Multi-tip tools in Pro/NC

Beat Fretz

Multi-tip Tools: Since Pro/ENGINEER Wildfire 2.0

For current tools

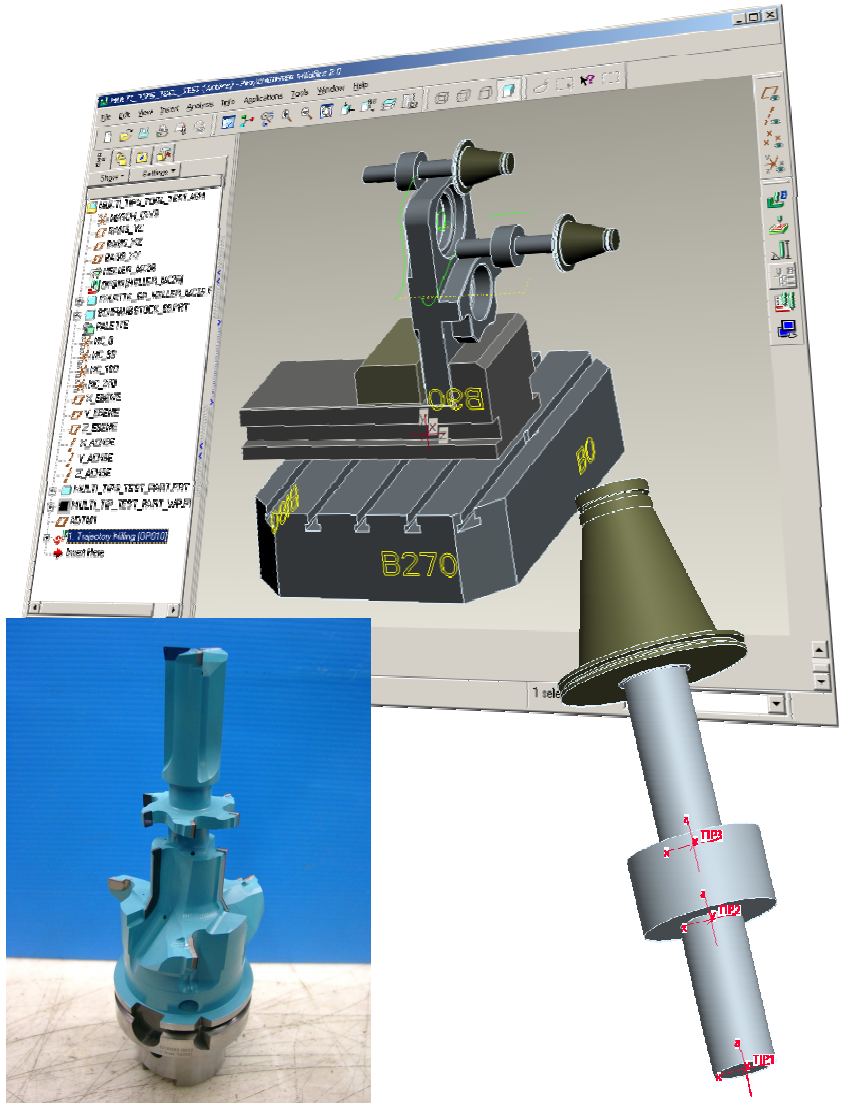
- Multiple Controlpoints (Length Offsets)
- Replacement of OSETNO_VAL and Z_GAUGE_Offset
- For all milling sequences

New Tool Type : Multi-tip

- Only for drilling (incl. Custom Cycle), and 2- / 3-axis trajectroy
- Since WF 3.0 for manual sequence
- Defined by
  - Tip #, z-offset, diameter and angle

CL Data Output

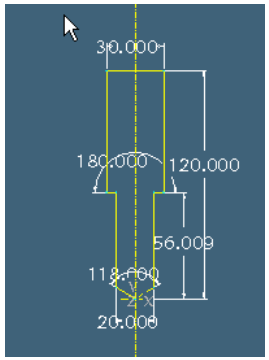
- CL coordinates in regard of tip point
- LOADTL/tool number, OSETNO, offset number
- PPRINT with additional tool information

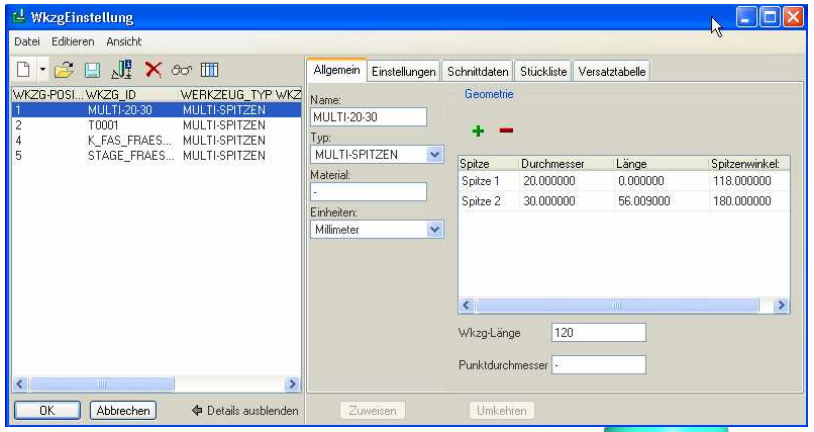


Multi-tip tools

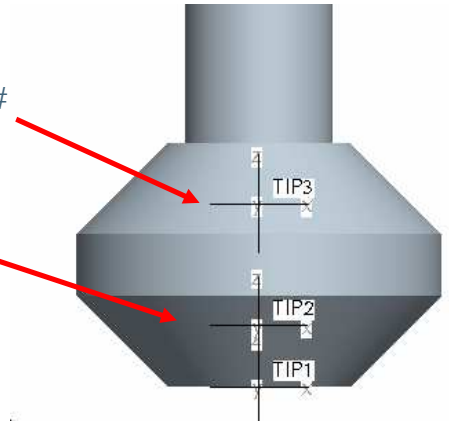
Tool definition

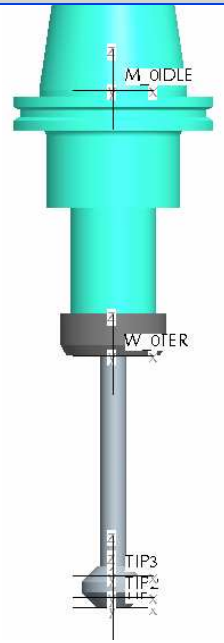
- Parameter tool
  - Simple and fast to define
  - Not suitable for all geometrical forms





