SINUMERIK live:
turning technologies longitudinal turning and plunge-turning

Differences and use with SINUMERIK Operate

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SINUMERIK live
- Application technology explained in an easily understandable way

Turning technologies

longitudinal turning and

plunge-turning

Differences and use with

SINUMERIK Operate

Series of videos with the aim of presenting individual topics on the practical use of SINUMERIK within a short time!

Consists of short slide presentations and **application in practice**!

Turning technologies longitudinal turning and plunge-turning
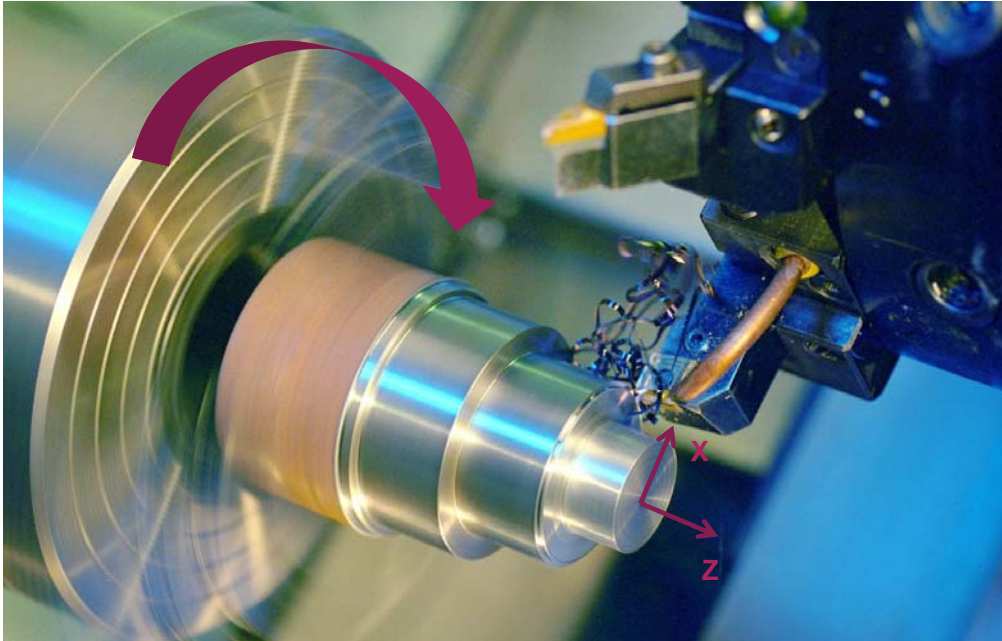## Differences and use with SINUMERIK Operate

Basics:

- For the creation of rotation-symmetrical parts (mainly axes, shafts, flanges)

- The workpiece rotates about its own axis (the axis of rotation is in the workpiece), the rotary tool traverses the contour

- Outer turning (on peripheral surface), inner turning, face turning (on face end)
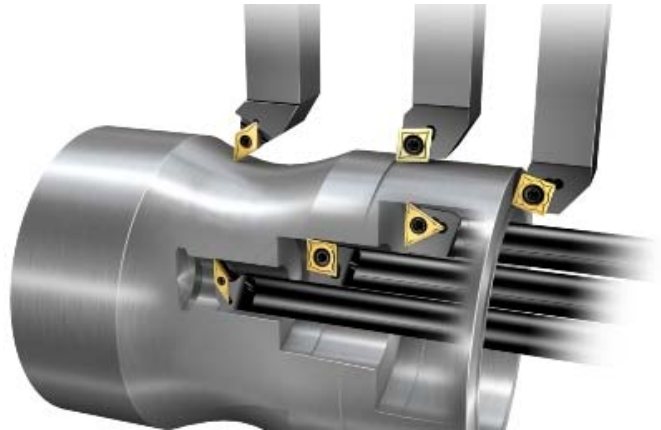
- Turning operations: X and Z axis

Classification of turning technologies:

