using a probe or by probing using an appropriate device

8. Check the work offsets programmed in the part program and if required adapt to the machine configuration.

9. Perform the simulation.

10. Start fabrication, work through the machining plan.

11. Remove the workpieces, the two parts together constitute the soft clamping fixture

### 6.2.5 Engraving the workpiece

1. Approach the machine reference point.

2. Read-in the machining plan: GRAV.MPF.

3. Adapt the text to be engraved

4. When required: Read-in the tool list TOOLS_TMZ.INI

5. When required: Measure the tools, enter in the tool list.

6. When required: Insert the tools in the magazine.

7. Using the clamping fixtures, clamp the workpiece for the second clamping.

8. Set the workpiece zero by scratching.

9. Check the work offsets programmed in the part program and if required adapt to the machine configuration.

10. Carry out the simulation, if required adapt the length and line break of the engraved text.

11. Start fabrication, work through the machining plan.

12. Remove the workpiece

# 7 Working through the ShopTurn/ShopMill machining plans

## 7.1 Working through the ShopTurn machining plan "WEIHNACHTEN2021.MPF"

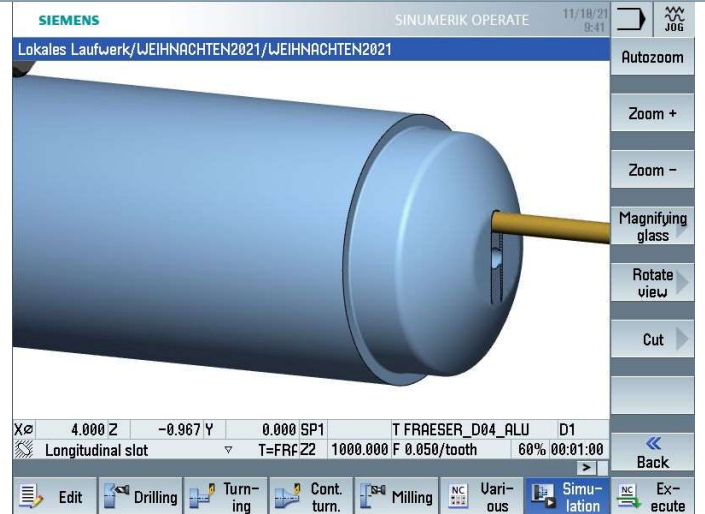| Machining step | Image |
|---|---|
| Clamping the workpiece, observe the unclamped length of 101 mm |  |
| Turning the face surfaces (roughing) |  |
| Roughing the contour |  |

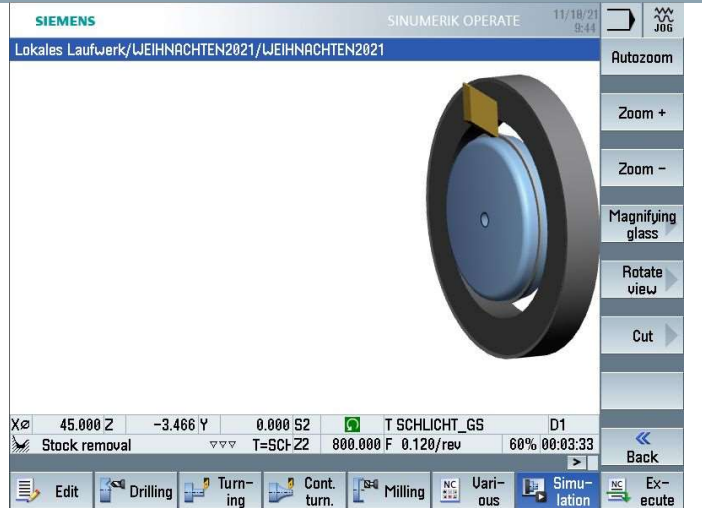| | |
|---|---|
| Finishing the contour |  |
| Pilot hole for subsequent machining with the driven tool |  |
| Milling the slot to mount the milled part (tree contour). |  |

| | |
|---|---|
| Parting and inserting the workpiece in the counterspindle |  |
| Roughing the base surface |  |
| Finishing the base surface with chamfered edge |  |