- 3D model (recommended)
  - Better collision detection
  - Not limitation on geometry
    - Higher tip # can have smaller diameter than lower tip #
    - Tip point can reside anywhere on a cutting edge

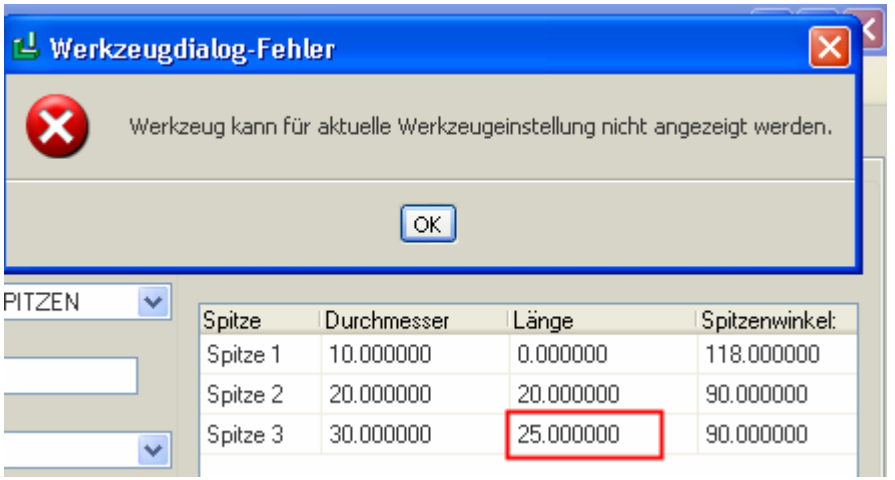


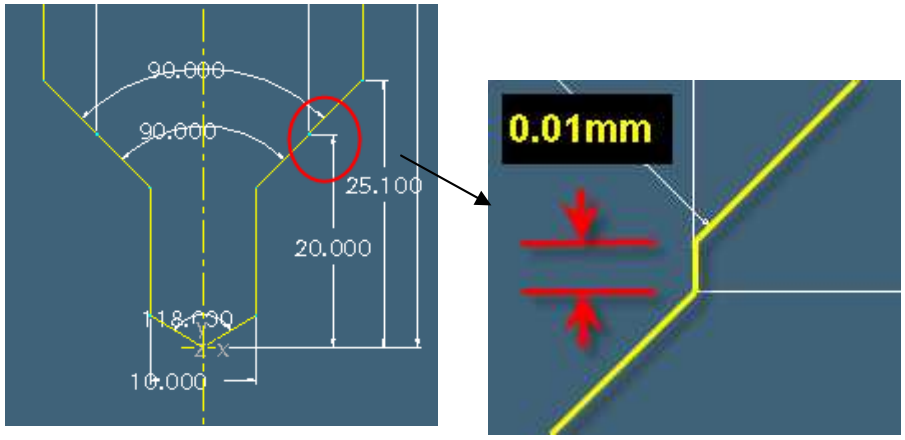


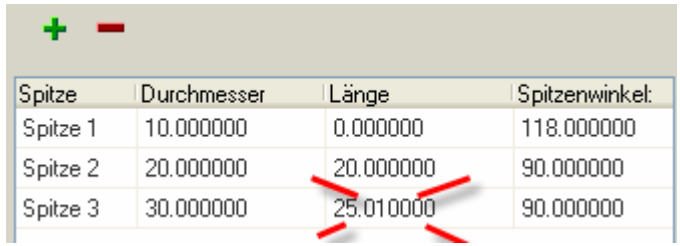
Multi-tip tools

Parameter tool

- Cannot be used for all forms !
  - Tip in the middle of a cutting edge
  - Tool cannot be viewed because, the edge length is 0 mm
  - Depending on accuracy (e.g. 0.01mm), the tool can be viewed, but
  - Careful: Such tools can often not be desplayed in shaded mode during simulation
- **Better use 3D tool instead !!**







Multi-tip tools

Setup

- Config.pro (up to Wildfire 2.0) „allow_multiple_tool_tips yes“
- PPRINTS
  - Div. Tool informations

TOOL_NAME	Ja
TOOL_TYPE	Ja
TOOL_POSITION_NUMBER	Ja
TOOL_COMMENTS	Ja
TOOL_PARAMETERS	Ja
TOOL_OFFSET_NUMBER	Ja

- „TIP_CONTROL_POINT YES“

TIP_CONTROL_POINT	Ja

  - TOOLINFO START
  - TOOLINFO_END

```
0   $$*       Pro/CLfile  Version Wildfire 3.0 - M040
1   $$-> MFGNO / MULTI
2   PARTNO / MULTI
3   $$-> FEATNO / 534
4   MACHIN / UNCX01, 1
5   $$-> CUTCOM_GEOMETRY_TYPE / OUTPUT_ON_CENTER
6   UNITS / MM
7   PPRINT / TOOL NAME : STAGE_FRAESER_1
8   PPRINT / TOOL_TYPE : MULTI_TIP
9   PPRINT / TOOL POSITION NUMBER : 5
10  PPRINT /           TOOL COMMENTS
11  PPRINT / STUFENWERKZEUG
12  PPRINT / TOOL OFFSET NUMBER : 1
13  $$ TOOL_INFO_START
14  PPRINT / TOOL TIP CONTROL POINT : 1
15  PPRINT / TOOL LENGTH OFFSET : 0.000000
16  PPRINT / TOOL DIAMETER : 35.000000
17  PPRINT / TOOL COMMENT : stufe1
18  $$ TOOL_INFO_END
19  LOADTL / 5,  OSETNO,  1 $$-> stufe1
20  $$-> CSYS / 1.0000000000, 0.0000000000, 0.0000000000, 0.0000000000,  $
21          0.0000000000, 1.0000000000, 0.0000000000, 0.0000000000,  $
22          0.0000000000, 0.0000000000, 1.0000000000, 0.0000000000
23  SPINDL / RPM, 500.000000,  CLW
24  COOLNT / ON
```

