

400 L X55.15 Y-26.721 Z69.357 A-64.165 B343.65
401 L X56.087 Y-26.499 Z69.153 A-63.959 B343.156
402 L X57.024 Y-26.277 Z68.949 A-63.752 B342.67
403 L X57.961 Y-26.055 Z68.744 A-63.544 B342.191
404 L X58.887 Y-25.801 Z68.542 A-63.331 B341.729
405 L X59.813 Y-25.547 Z68.339 A-63.117 B341.273
406 L X60.739 Y-25.293 Z68.136 A-62.902 B340.825
407 L X61.665 Y-25.039 Z67.933 A-62.685 B340.382
408 L X62.591 Y-24.785 Z67.73 A-62.467 B339.947
409 L X63.517 Y-24.531 Z67.528 A-62.247 B339.517
410 L X64.431 Y-24.247 Z67.326 A-62.025 B339.104
411 L X65.346 Y-23.963 Z67.124 A-61.801 B338.696
412 L X66.26 Y-23.679 Z66.922 A-61.575 B338.295
L X67.175 Y-23.395 Z66.72 A-61.349 B337.899
X68.089 Y-23.111 Z66.518 A-61.122 B337.509
Y-22.827 Z66.317 A-60.895 B337.115
Y-22.618 Z66.091 A-60.668 B336.722
Y-22.402 Z65.866 A-60.441 B336.329
Y-22.164 Z65.641 A-60.214 B335.936
21.925 Z65.415 A-60.0 A-60.0 B335.543
1.868 Z65.189 A-59.777 B335.150
.811 Z64.963 A-59.550 B334.757
23 Z63.6 A-59.323 B334.364
58 Z63.2 A-59.096 B333.971
24 Z63.2 A-59.096 B333.971
Z62.8 A-58.869 B333.578
Z62.8 A-58.869 B333.578

hyperMILL®

VIRTUAL Machining



NC-based simulation
and seamless networking
with the machine

SIMULATION

Perfect fusion of the virtual and real worlds

OPEN MIND has developed *hyperMILL*® VIRTUAL Machining* to evaluate, control and optimise machining processes more reliably. This highly efficient simulation solution consists of three modules: Center, Optimizer and CONNECTED Machining.

Increased safety in simulations

Actual machining situations, that is, the machine including controller and PLC, are mapped virtually and simulated based on the NC code in the *hyperMILL*® VIRTUAL Machining Center. All processes are transparent to the user, and can be analysed in detail. Real-world machine collisions, causing costly machine damage, production downtime and thereby critical delays, are avoided.

More than just simulation

Powerful optimisation algorithms ensure efficient multi-axis machining design. The *hyperMILL*® VIRTUAL Machining Optimizer automatically finds the best tilt angle, thereby ensuring seamless machining. In addition, *hyperMILL*® CONNECTED Machining enables in-depth networking and synchronisation with the machine.