| | |
|---|---|
| Finished part in the counterspindle |  |
| Finished base |  |
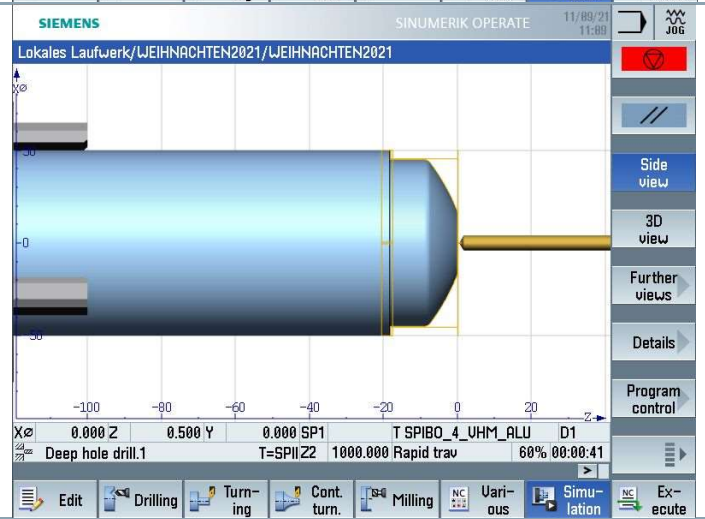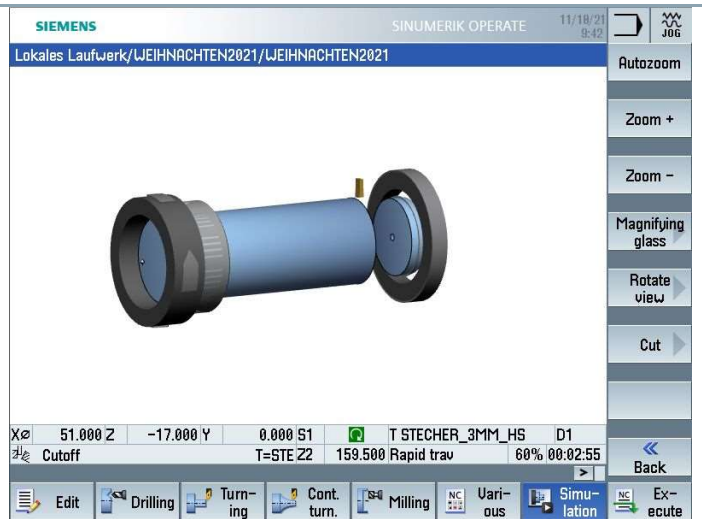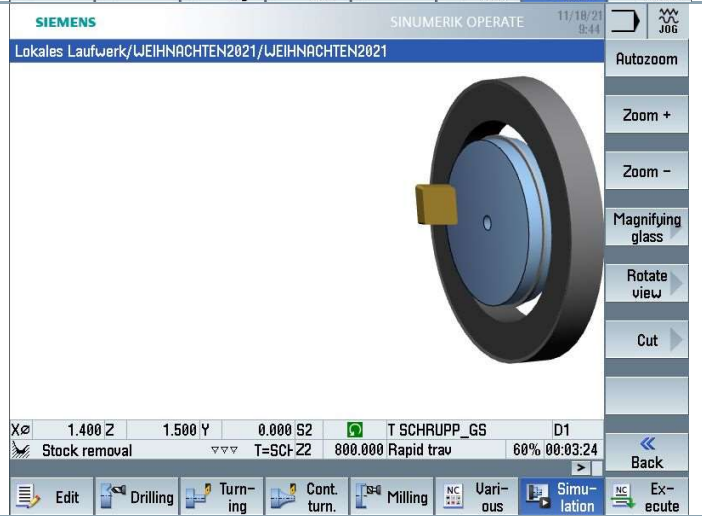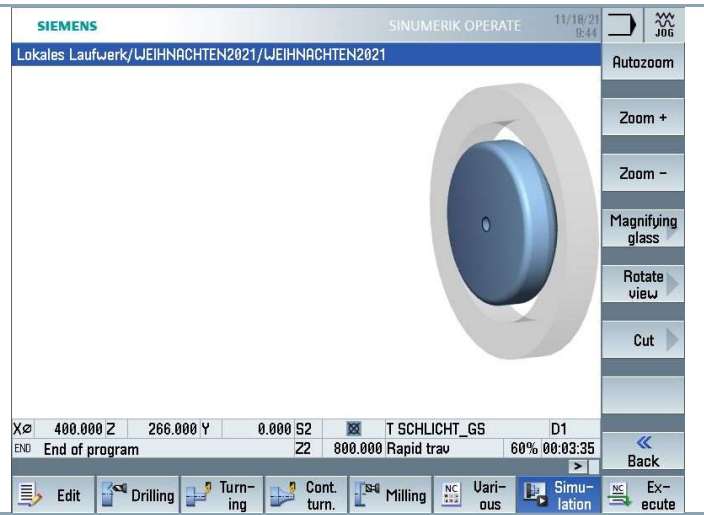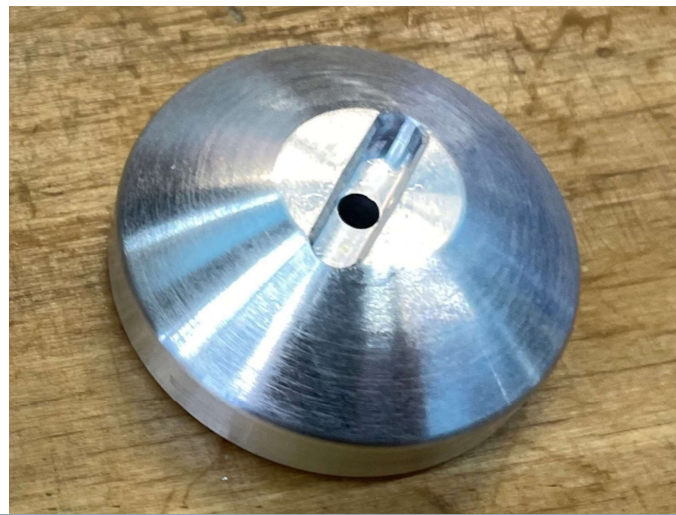