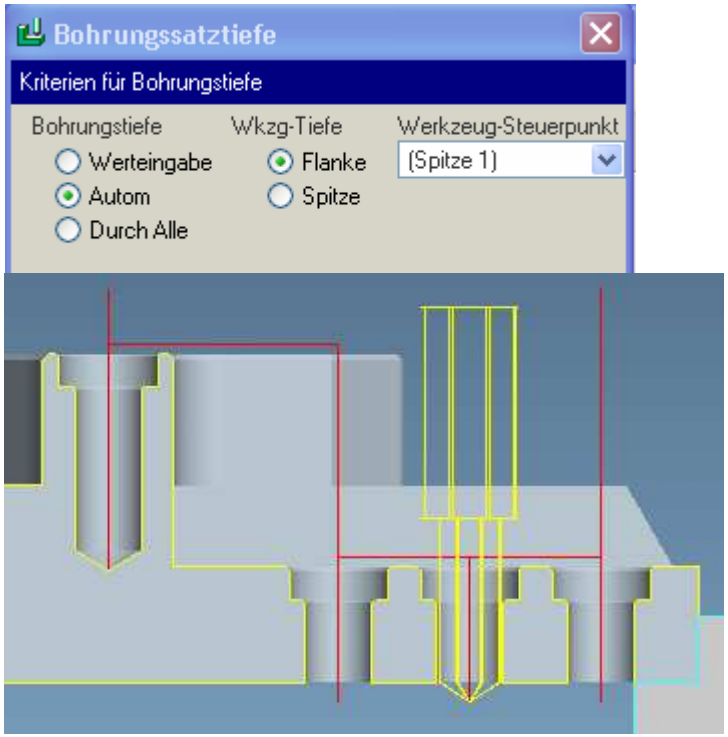
- LOADTL ,5 / OSETNO ,1 / $$-> stufe 1
  - Tool # / Offset # / Comment per tip

Multi-tip tools – Standard Drilling

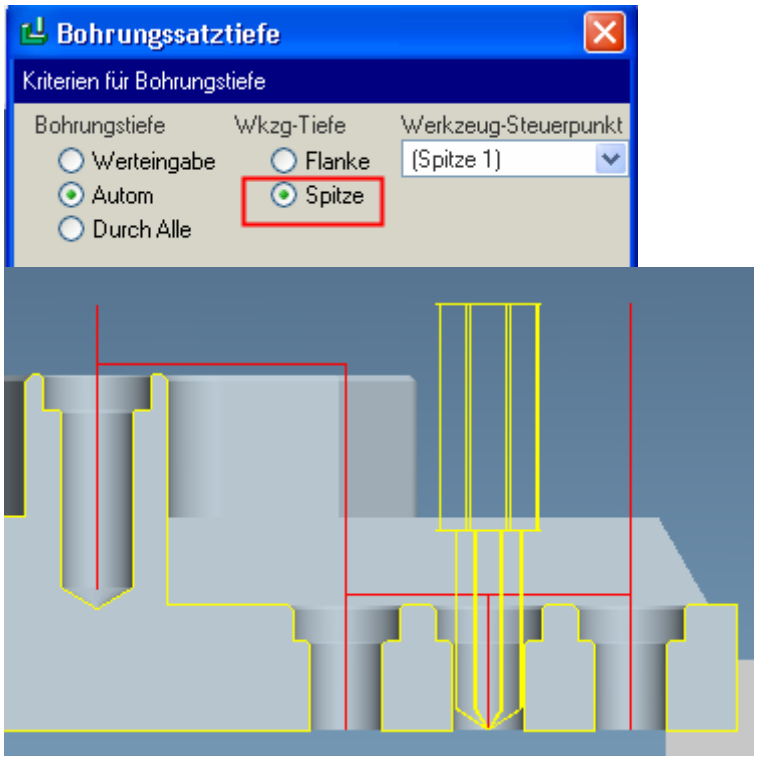
Standard drilling using Tip 1

- Selection of Tip number and tool depth reference

Tool depth = Shoulder
Tool Tip Point = Tip 1



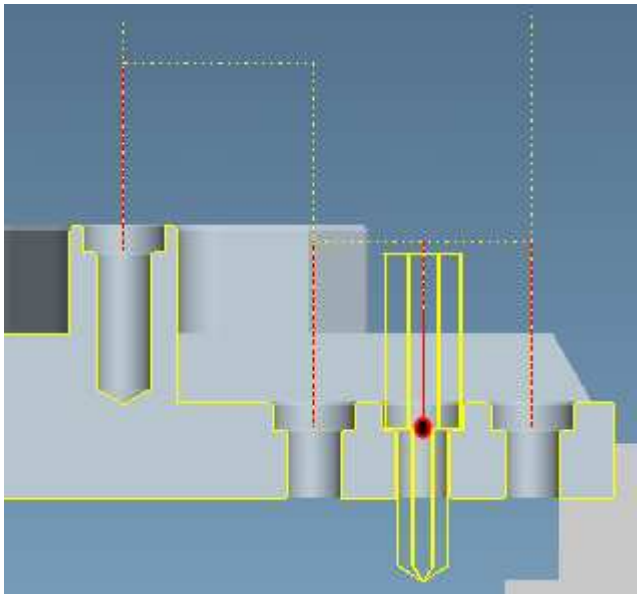
Tool depth = Tip
Tool Tip Point = Tip 1



Multi-tip tools – Standard Drilling

Standard drilling using Tip 2

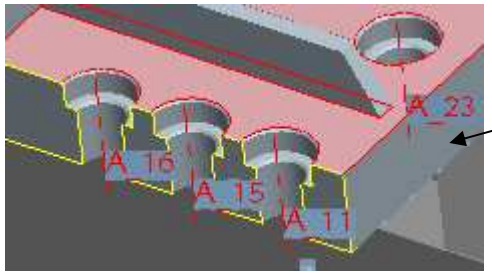
- Selection of Tip number and tool depth reference
- Automatic Hole depth recognition
- Clearance automatically in regard of lowest tool tip point