Greater efficiency thanks to a new generation of postprocessors

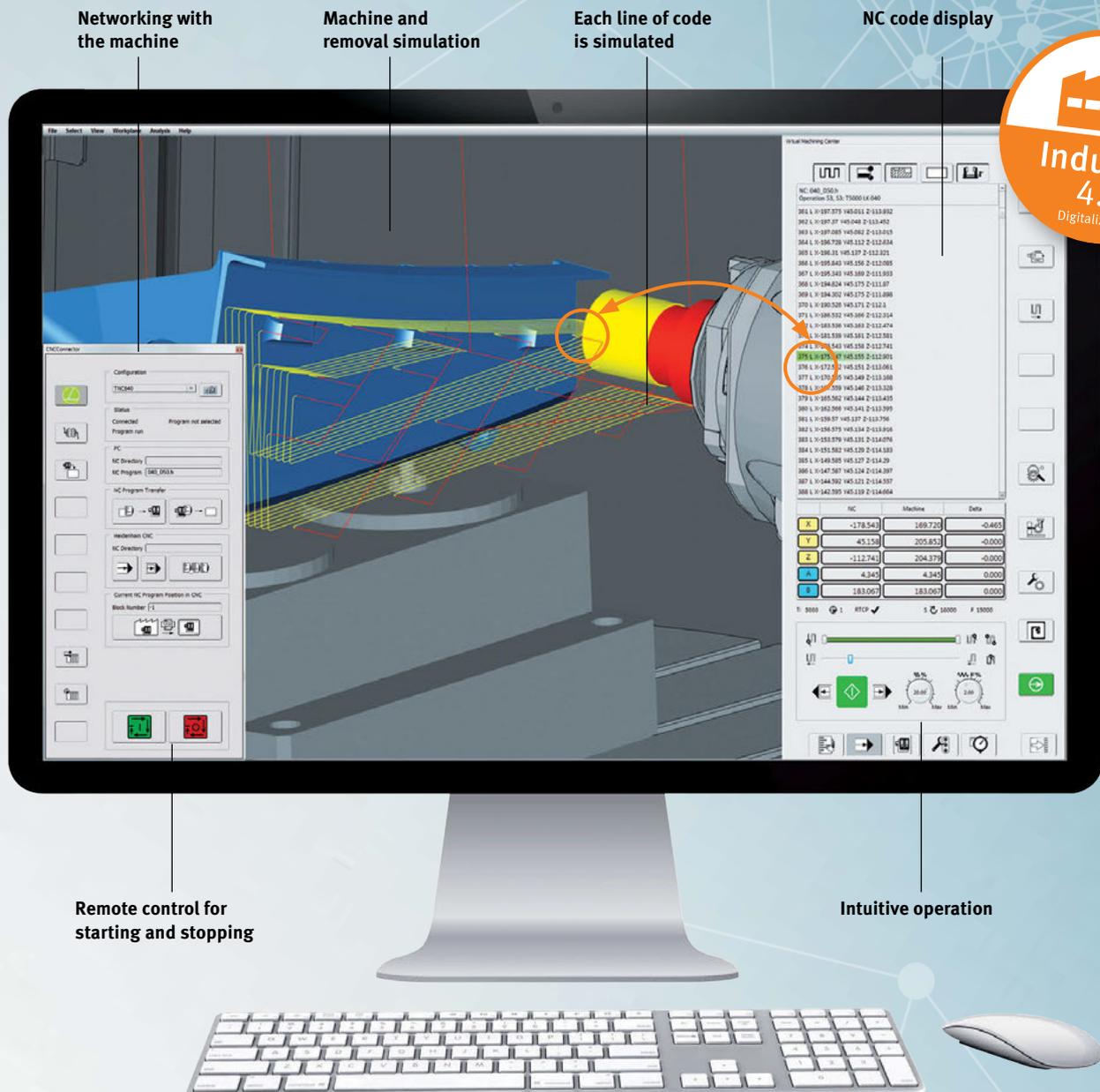
Postprocessor technology* has also been significantly further developed with the *hyperMILL*® VIRTUAL Machining simulation solution, and supplemented with many innovative functionalities. For instance, bidirectional linking is now possible between the NC program and the machining information from *hyperMILL*®. By means of this connection the respective *hyperMILL*® job can be assigned to the NC Code.

*Note: *hyperMILL*® VIRTUAL Machining requires a *hyperMILL*® VIRTUAL Machining postprocessor.



Application areas

- Checking, evaluating and optimising the machining process
- Matching a job to available machines
- Easily shifting job tasks between available machines
- Support for the acquisition of new machines
- More accurate estimation of costs for bid proposals



“The *hyperMILL*® VIRTUAL Machining Center is key to designing prove-out processes in a far more safe and efficient way.”