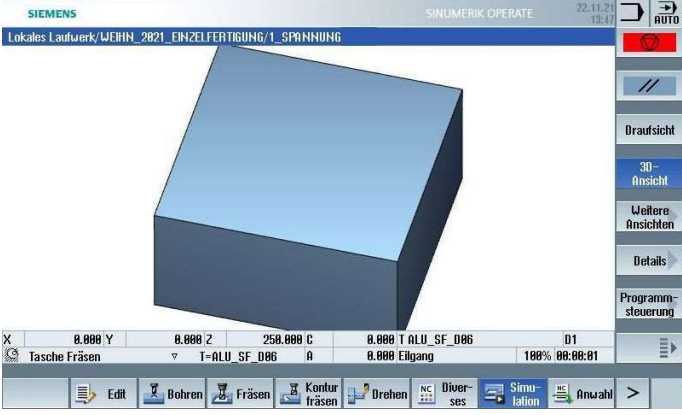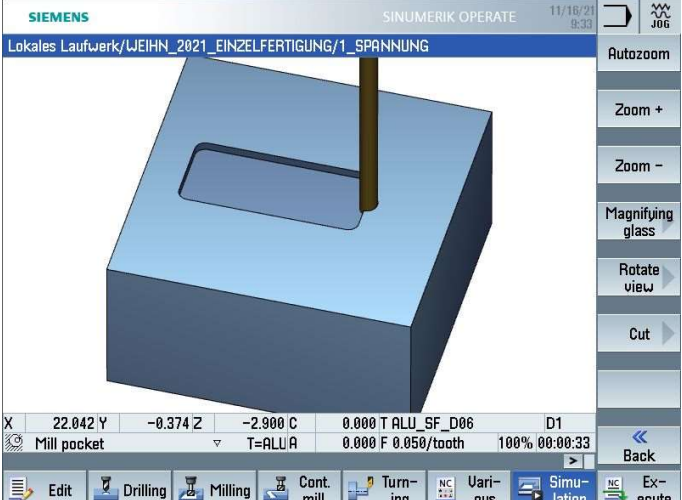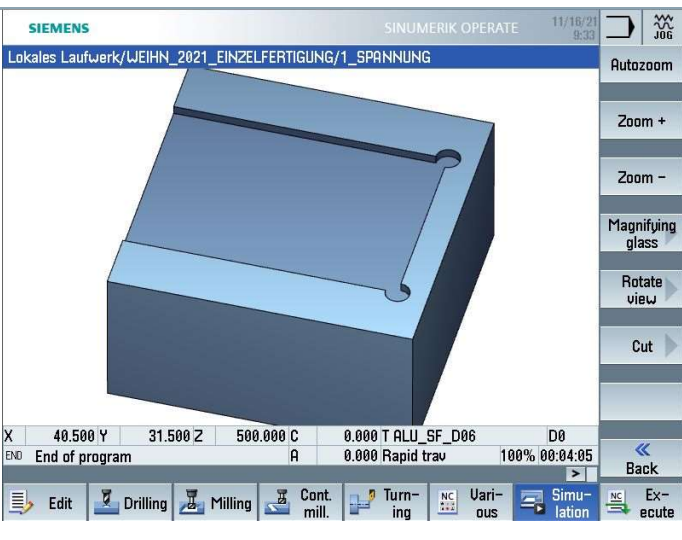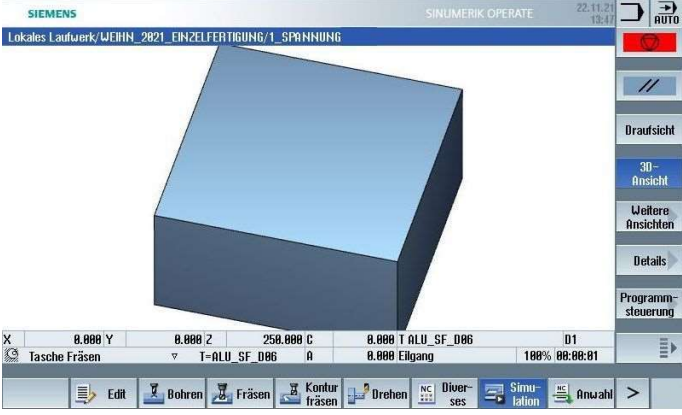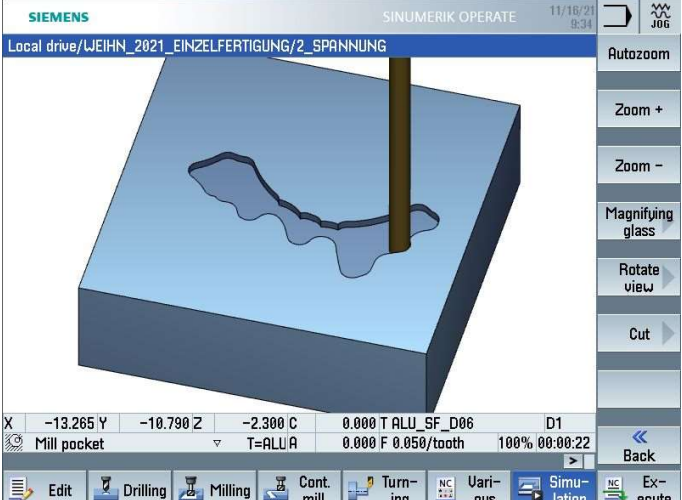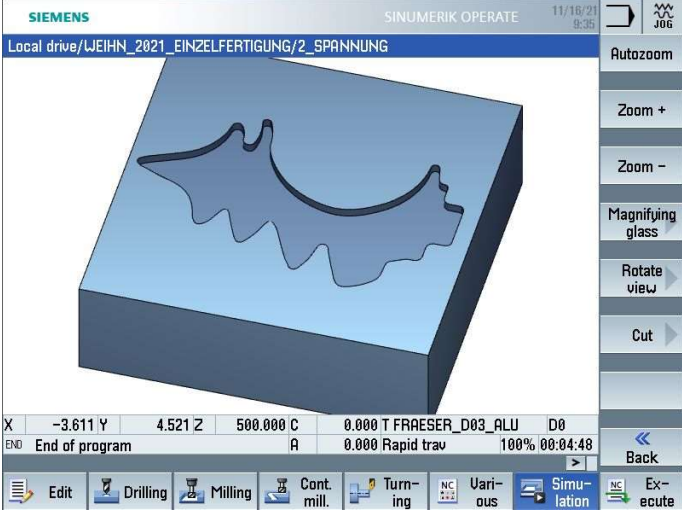
## 7.2 Working through the ShopMill machining plan "1_SPANNUNG.MPF"