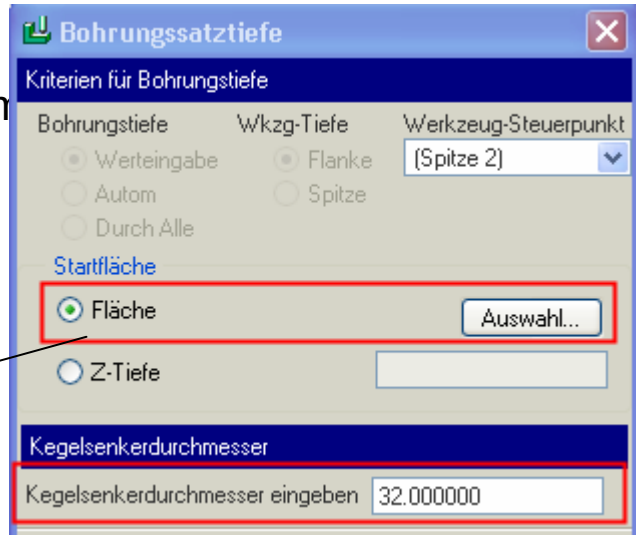


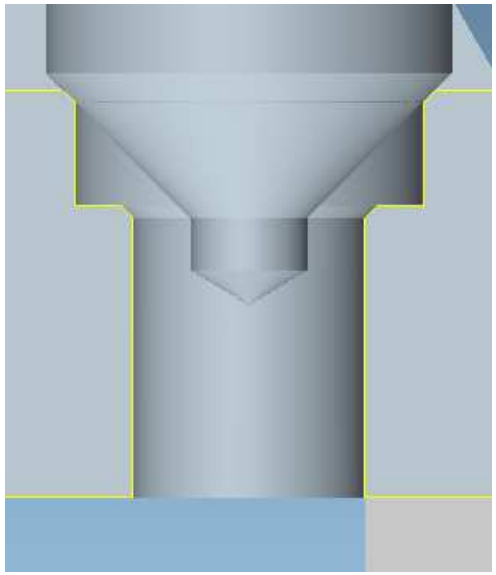
Multi-tip tools – Countersink

Countersink

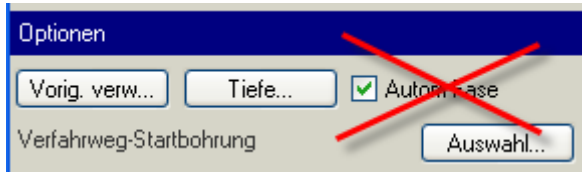
- Selection of tip to be used
- Selection of start surface
- Definition of countersink diam

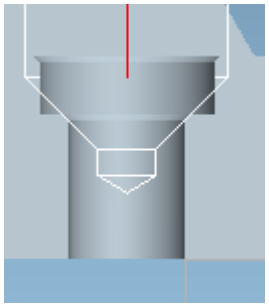






- Note: Use of „Auto Chamfer“ is not recommended
  - Can lead to unpredicted results



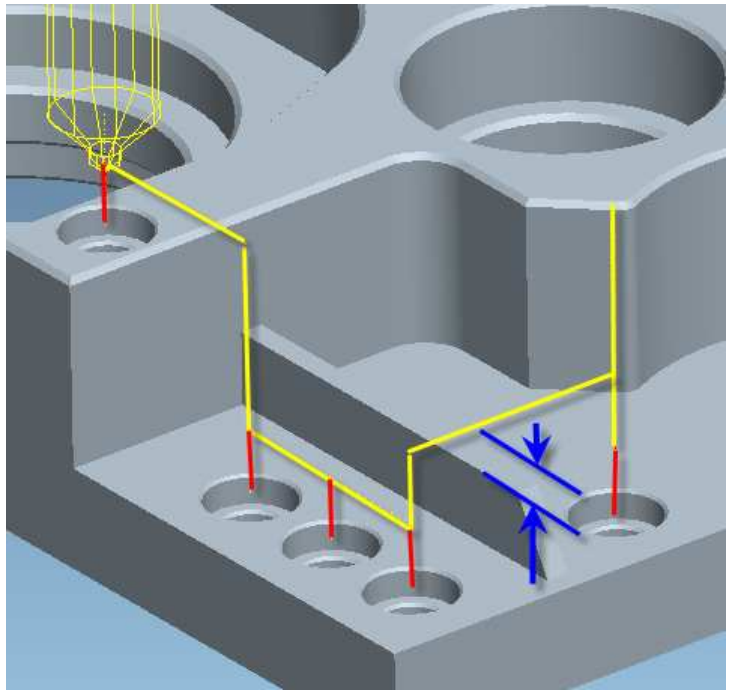


Multi-tip tools – Countersink

Collision detection

- Reference part selected as check surface
- Results in shortest collision free tool path
- Collision detection in regard of lowest tip point, eventhough the current tool path uses only Tip 2 for machining

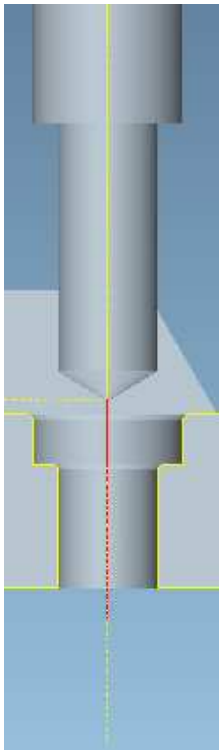
Countersink with Tip 2



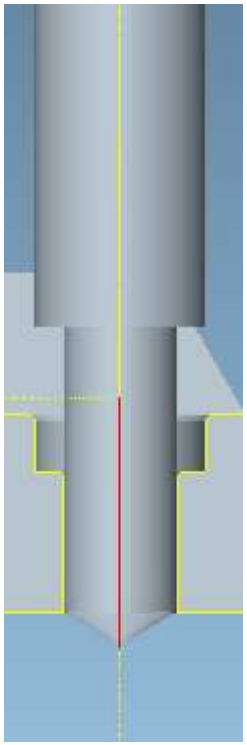
Multi-tip tools – Custom Cycle

Custom Cycle

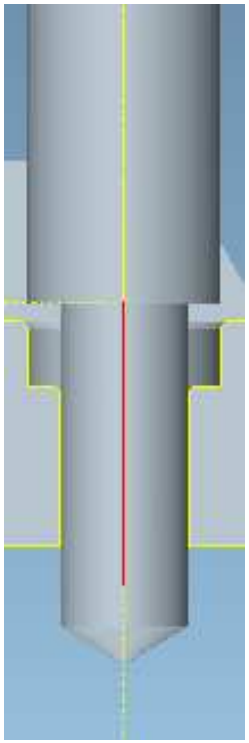
- Drilling (Tip1, S1, F1) und 180 degrees sinking (Tip2, S2, F2)