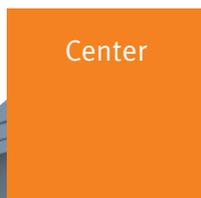
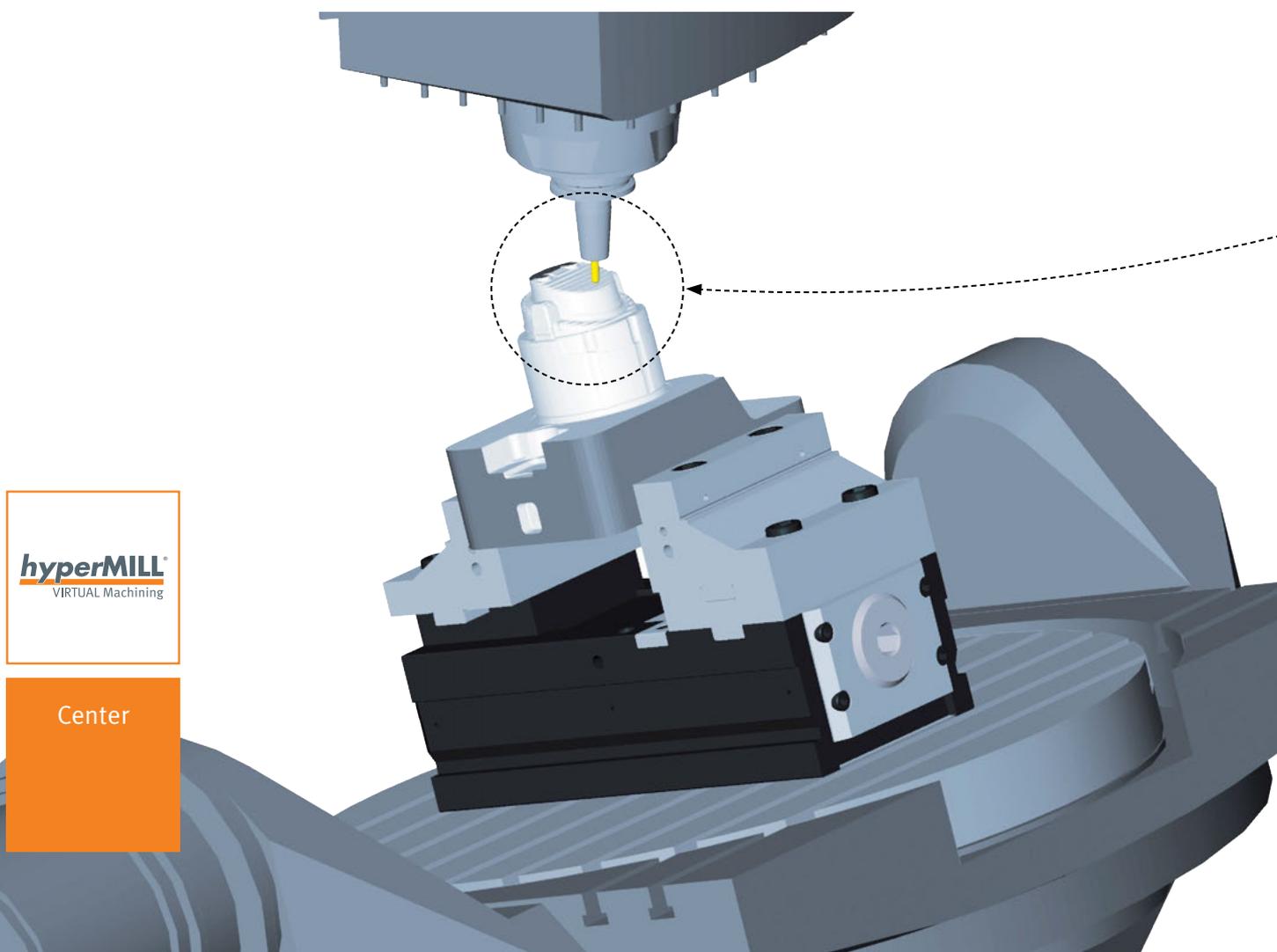
Dr Josef Koch, CTO, OPEN MIND Technologies AG

Everything for efficient simulation

The *hyperMILL*® VIRTUAL Machining Center represents the core of the new solution. This offers all the classic options for simulation, embedded in a highly intuitive user interface. Here, machine simulation is carried out with a defined machine model, taking into account the workpiece and tool as well as the tool holder, fixtures and clamps. Axes can be moved and simulated manually, and possible collisions and limit switch traversals are detected automatically.

Highly efficient and reliable Simulation based on NC code

Machine movements are often simulated before the postprocessor run. In these cases, there is no connection between the postprocessor and the simulation and the actual machining situation cannot be fully simulated. For this reason, OPEN MIND has decided to go one major step further with its *hyperMILL*® VIRTUAL Machining Center. The simulation is based on the NC code after the postprocessor run is completed. The code is simulated line for line, including the transition movements. This ensures that the virtual machine movements fully correspond to the actual machine movements. As such, the NC-based machine simulation assures reliable collision detection and safer and more efficient prove-out processes.