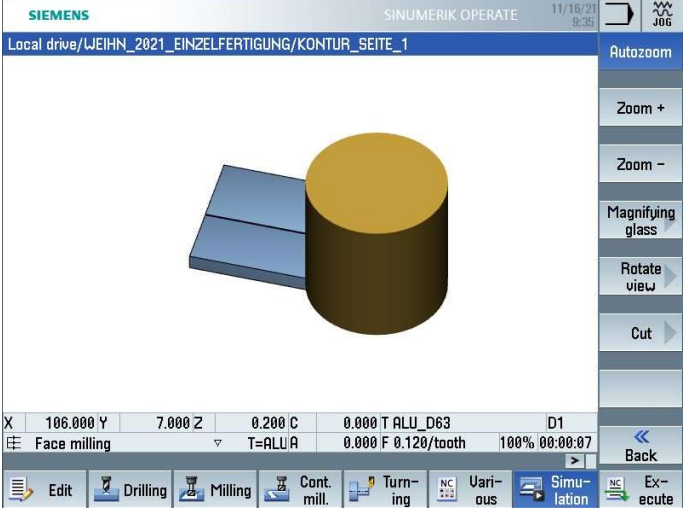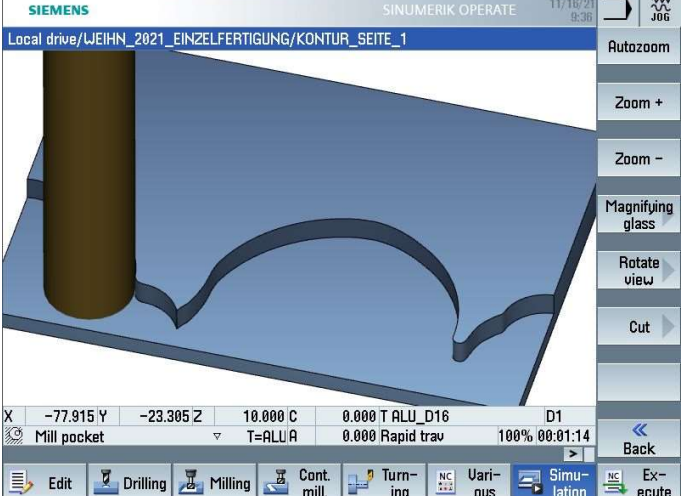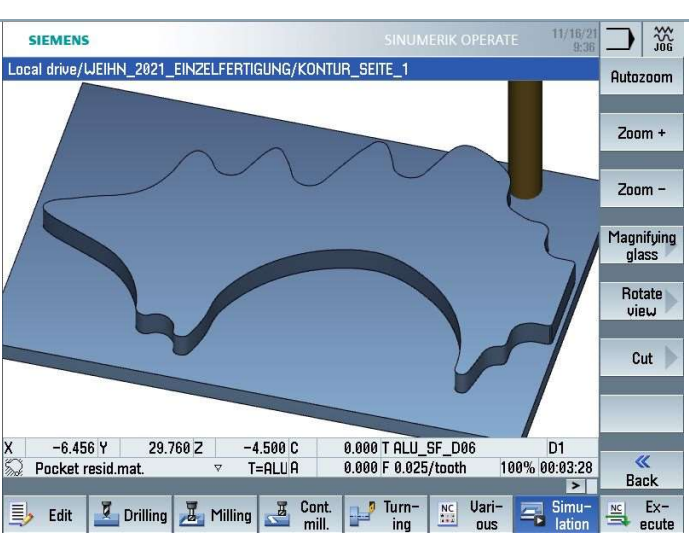| Machining step | Image |
|---|---|
| Clamp both blanks for the fixture with the required distance between them (approx. 5 to 10 mm). This is not visible in the simulation; a virtual blank is used, which represents the two real clamped aluminum blocks. |  |
| Milling the pocket for the 1st clamping of the subsequent workpiece |  |
| Finished 1st clamping fixture in the simulation |  |