Turning is divided into various technologies. In the SINUMERIK, all of these machining options are covered with "stock removal" (longitudinal turning), "plunge turning" and "plunge-cutting".
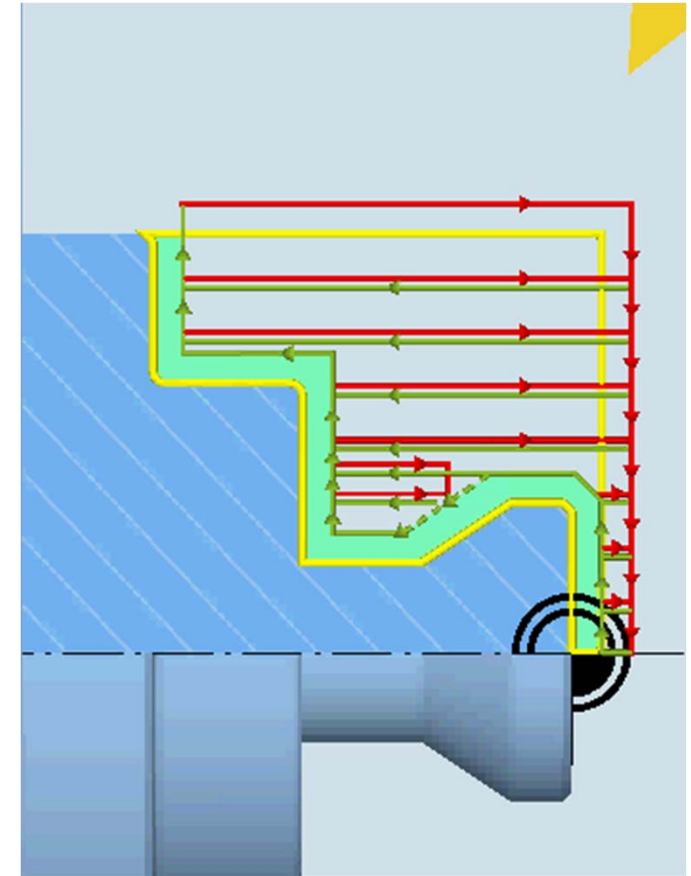
Definition of longitudinal turning:

- During longitudinal turning, the turning chisel moves in parallel to the workpiece axis

- On the main spindle, the tools moves from right to left. On the counter spindle, it moves from left to right.

- Longitudinal turning can be used both for inner and outer diameters. When machining inner diameters, a drill hole must first be available.

- In addition to the machining of the peripheral surface (longitudinal), the face end (planar) can also be machined

Feedrate
Rapid traverse

☑ Longitudinal turning is mostly used to give a cylindrical workpiece a specific diameter dimension. The roughing procedure for reducing the cylindrical diameter dimension is also called "stock removal".

☑ **Typical applications:**

- Complete or partial over-turning of blanks or components

- Turning of inner or outer sections

☑ **Tool: Turning chisel**
The roughing of large parts places very different demands on the tool compared to smoothing applications (angle, shape, size).

☑ **Limits:**
Longitudinal turning can only machine turning contours which correspond to the maximum clearance angle of the turning chisel. Often, additional tools are needed in order to achieve the turning contour.
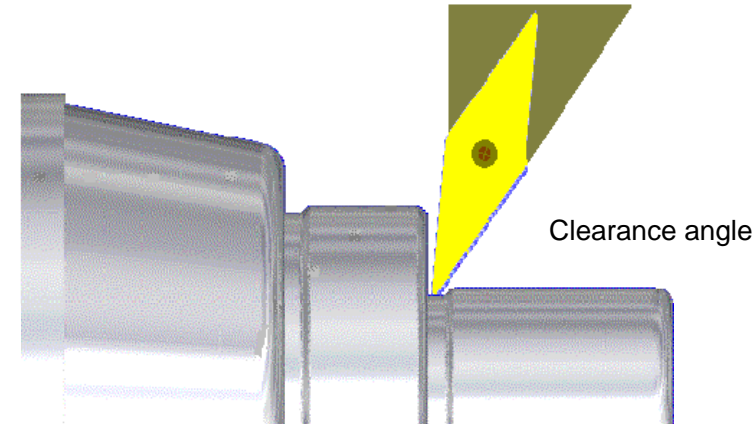
Clearance angle

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Plunge-turning (longitudinal and planar):

- In longitudinal plunge-turning, the feed direction of the plunge cutter is vertical to the workpiece axis.

- In planar plunge-turning, the feed direction of the parting tool is parallel with the workpiece axis.

- The parting tool has three cutting edges, thus allowing chip removal that is as free of interruption as possible in both the radial and axial directions (less rapid traversing).