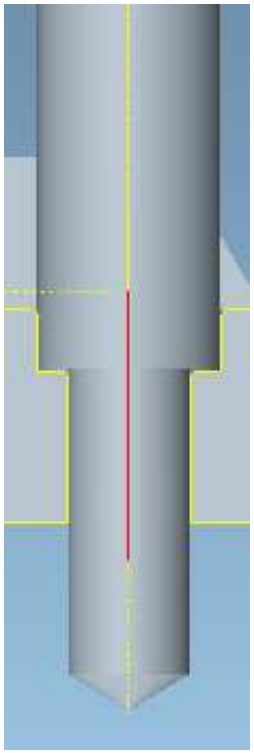
Tip1
S= S1
F=Rapid



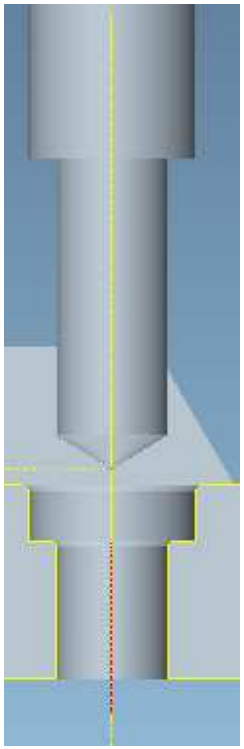
Tip1
S= S1
F=Feed1



Tip2
S= S2
F=Rapid



Tip2
S= S2
F=Feed2

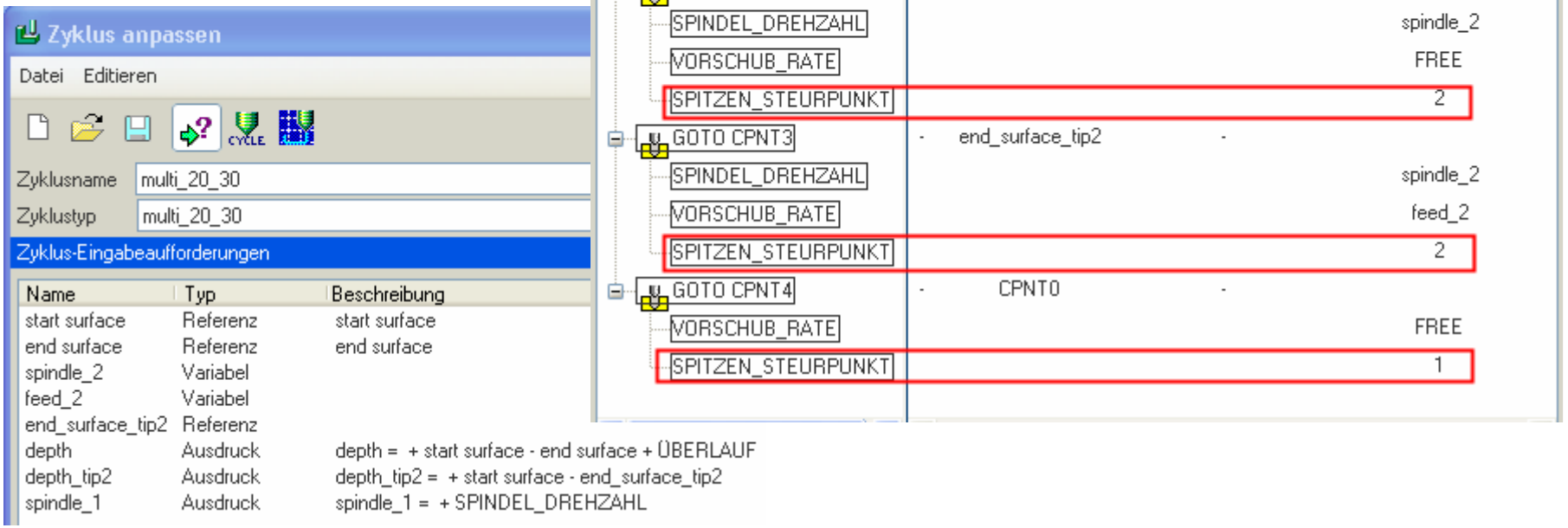


Tip1
S= S1
F=Rapid

Multi-tip tools – Custom Cycle

Definition of cycle

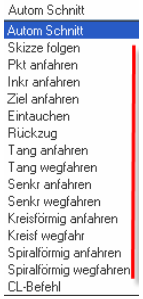
- Selection of references
- Definition of variables
- Selection of Tip #

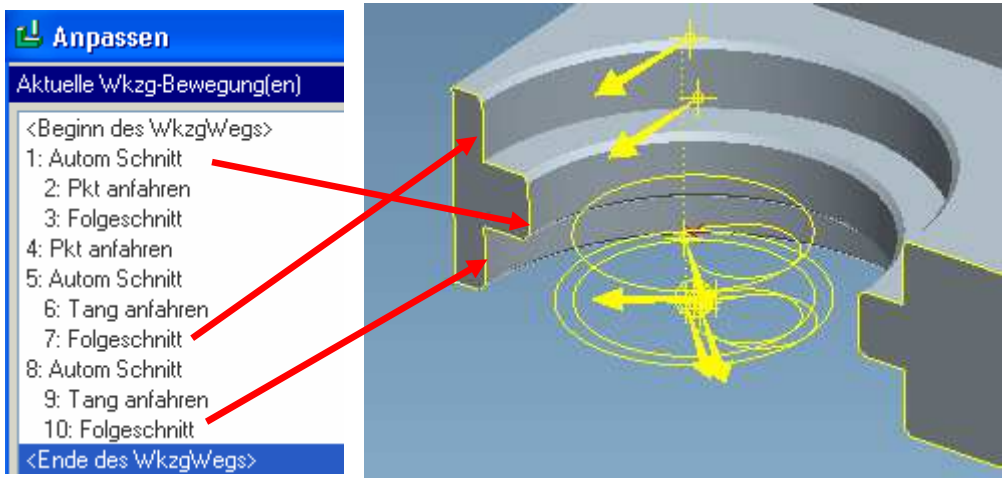


Multi-tip tools – trajectory milling

Trajectory

- One automatic_cut per machining geometry
- Optimised connections
  - Goto Point
  - Tangent etc..