| | |
|---|---|
| Finished 1st real clamping fixture |  |

## 7.3 Working through the ShopMill machining plan "2_SPANNUNG.MPF"

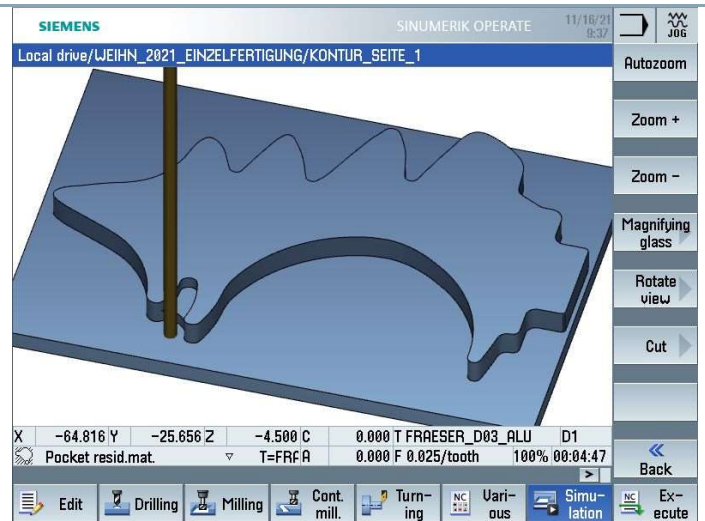| Machining step | Image |
|---|---|
| Clamp both blanks for the fixture with the required distance between them (approx. 5 to 10 mm). This is not visible in the simulation; a virtual blank is used, which represents the two real clamped aluminum blocks. |  |
| Milling the inner contour for the 2nd clamping of the subsequent workpiece. The workpiece is milled in several steps using milling cutters with different diameters.<br><br>*Note: This requires SINUMERIK option "Machine residual material" see the NC program. If option "Machine residual material" is not available at the machine, then use the smallest milling cutter from the very start (FRAESER_D03_ALU) and then delete NC block "pocket residual material".* |  |
| Finished 2nd clamping fixture in the simulation |  |