Features

- Simulation based on NC code
- Bidirectional linking of NC block and *hyperMILL*® job enables quick comparison of the respective machining job
- Full simulation of all movements, including transition movements
- Quick collision check that can be carried out independently of the simulation
- Interactive placement of workpiece and fixtures
- Manual movement of the virtual machine
- Approach of target points with and without Rotating Tool Center Point (RTCP)
- Display of axis limits
- Comprehensive analysis functions
- Fast comparison of the programmed datum points and tools with the actual machine configuration

Clear program management

All main and sub programs are mapped in a clear structure. Individual operations can be simulated separately, or used as a starting point for the simulation.

Insert

- ◆ Tool 7, Bull Nose D12 R2
- ◆ Tool 2, Bull Nose D8
- ◆ Tool 5, Bull Nose D6
- ▢ Tool 3, Ball Mill D6
 - Operation 10, T3 5X Restmachining
- ▢ Tool 4, Ball Mill D3
 - Operation 15, T4 3D Z-Level Machining
 - Operation 16, T4 5X Rework

Intuitive user interface

The design of the user interface is based on an actual controller. Machine operators, CAM programmers and manufacturing planners benefit from the intuitive operation. This reduces the learning curve for the simulation technology to a minimum.

NC: Insert.nc
Operation 16, T4 5X Rework

63805 L X-52.972 Y-11 C311.694
63806 L X-53.928 Y-11.005 C311.307
63807 L X-54.883 Y-11.01 C310.92
63808 L X-55.361 Y-11.013 C310.726
63809 L X-55.374 Y-11.039 Z19.682
63810 L X-55.388 Y-11.065 Z19.182
63811 L X-55.634 Y-11.091 C308.865
63812 L X-55.755 Y-11.09 C308.907
63813 L X-56.018 Y-11.062 C310.941
63814 L X-56.073 Y-11.067 Z19.202
63815 L X-56.182 Y-11.076 Z19.241
63816 L X-56.334 Y-11.097 Z19.328
63817 L X-56.468 Y-11.123 Z19.439
63818 L X-56.581 Y-11.155 Z19.573
63819 L X-56.67 Y-11.192 Z19.725
63820 L X-56.731 Y-11.231 Z19.891
63821 L X-56.763 Y-11.273 Z20.066
63822 L X-56.766 Y-11.315 Z20.244
63823 L X-56.738 Y-11.357 Z20.421
63824 L Z41.502 FMAX
63825 L X-55.419 Y-11.36 Z41.495 A19.638 C311.949 F9999
63826 L X-54.1 Y-11.362 Z41.489 A19.281 C312.993
63827 L X-52.781 Y-11.364 Z41.483 A18.931 C314.074
63828 L X-51.462 Y-11.367 Z41.477 A18.588 C315.195
63829 L X-50.143 Y-11.369 Z41.472 A18.251 C316.355
63830 L X-48.824 Y-11.371 Z41.466 A17.921 C317.558
63831 L X-47.505 Y-11.374 Z41.461 A17.599 C318.803
63832 L X-46.186 Y-11.376 Z41.456 A17.285 C320.092
63833 L X-44.867 Y-11.379 Z41.451 A16.98 C321.428
63834 L X-43.548 Y-11.382 Z41.447 A16.683 C322.809

