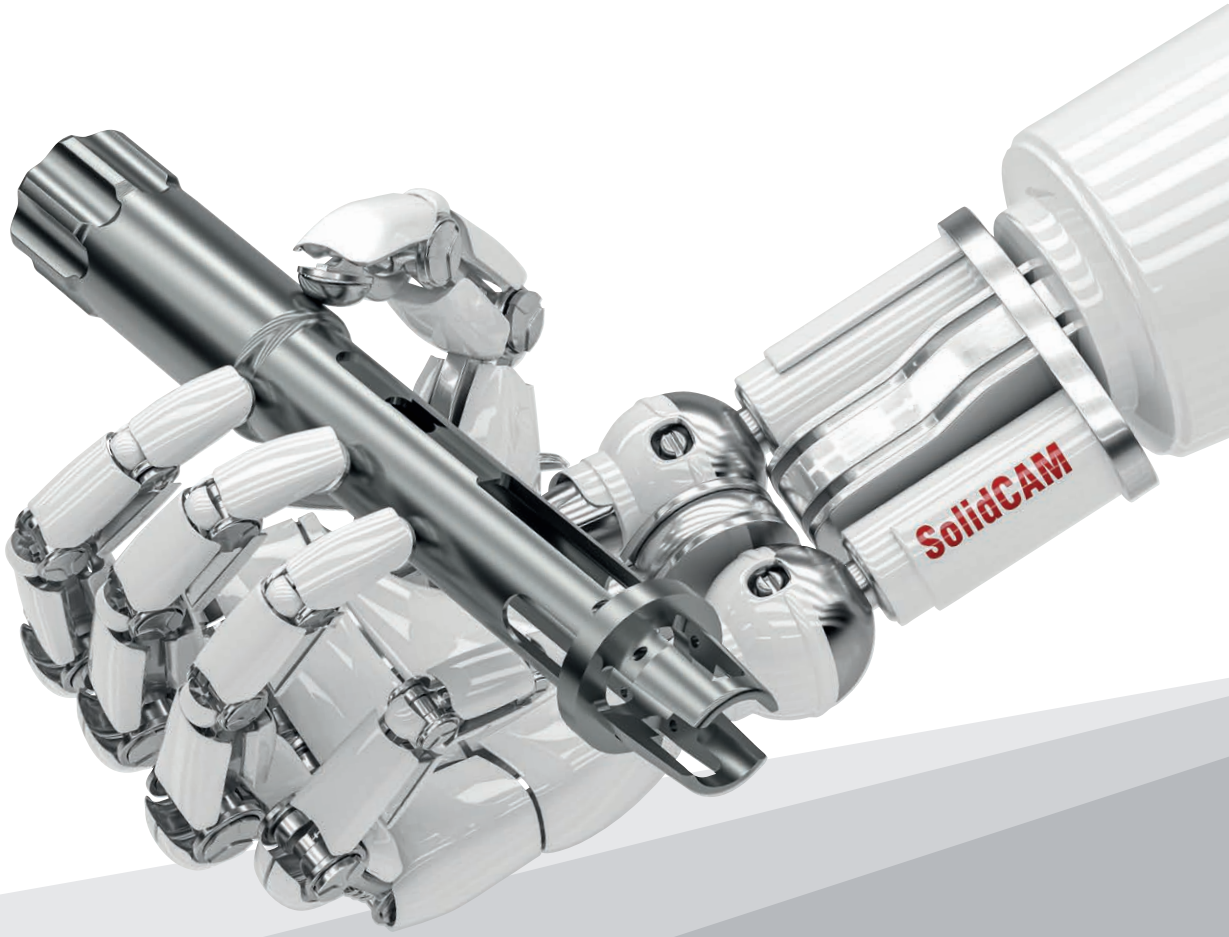
SolidCAM

THE FUTURE OF CAM

WHITEPAPER 05/22

SolidCAM & Swiss

Do You See a Swiss Machine in Your Shop Soon?