- Different parameter setting per cut

	5. LEIT_GR_BOHR...	Wkzgsteuerungs-ka...	Wkzgsteuerungs-ka...	Wkzgsteuerungs-kante ID 544
VORSCHUB				
SCHNITT_VORSCHUB	200	(200)	100	100

- Selection of Tip # per cut (TIP_CONTROL_POINT)

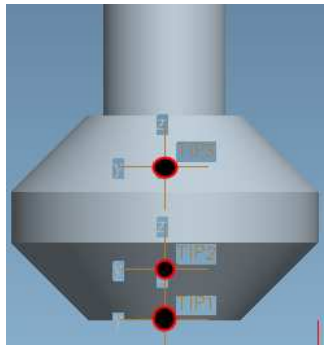
SPITZEN_STEURPUNKT	(1)	(1)	2	3
WKZGWCHSEL_SPTZ_NR	(URSPRÜNGLICH)			

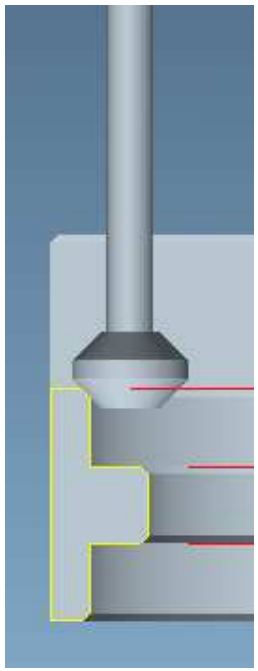
- Selection of Tip for last move (TLCHG_TIP_NUMBER = CURRENT or INITIAL)