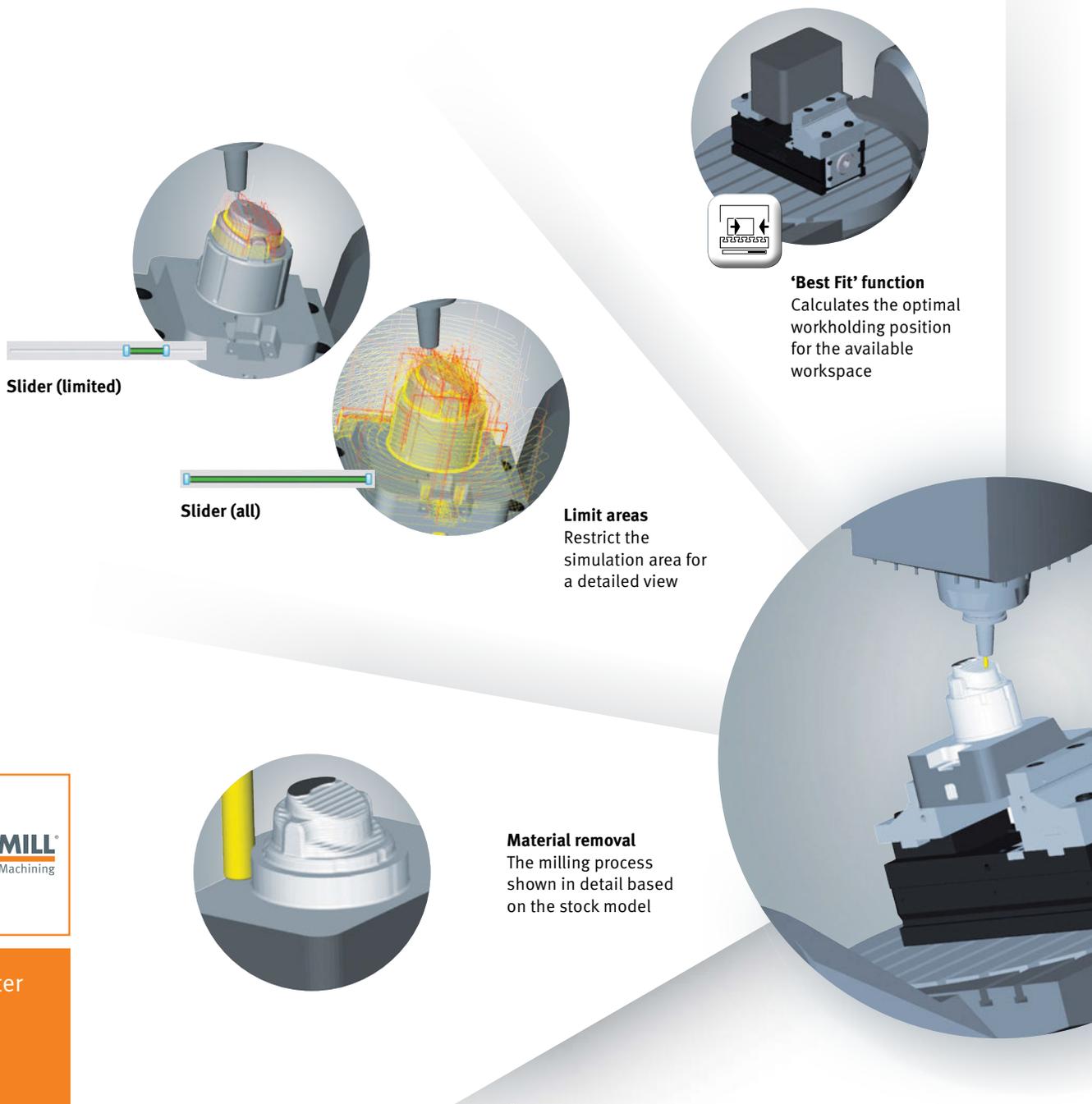
	NC	Machine	Delta
X	-54.109	-33.015	-0.268
Y	-11.006	79.872	-0.721
Z	20.182	445.217	0.262
A	20.000	20.000	0.000
C	311.234	311.234	-0.314

T: 4 1 RTCP ✓ S 6370 F 760

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Everything for illuminating analyses

Alongside efficient simulation, the *hyperMILL*® VIRTUAL Machining Center contains comprehensive analysis functions that enable detailed observation of the individual machining situations. This means that a precise check is carried out before the machine is run. This prevents errors and inefficient operations, as individual machine components are analysed to ensure that there is sufficient safety. Various technical charts provide valuable information about the quality of the machining programs. Movements, feedrates and the spindle speed are all shown. Conspicuous axis movements and accelerations can be quickly recorded and corrected before the program is run at the machine.