www.solidcam.com

CONTENTS

01 Do You See a Swiss Machine in Your Shop Soon?

02 How are Swiss Machines Different from conventional CNC-lathes

03 Is a Swiss Machine Right for My Shop? Where should I start?

04 Why SolidCAM is the Right Partner for Swiss

05 The iMachining Difference

06 We are here to help! Reach out to SolidCAM!

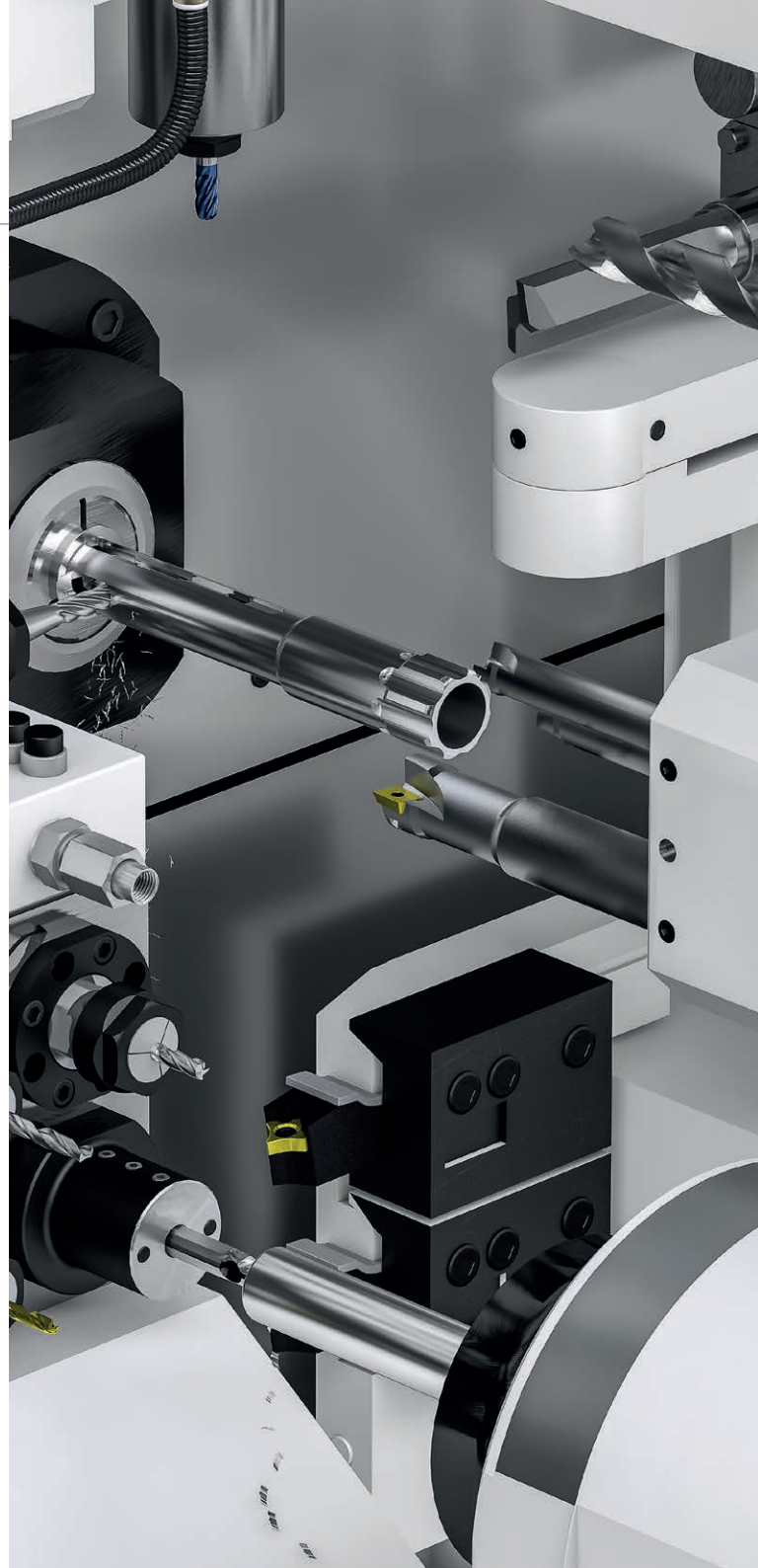
JUST A MATTER OF TIME?

Sales of Swiss-Type CNC-Machines (aka “Sliding Headstock Machines” or just “Swiss Machines”) are the fastest-growing category of Advanced Mill-Turn Machine sales globally, and demand is projected to continue rising. Once only found on the floor of specialized medical device and aerospace manufacturing companies, more and more job shops (high-mix, low-volume) are diving headfirst into this not-so-new technology. But why?

Traditionally, sliding headstock automatic lathes were purchased for manufacturing small production components, such as screws or simple turned parts in high volumes. The formerly cam-controlled automatic lathes are now almost entirely equipped with CNC controls. One of the main differences with short lathes: In the sliding headstock lathe, the longitudinal feed is not provided by the tool but by the material (main spindle) itself, so that the workpiece provides both feed and cutting speed. Through the clamping system and the subsequent guide bushing, the material bar is inserted into the working area of the CNC lathe. Ideally, this is fully automated by a loading magazine or bar loading magazine. Sliding headstock lathes reduce the number of setup operations by attaching milling and turning tools to multiple tool columns that operate simultaneously on multiple spindles.