- The tools for the plunge-cutting and plunge-turning differ in terms of the shape of the cutting plate and the cutting plate seat
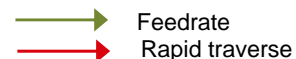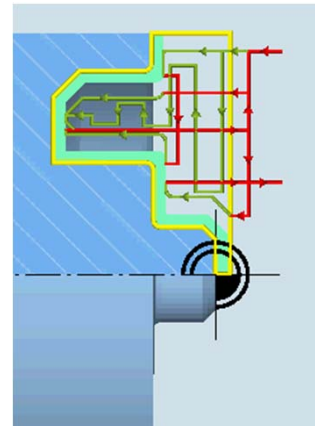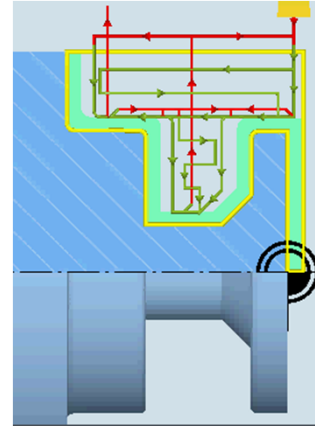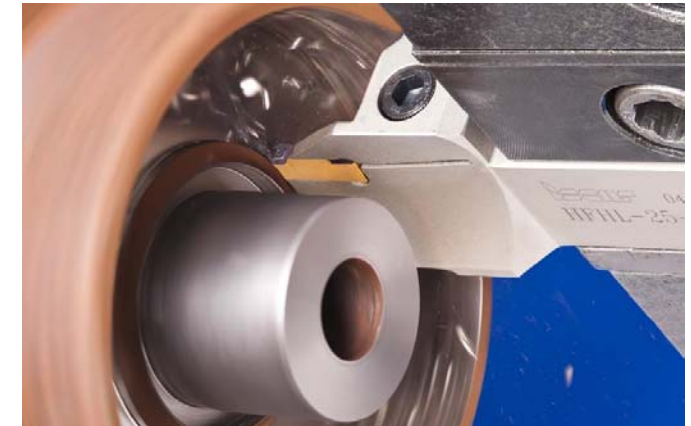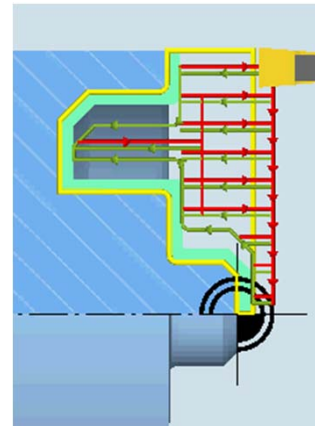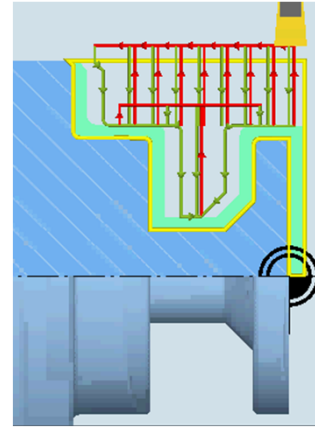

Feedrate

Rapid traverse

Plunge-cutting (longitudinal and planar):

- The chip removal during plunge-cutting only takes place in the feeding direction.

- The machining for longitudinal plunge-cutting is done vertically to the rotation axis.

- The machining for planar plunge-cutting is done parallel to the rotation axis.

- Parting tools can only absorb forces that are applied vertically to the tool axis.

- Plunge-cutting is mainly used to make grooves. Often, but not always, the grooves have the same width as the plunge cutting tool.


→ Feedrate
→ Rapid traverse

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Cutting off:

- At the end of the machining process, the tool is cut off by means of the cutting off procedure.

- The cut-off cycle comprises an "auxiliary cut-in" and the actual cut-off procedure. The auxiliary cut-in permits better removal of the chips.

- Cutting off is a cut-in the center point of the diameter.

- It is often necessary to reduce the speed just before the cut-off procedure to be better able to control the rotating, cut-off workpiece.
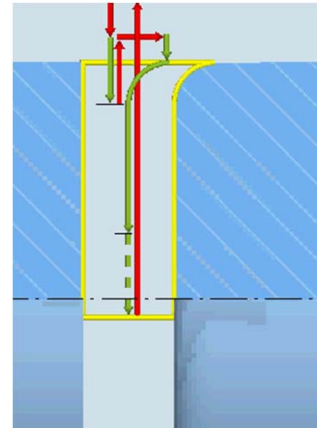
→ Feedrate
→ Rapid traverse

☑ Plunge-cutting and plunge-turning are **highly productive alternatives**, especially for deep, circumferential grooves or difficult contours with undercuts which require several changes of standard turning tools.