Slider (limited)

Slider (all)

'Best Fit' function
Calculates the optimal workholding position for the available workspace

Limit areas
Restrict the simulation area for a detailed view

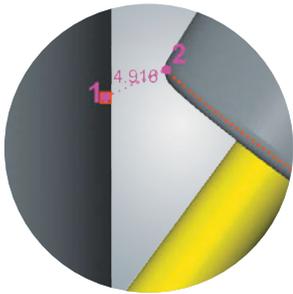
Material removal
The milling process shown in detail based on the stock model

hyperMILL
VIRTUAL Machining

Center

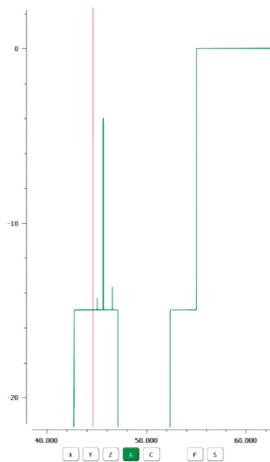
Features

- 'Best Fit' function for optimal placement of the component in the workspace
- Detailed analysis of the traverse paths
- Setting of user-defined breakpoints
- Safe workspace monitoring



Distance control
Easy measurement of distances between two components

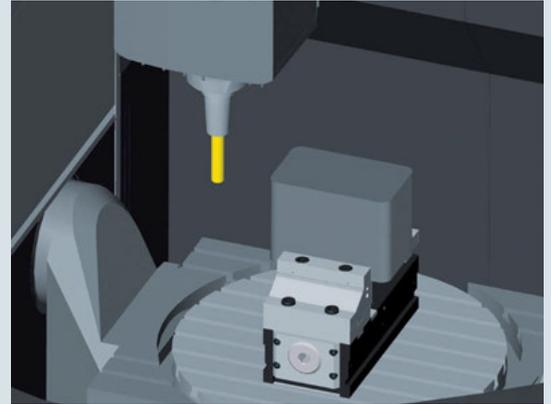
Axis diagram
Detailed analysis of machine axis movements



Flexible manufacturing planning
Tools, fixtures and stock as well as clamps can be managed manually. The user can make changes directly in the simulation environment. The changes can be previewed and stored, or not accepted as a process change.

■ Workspace monitoring

With the help of a stored machine model, the workspace monitoring checks whether any limit switches are traversed by the 2.5D, 3D, 3+2 or 5axis simultaneous machining movements. The movements of both the linear axes (X, Y and Z) and the rotary axes (A, B and C) are checked, as are the clamps and fixturing systems.



■ Setting breakpoints

The simulation can be controlled to stop at certain locations in order to reliably check critical points and estimate the subsequent processes more precisely. The breakpoints are created automatically under certain conditions, such as a tool change or a change from rapid to cut movements. Moreover, breakpoints can also be selected manually through an NC block line, or picked up from any point on the toolpath.

■ Adjusting visibility

The visibility of the individual machine components can be adjusted in order to enable optimal visualisation of the simulation. Preset machine views, such as 'Head and Table', can be called up at the push of a button.

■ Safe working space analysis

The unique Best Fit function automatically optimises the machining operation to match the available workspace. Workspace monitoring is able to indicate instances where the limit switches have been traversed but the actual workspace is still sufficient for machining. In this case, the Best Fit function automatically determines the optimal setup location for the respective workspace. This does away with the need for unnecessary set-up changes and resulting downtimes.