This „do-all-in-one“ machining strategy of today’s sliding headstock lathes shortens part production time and allows complex workpieces to be machined quickly, often in a single setup. Successfully utilizing a CNC sliding headstock lathe is like having your very own money-printing machine. Imagine reducing the total number of setups for an average workpiece from 4 to just 1 - that’s a huge time savings that modern shops with a wide array of parts simply can’t ignore!

Fun Fact: The term „Swiss-Type Machines“ used in English originated in the watchmaking industry. This type of machining is attributed to Jakob Schweizer, a well-known watchmaker from the Biel region of Switzerland. He perfected the process between 1872 and 1873, and his most important achievement was the sliding headstock, which allowed simultaneous rotation of the material, longitudinal movement and radial tool holders. This allowed fast forward and backward movements.

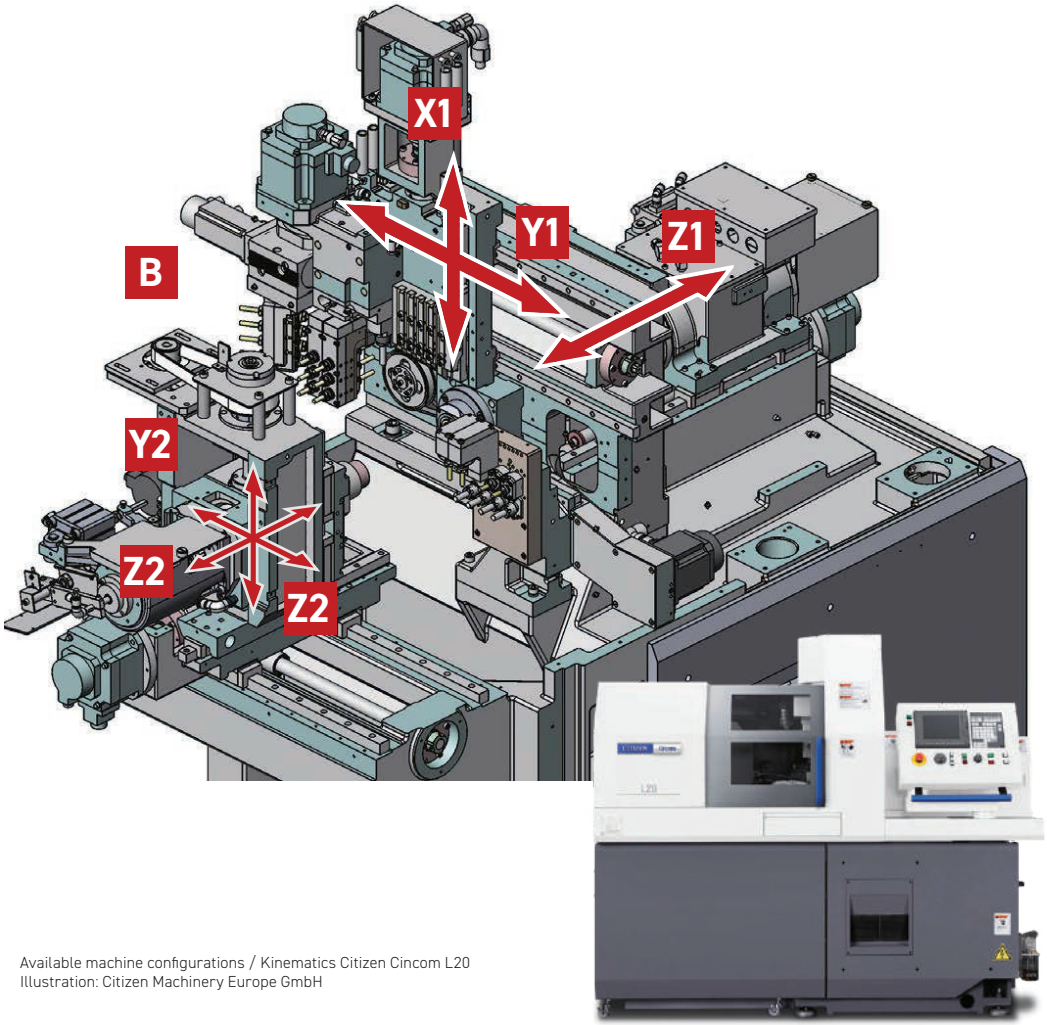


CNC-SWISS-TYPE VS. CNC-LATHE

When setting up a job on a standard lathe, the machine operator or programmer must read the drawing of the workpiece and decide how far the material should protrude from the chuck or collet in order to machine all or part of the workpiece without colliding with the fixture. Most larger workpieces, 25 mm in diameter or larger, that do not require additional support can be machined in this manner without difficulty.