☑ **Tool: Plunge cutter**
Machining is done in both the transverse and longitudinal direction during plunge-turning. This requires stable plunge-turning tools which have three main cutting edges (plunge-cutting and longitudinal turning) that are specially designed for this.
A plunge-turning tool can replace several turning tools for roughing, finishing, and plunge-cutting.

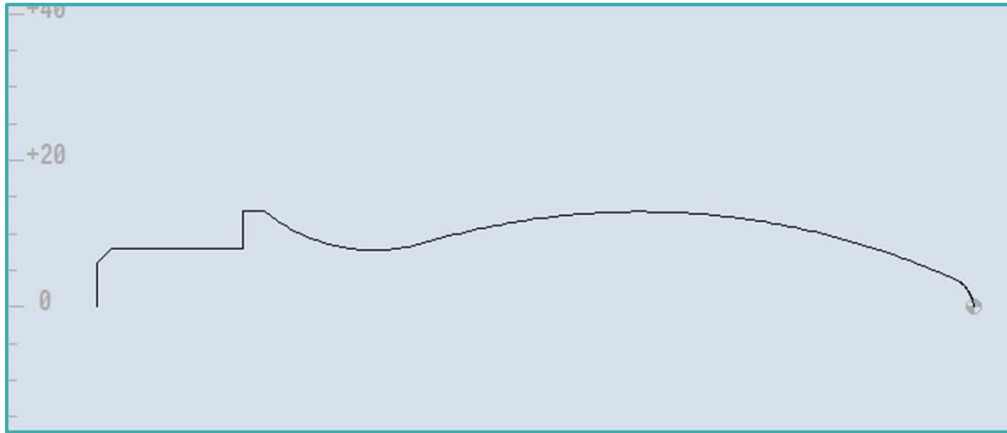☑ **Limits:**
When machining long, thin workpieces (removed from the clamping devices), high cutting pressures can lead to warpage of the workpiece. Concave contours also generally cannot be reached due to the geometry of the plunging (turning) tool.

Sample workpiece: rotation-symmetrical handle

- Contour as basis (e.g. via DXF reader)

- Contour turning

- Defining machining technologies

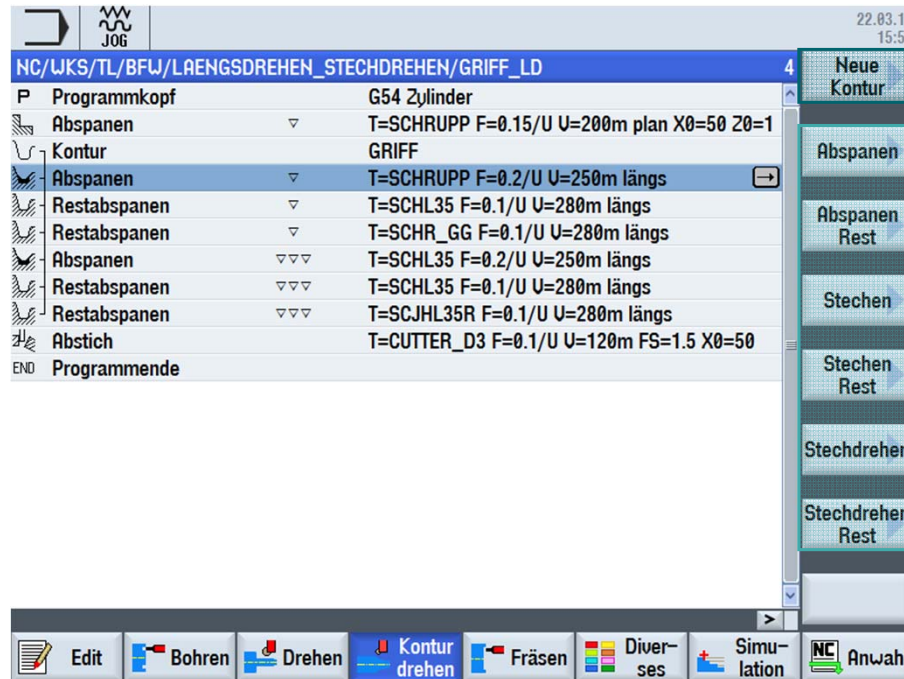- Residual material detection / machining, if applicable

Plunge-cutting, plunge-turning, longitudinal turning, and combined longitudinal and plunge-turning

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Program creation with ShopTurn:
The programming of the workpiece using ShopTurn is done intuitively via the graphical user interface.