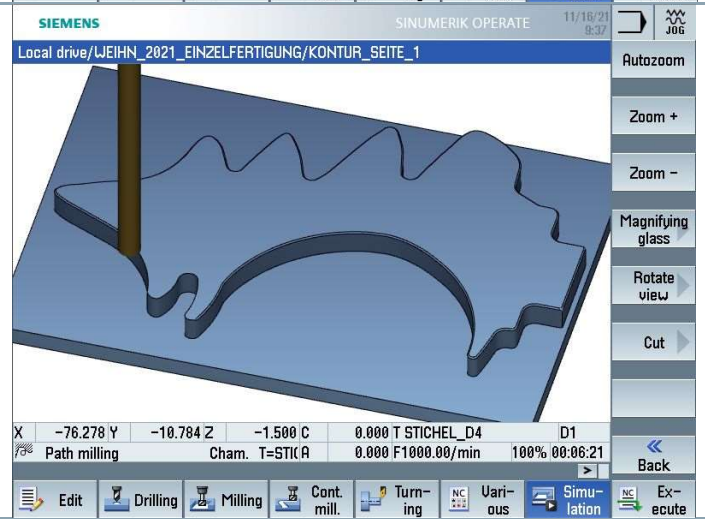| | |
|---|---|
| Finished 2nd real clamping fixture |  |
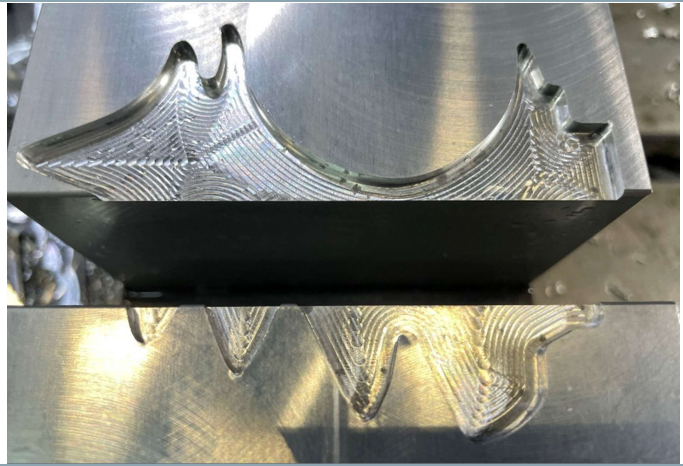
## 7.4 Working through the ShopMill machining plan "Kontur_SEITE_1.MPF"

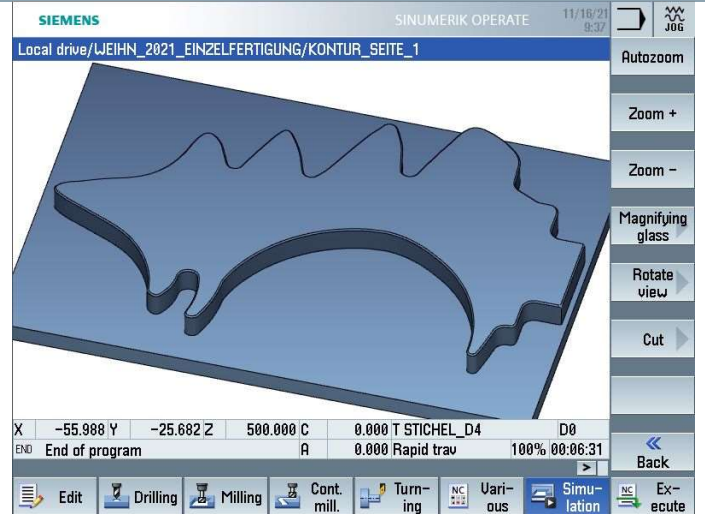| Machining step | Image |
|---|---|
| Machining starts with face milling the blank. |  |
| The outer contour is milled to the future material thickness in several steps with increasingly smaller milling cutter diameters, starting with a 16 mm milling cutter.<br><br>*Note: This requires SINUMERIK option "Machine residual material" see the NC program. If option "Machine residual material" is not available at the machine, then use the smallest milling cutter from the very start (FRAESER_D03_ALU) and then delete NC block "pocket residual material".* |  |
| Milling the contour with 6 mm milling cutter... |  |