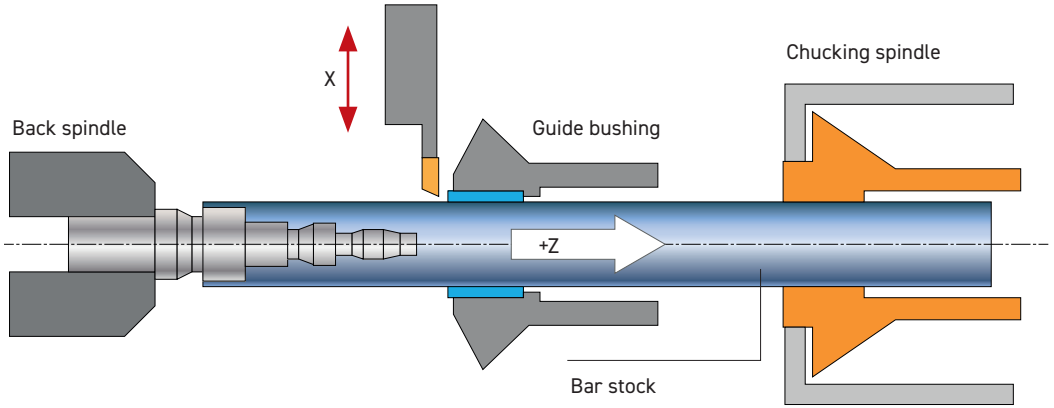
Imagine, however, that you have to turn a 150 mm long tie rod with Ø 6 mm.

Welcome to the world of the sliding headstock lathe!

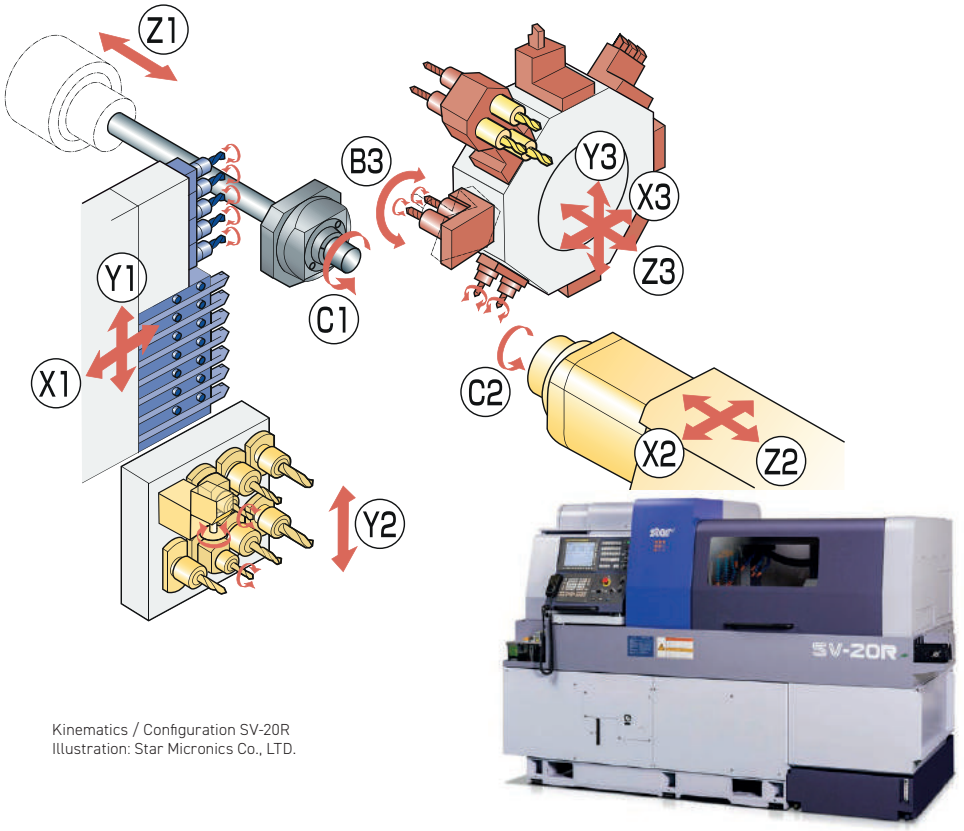


Available machine configurations / Kinematics Citizen Cincom L20
Illustration: Citizen Machinery Europe GmbH