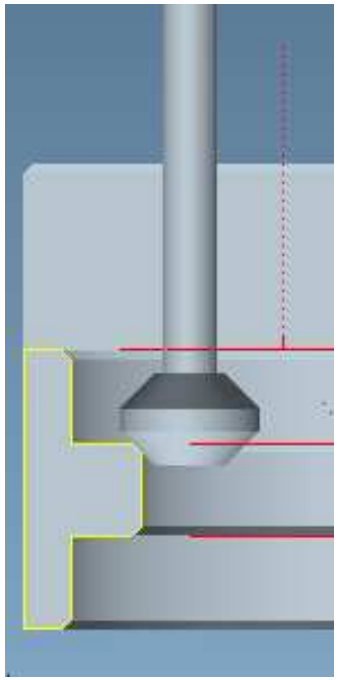
Multi-tip tools – trajectory milling

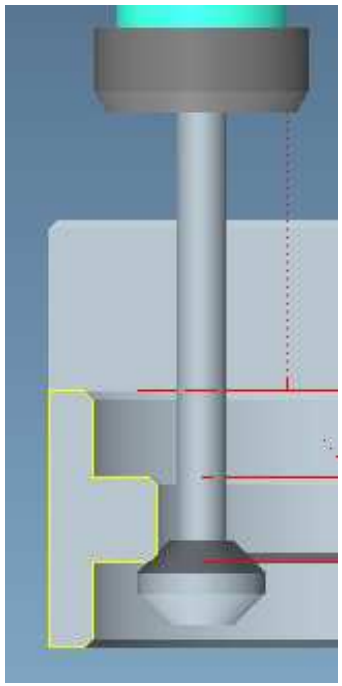
Trajectory

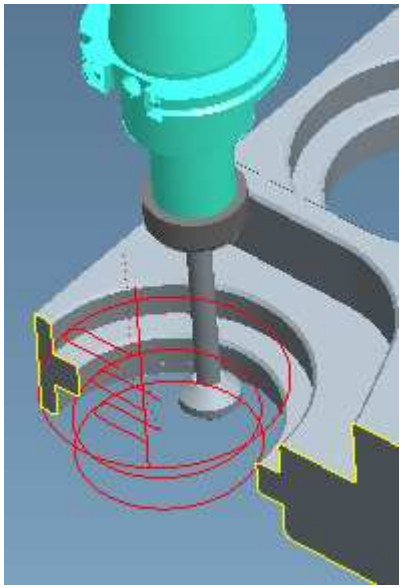
- Create chamfer with a multi-tip tool







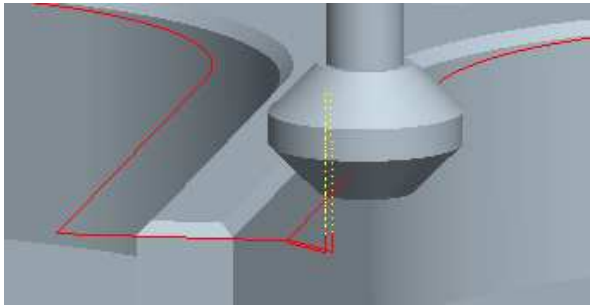


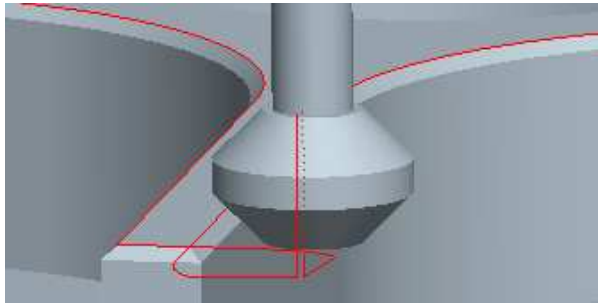


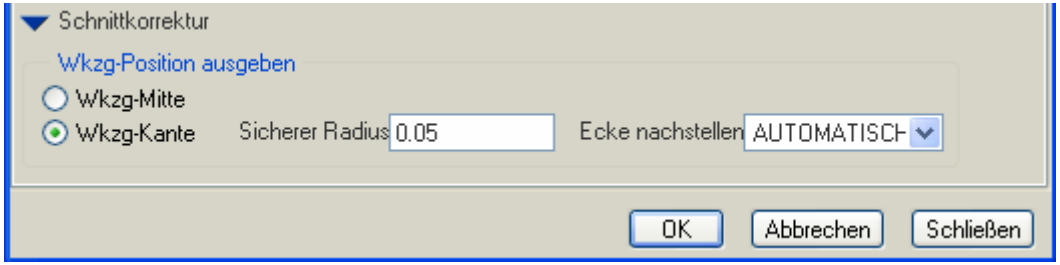
Multi-tip tools – trajectory milling

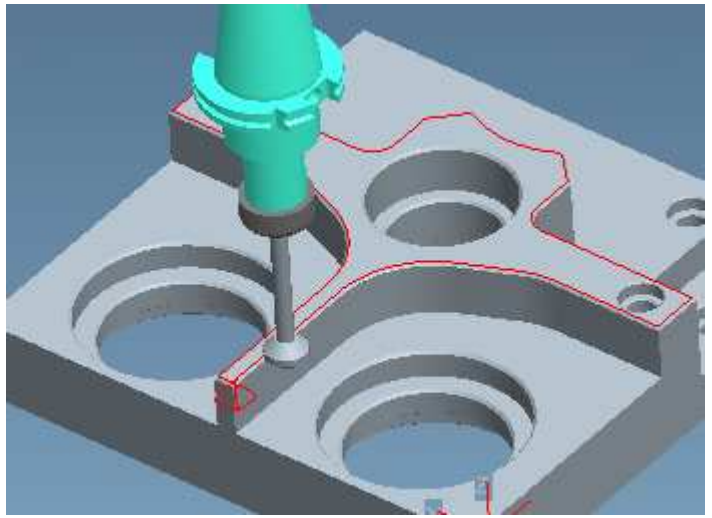
Trajectory

- Cutter Compensation
  - Tool-Center
  - Tool-Edge





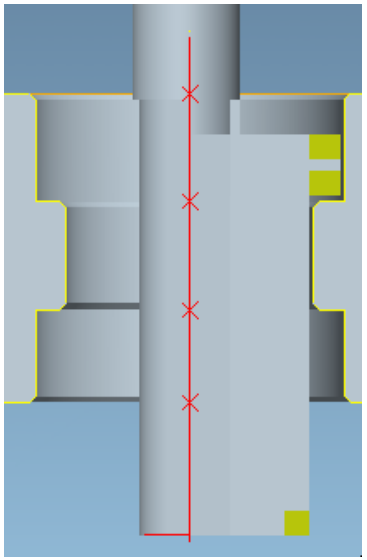


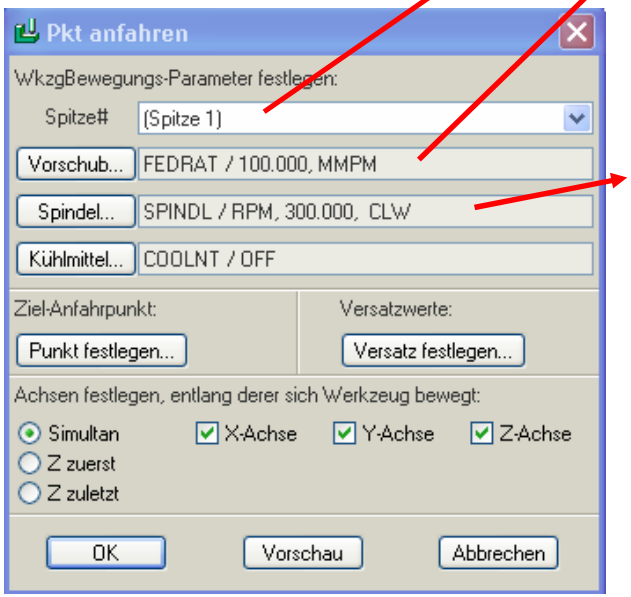


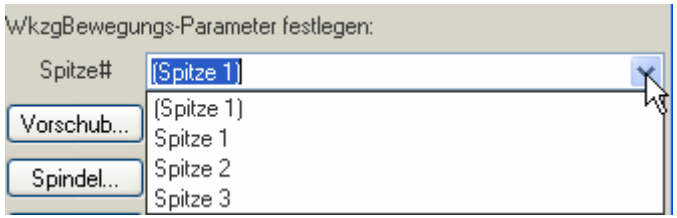
Multi-tip tools – trajectory milling

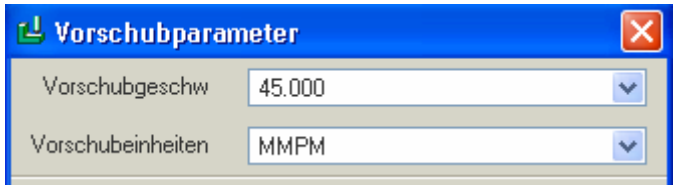
Single Step Programming

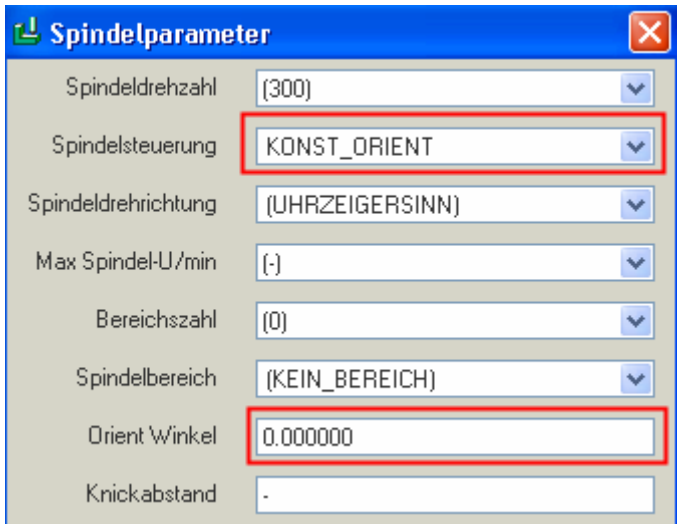
- GOTO Point
- GO_DELTA
- Selection of Tip #
- Cut feed
- SPINDLE_SPEED or SPINDLE_ORIENT