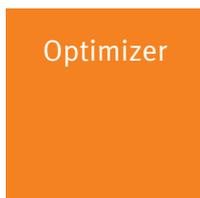
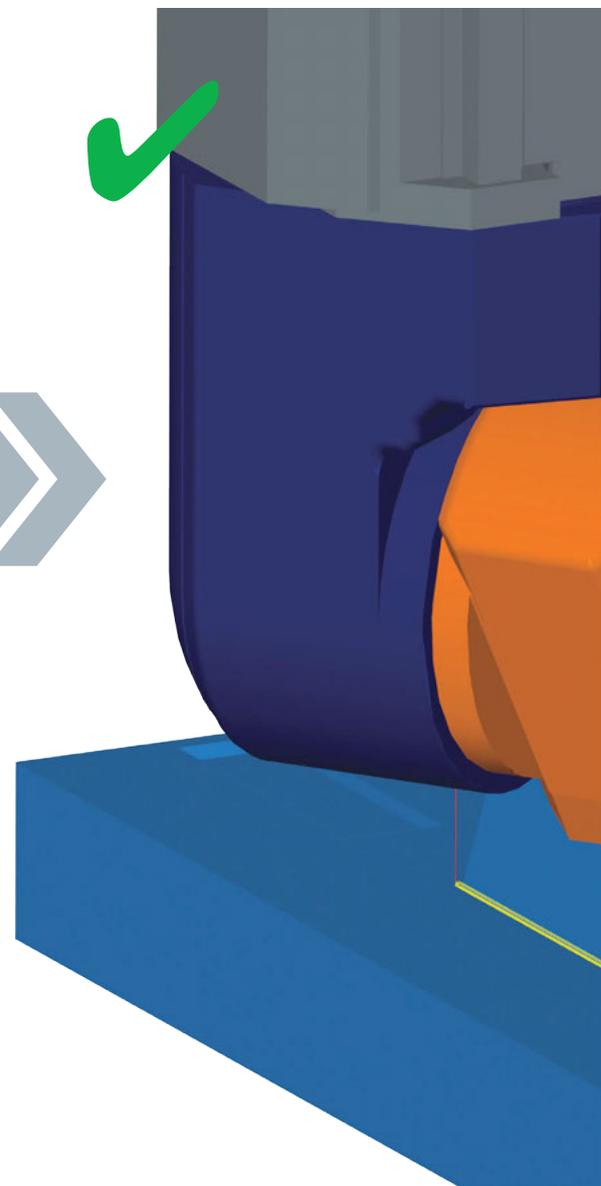
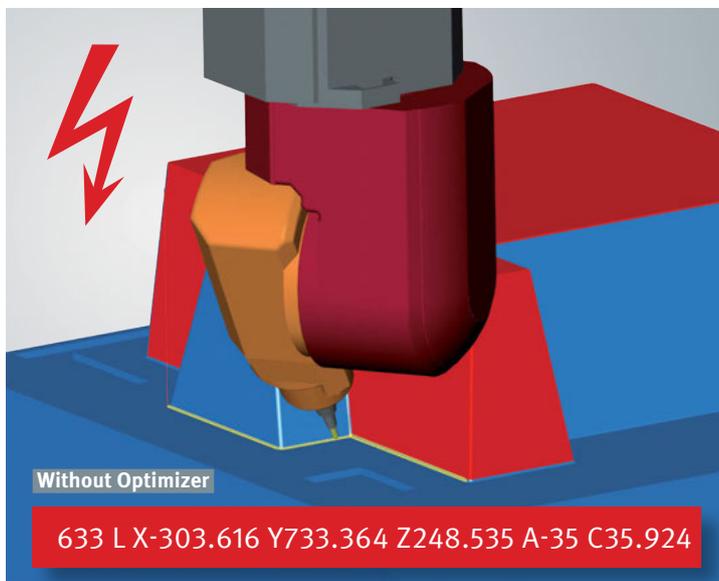
Always the best possible NC code

More axes, more solutions

There are several solutions for tool orientation in multi-axis machining. The selected solution plays a crucial role in determining machining quality and efficiency. If the user sets the axis position at certain points manually, it is often not possible to determine the best possible tool orientation due to the complexity of the decision.

Automatic solution selection optimises multi-axis positions

During the postprocessor run, the Optimizer automatically selects the best solution for collision-free orientation. Special kinematic properties and user-specific properties are taken into account for collision avoidance. Programming errors or subsequent editing of the machining program are avoided, and optimal, collision-free machining on the machine is assured.



Avoiding repositioning

In order to avoid time-consuming repositioning and retractions, the Optimizer analyses not just individual operations but entire machining sequences. Based on this analysis, the Optimizer selects the ideal solution for machining the entire sequence together, within the given machine limits.

Features

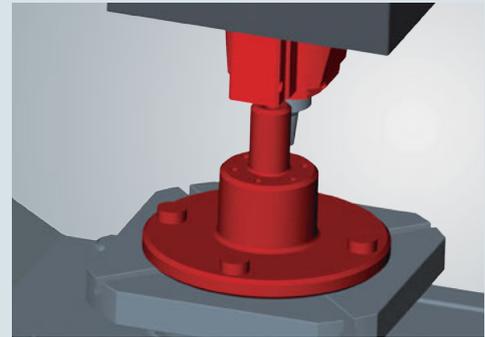
- Automatic solution selection for multi-axis positions
- Optimised movements
- Individual configuration options
- Process reliability