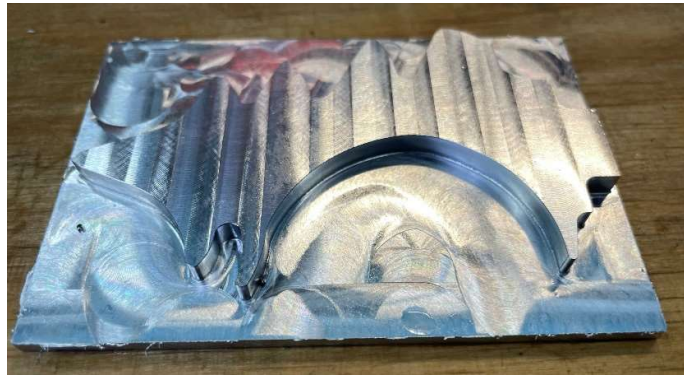| | |
|---|---|
| ... and with 2.5 mm milling cutter (FRAESER_D03_ALU) |  |
| Chamfering the contour |  |
| Final state in the first clamping in the simulation |  |

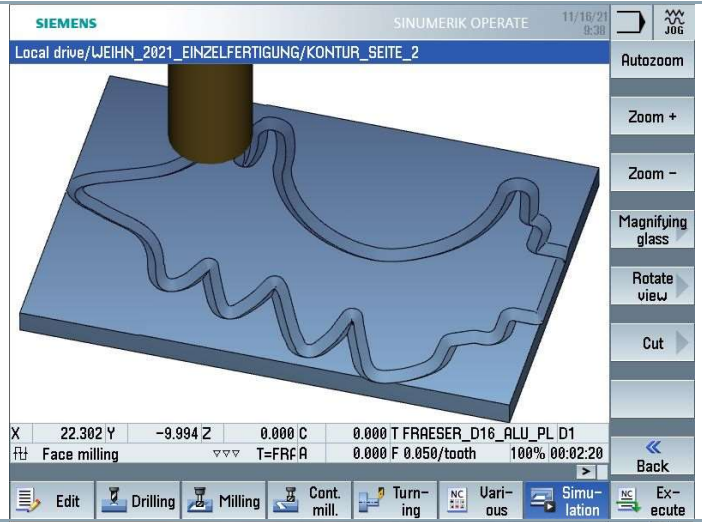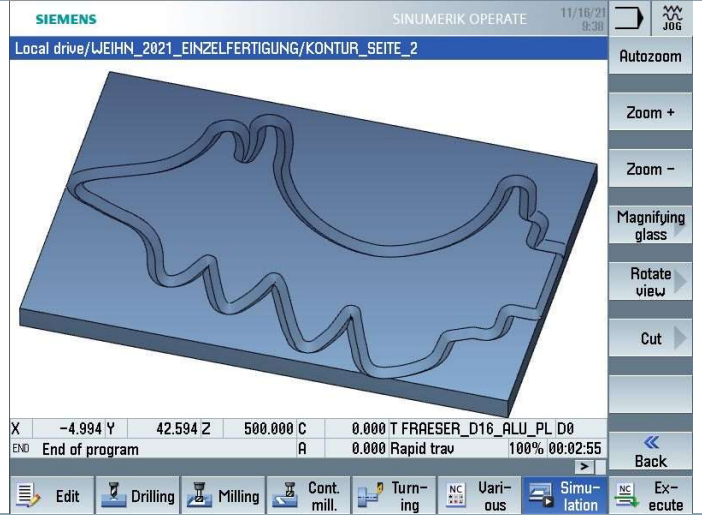| |  |
| Final state in the first real clamping |  |

## 7.5 Working through the ShopMill machining plan "Kontur_SEITE_2.MPF"

| Machining step | Image |
|---|---|
| Preparing the 2nd clamping fixtures, clamping the workpiece machined in the first clamping operation with the contour facing down. In the first machining step, the contour is milled from the opposite side. |  |
| The excess material is removed down to the required material thickness (see 1st clamping). In the simulation, the machining result appears as surface, in reality, the rear of the contour milled in the material in the first clamping is seen. |  |
| The contour (not visible in the simulation) is now chamfered from the 2nd side. |  |