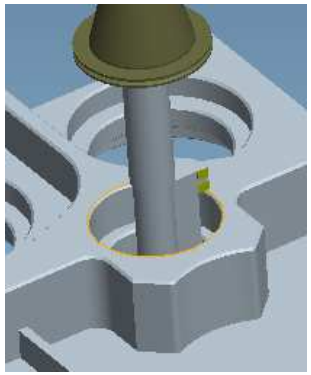


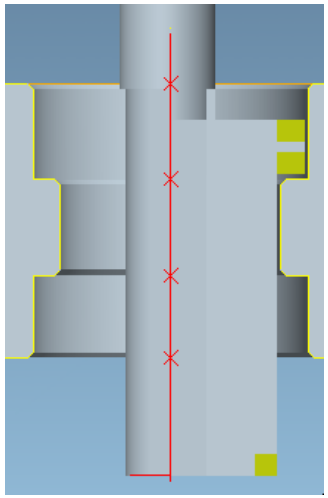


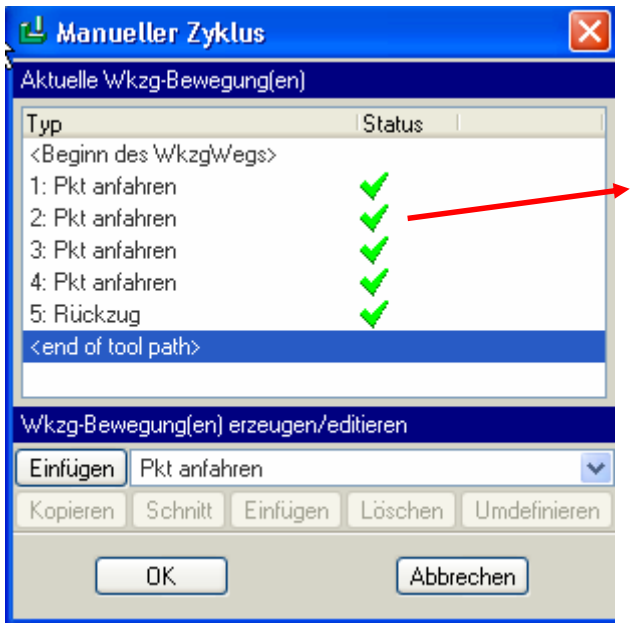
Multi-tip tools – manual cycle

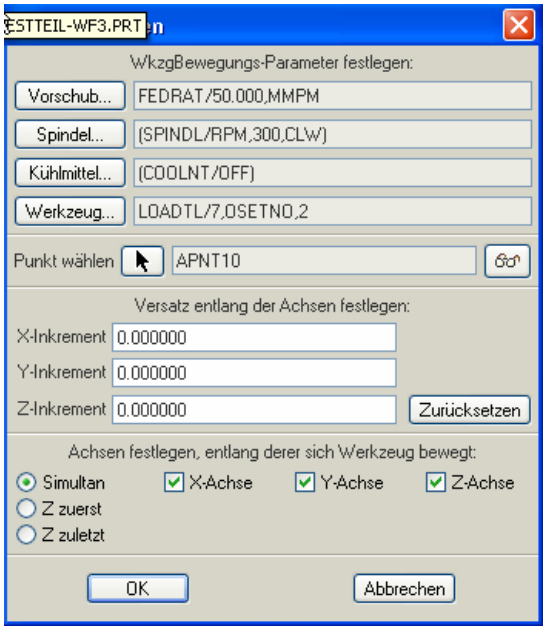
Single Step programming directly in process manager

- GOTO Point
- GO_DELTA
- Selection of Tip #
- Cut feed
- SPINDLE_SPEED or SPINDLE_ORIENT









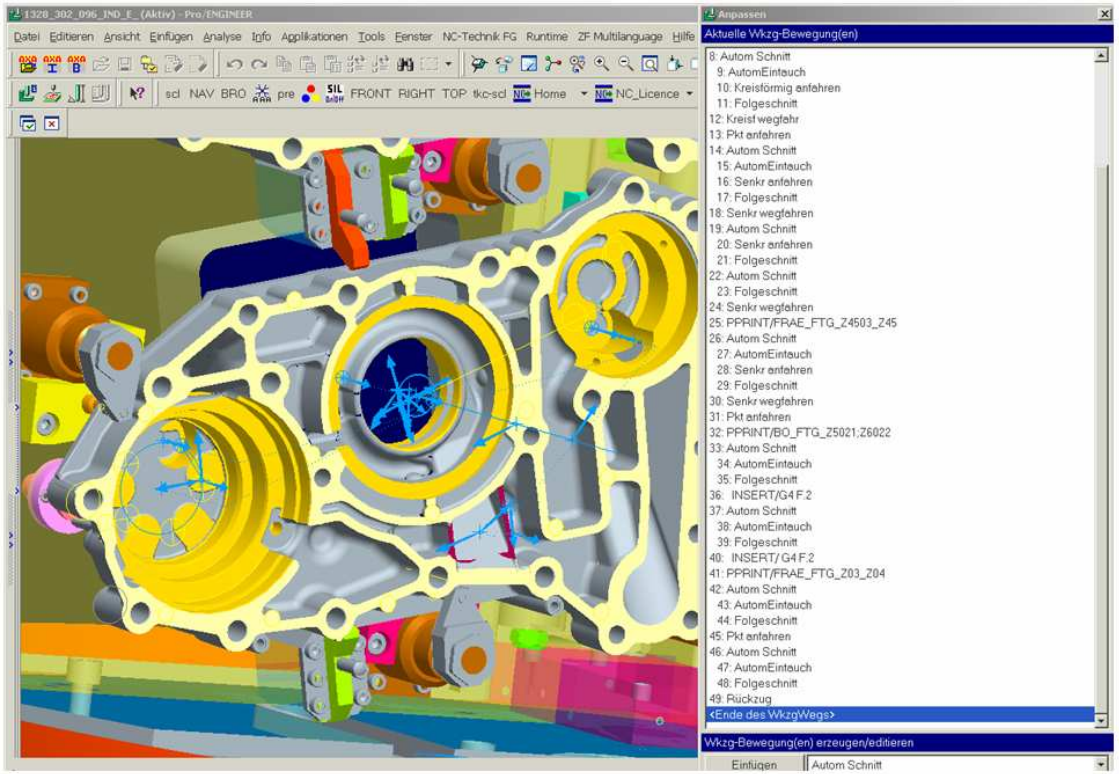
Multi-tip Tools in Pro/NC
Erfahrungen bei ZF Friedrichshafen

Winfried Geßler

Multispitzenwerkzeuge: Erfahrungen bei ZF Friedrichshafen

Stage Tool: Definition of the tool path

The whole tool path of a stage tool can be defined in a single NC-sequence. In the following example the tool path for 3 different tool tips will be defined by 10 automated steps.



IEF-N Geßler 5 Visit at PTC July 2006 Copy right ZF

Multispitzenwerkzeug: Erfahrungen bei ZF Friedrichshafen

Stage Tool: the benefit for the Pro/NC user and ZF

The benefit:

- Simple and stable programming and simulation of the tool paths.
- Time optimized NC paths for serial production can be created because of the definition of the complete tool path by a single NC sequence.
- For each automated cut the needed tip of the tool can be chosen.
- The connection between the single working steps can be controlled by the function „Goto Point“ in an optimal manner.
- Very good process stability by saving all tool dependent data in the tool and not distributed over tool and NC sequence parameter.

IEF-N Geßler 6 Visit at PTC July 2006 Copy right ZF