With Optimizer

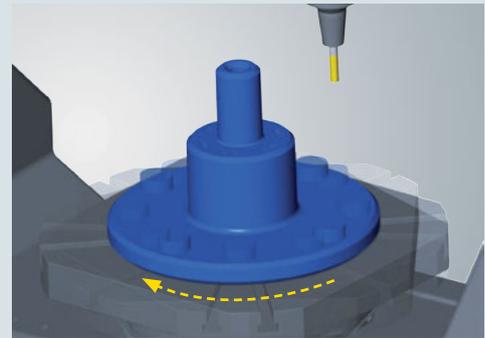
633 L X-36.390 Y926.973 Z248.535 A35 C-144.076

■ Movement optimisation

If a 3axis movement is not possible due to detected collisions, the Optimizer changes the movement with the aid of a fourth or fifth axis. In this example, the fourth position would lead to a collision with the spindle's attaching parts. For this reason, the C axis rotates so that the machining can be carried out in a collision-free manner.



Without Optimizer: Collision detected



With Optimizer: Collision free

■ Precise machining

Independent of the kinematic properties of the machine, the Optimizer automatically creates additional intermediate positions in the toolpaths. This means that soft machine movements for precise machining are also ensured near the pole.

■ Optimised movements

The movements between the individual operations are perfectly aligned with the kinematic properties of the respective machine. The Optimizer analyses these movements to avoid large compensation movements during repositioning. Meanwhile, the rotary axes are moved along the shortest path, and the movements of the linear axes are minimised. This allows greater speeds to be achieved during the movements.

Seamless networking with the machine

Closely connected

Seeing the actual machining situation in the simulation environment in real time, perfectly synchronising the machine and simulation and easily controlling machining from your laptop: Wouldn't that be incredibly efficient? This is all possible with the new *hyperMILL*® CONNECTED Machining module. The module provides bidirectional data exchanging with the machine controller, which means it can send data to the machine and execute it there, as well as receive data from the machine.

Increased safety

In-depth networking – fully in the spirit of Smart Factory – also enhances safety in the machine set-up and in machining. Should any datum points, tools or machine setting parameters not correspond to the programmed values in *hyperMILL*®, the reliable *hyperMILL*® CONNECTED Machining safety mechanism kicks in, which prevents NC program transfer to the machine and keeps the machine from starting.



NC block synchronisation

The NC block of the machine can be synchronised with the *hyperMILL*® VIRTUAL Machining Center so that the machining position of the machine simulation corresponds exactly to the actual machine position.

Datum point alignment with the real machine

The machine datum points are aligned with those of the NC program. Fixturing errors or incorrect positions are avoided.



Bidirectional connection

Features

- Readout of datum point definitions, tool data and critical machine parameters from the controller, including comparison with the data stored in *hyperMILL*®
- Quick NC program transfer
- Remote control of CNC machines
- Synchronisation of the simulation with the machine's NC block
- Reliable safety mechanisms

Automatic tool comparison

Tool data from the NC program is automatically compared with the tool data of the machine. If this data does not match, an error message is output and the program run is halted.

NC program transfer

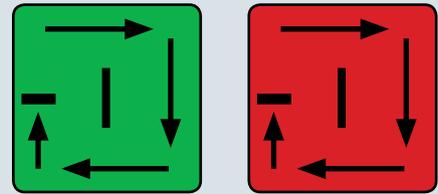
The NC program is loaded directly into the memory of the machine controller. There is no chance of program mix-ups.

■ Quick networking with the machine

hyperMILL® CONNECTED Machining seamlessly integrates into the existing user interface of the *hyperMILL*® VIRTUAL Machining Center. The connection to the CNC machine can be easily created with the click of a mouse.

■ Remote control

Seamless interaction with the machine via remote computer. This means that the program can be easily started or stopped from a PC.



■ Convenient retract movements

Thanks to *hyperMILL*® CONNECTED Machining, even difficult retract movements can be carried out.

■ Reliable safety mechanisms

- Safe collision checking
- Protection from unauthorised access
- Comparison of machining parameters
- Comparison of machine parameters
- Machine does not start until after all safety mechanisms have been checked



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We push machining to the limit

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