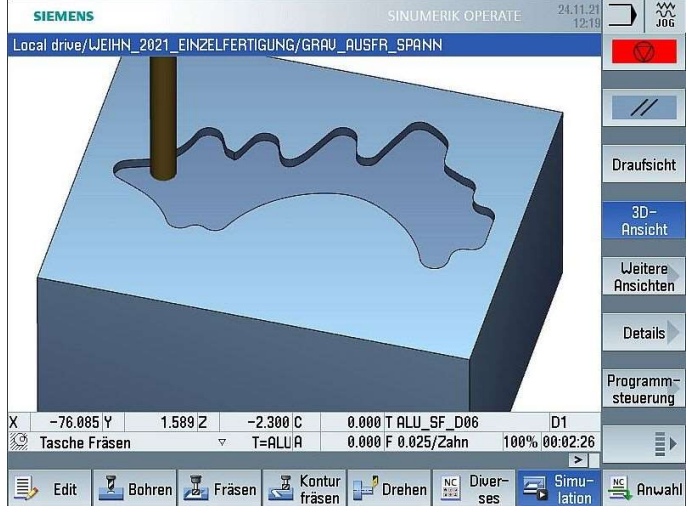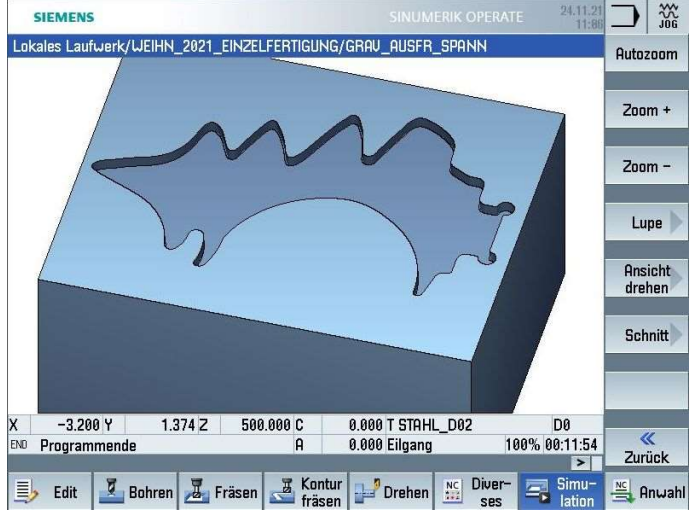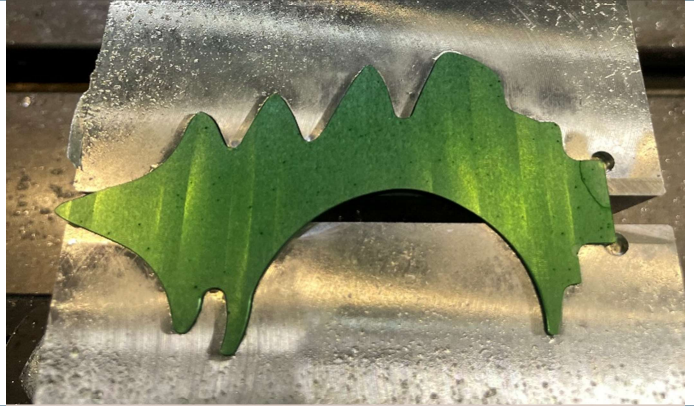| | |
|---|---|
| The surface is then finely finished using the 16mm milling cutter |  |
| Machining result of the 2nd clamping in the simulation |  |
| Real machining result of the 2nd clamping operation |  |

## 7.6 Working through the ShopMill machining plan "GRAV_AUSFR_SPANN.MPF" (optional)

Soft clamping jaws should be used for engraving if the milled part was colored before engraving.

| Machining step | Image |
|---|---|
| Clamp both blanks for the soft clamping fixture with the required distance between them (approx. 5 to 10 mm). This is not visible in the simulation; a virtual blank is used, which represents the two real clamped blocks of soft clamping material. |  |
| Milling the inner contour for the clamping of the milled part during engraving. The workpiece is milled in several steps using milling cutters with different diameters.<br><br>*Note: This requires SINUMERIK option "Machine residual material" see the NC program. If option "Machine residual material" is not available at the machine, then use the smallest milling cutter from the very start (in this case STAHL_D02) and then delete NC block "pocket residual material".* |  |
| Clamping fixture in the simulation |  |

## 7.7 Working through the ShopMill machining plan "GRAV.MPF", optional

| | |
|---|---|
| Clamp the workpiece (that has been colored) using the soft clamping fixtures. Load the ShopMill machining plan for engraving. Set the zero point. |  |
| Start the program and the programmed text is milled |  |

# 8   Mounting

The milled part is glued into the turned base using superglue and decorated with a small Christmas bauble.

## 9 Information in the Internet

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**Design of the parts, creation of the drawings, developing machining plans**

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