ShopTurn displays the machining sequence in a **clear program structure** and presents the individual cycles and contour elements in the graphic view.

The versatile contour calculator allows the **creation of any contours** or the native read-in of DXF data.

A **stock removal cycle with residual material detection** permits more efficient machine cutting. In addition to the classic longitudinal or planar turning, the stock removal cycle also give you the capability of contour grooving and plunge-turning.
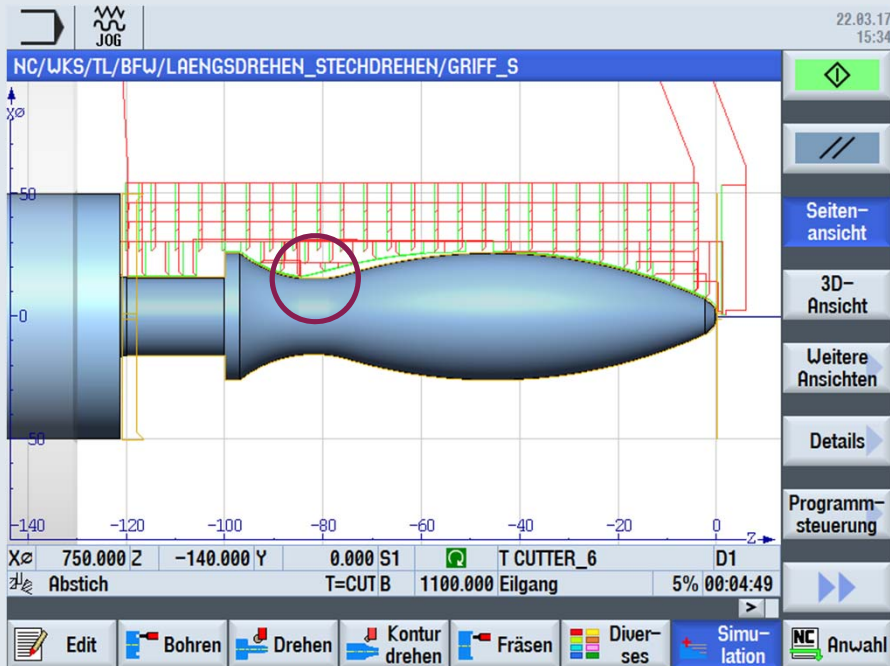
Plunge-cutting, plunge-turning, longitudinal turning, and combined longitudinal and plunge-turning

Plunge-cutting:

Plunge-turning:

It is not possible to do the entire machining with one plunge cutting tool because the tool cannot reach the critical spots with a straight cutting edge.
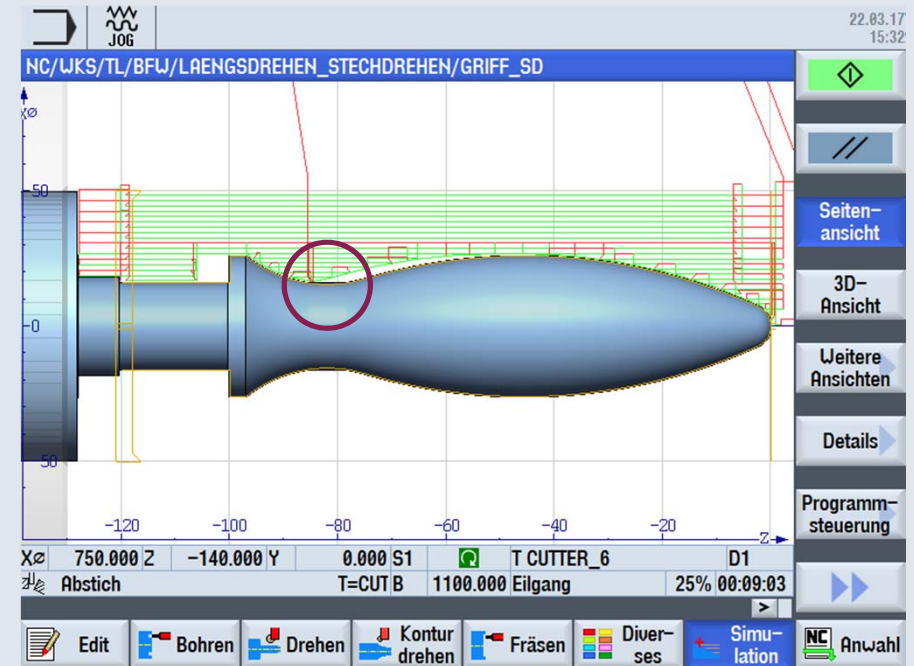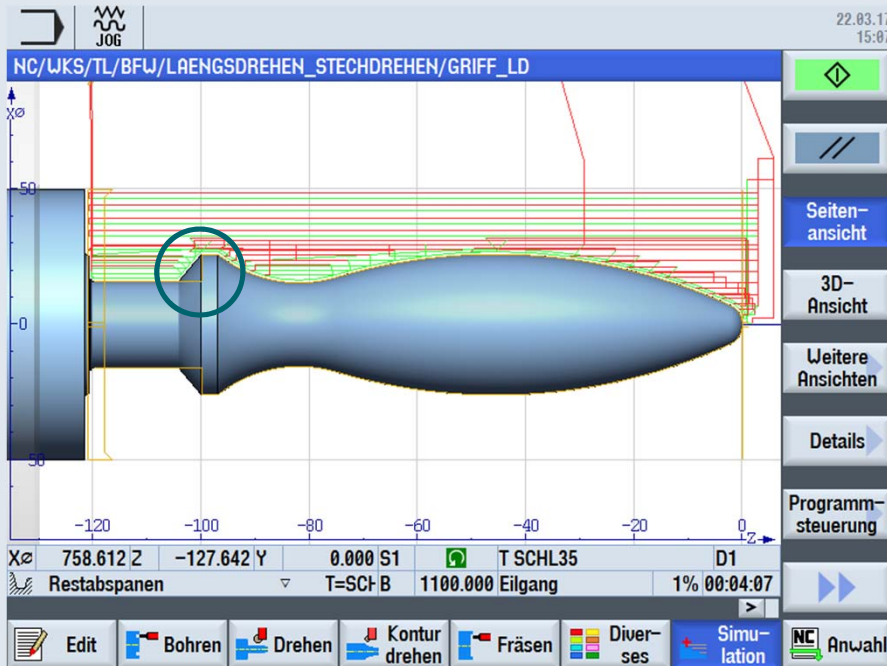
Feedrate
Rapid traverse

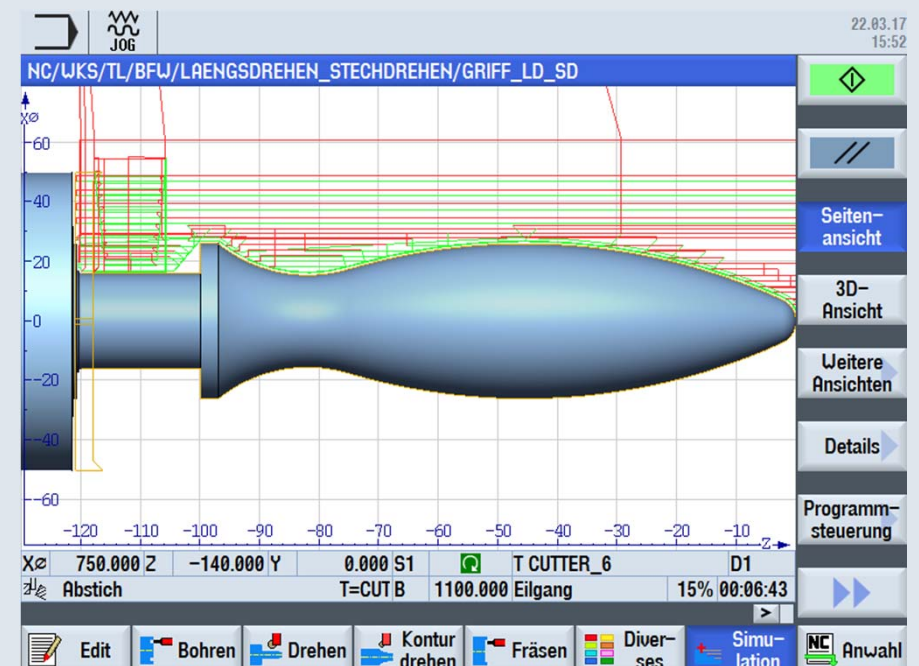# Plunge-cutting, plunge-turning, longitudinal turning, and combined longitudinal and plunge-turning

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Longitudinal turning:

Complete machining exclusively with longitudinal turning not possible due to the undercut

Combined longitudinal and plunge-turning:

Practical example on the DOOSAN 2600SY turning machine

→ Feedrate
→ Rapid traverse

Comparison of longitudinal and plunge-turning

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Longitudinal turning:

+ High infeeds are possible (cutting cross-section)

+ High feed rates possible during roughing

+ Perfect chip clearance

- Not all of the contours can be produced depending on the tools, therefore several tool changes are often necessary

Plunge-turning:

+ Avoidance of non-cuts

+ Reduction of tool changes

+ High degree of flexibility for applications

- Not all contours are possible due to tool

- Unfavorable chip clearance (jamming of chips possible)

When do I use which technology?

Plunge-turning is used for shapes such as deep grooves and parts with steep walls, which can only be produced using this technology.

Longitudinal turning, however, is used for flowing contours.

☑ **Turning:**
Although the traversing paths for turning can only be programmed by two axes, the complexity and the diversity of the technology are enormous.

☑ **Longitudinal turning:**
In longitudinal turning, the machining is done by a turning chisel parallel to the rotation axis. This technology is especially well-suited for flowing contours of long workpieces.

☑ **Plunge-turning:**
In addition to plunge-turning, there is plunge-cutting and cutting off. With the aid of these technologies, almost any rotationally symmetrical contours can be achieved.
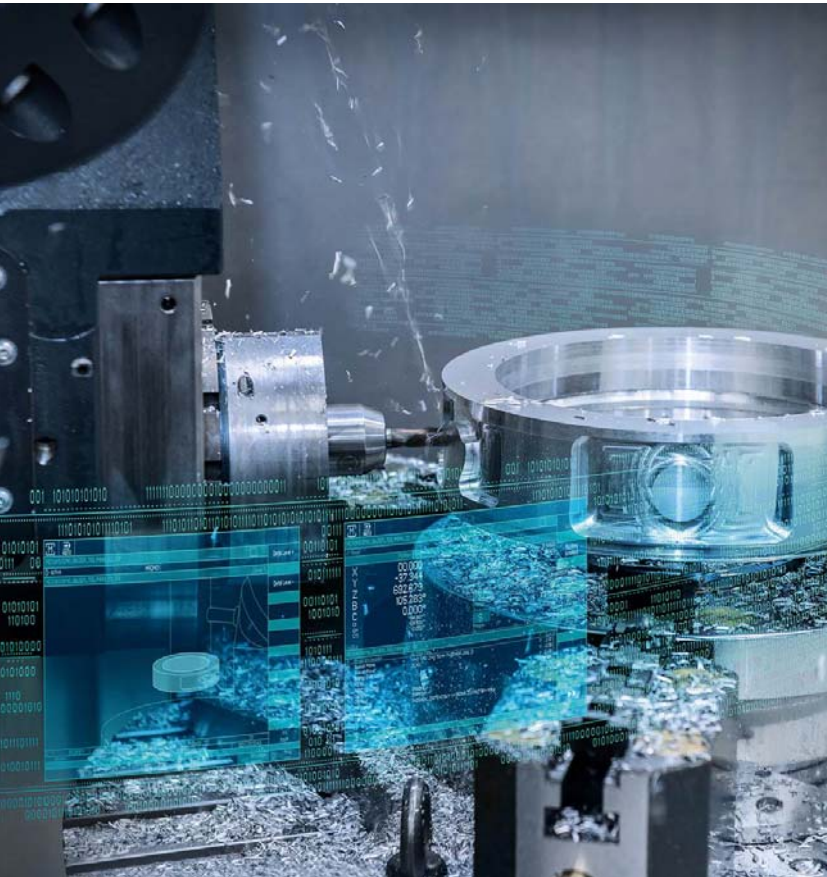
☑ **Use with SINUMERIK Operate:**
SINUMERIK Operate supports the programming by means of animated graphics and simulations, pre-configured cycles for easy machining step programming and residual material detection, and suggestions regarding suitable machining technologies.

Thank you for your attention!

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