SWISS-TYPE OVERVIEW

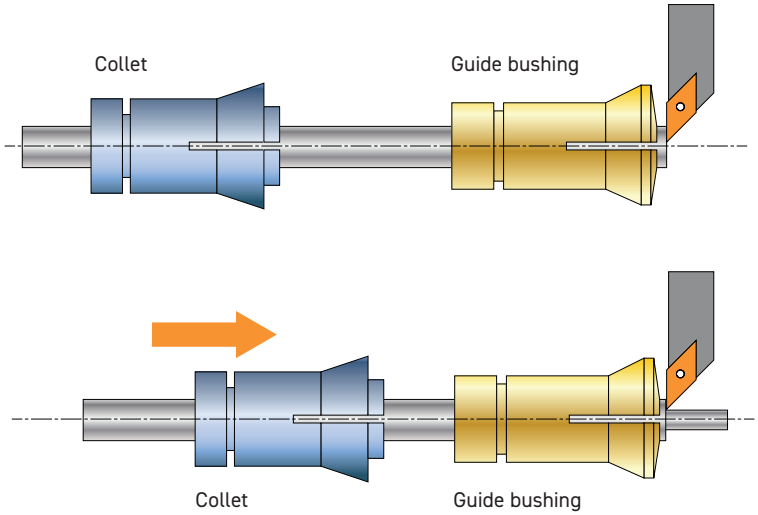


A



C

Kinematics / Configuration SV-20R
Illustration: Star Micronics Co., LTD.



B

Collet & Guide Bushing – Optimum Material Support

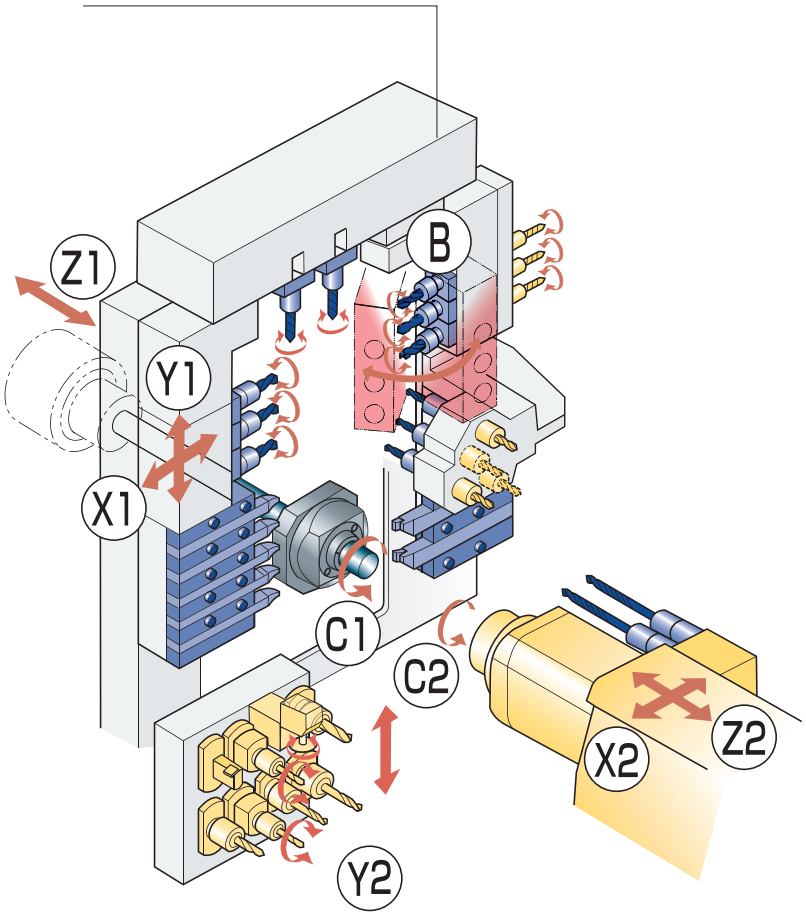
During machining, the bar stock remains clamped in a collet that can slide along the headstock behind the guide bushing. Due to this design, the tool cutting edge always works very close to the guide bushing. Therefore, in order to ensure high precision, machining is done in segments. [A]

The special design prevents deflection and deflection of the material during machining, which allows extremely rigid, high-precision machining of long parts with small diameters. [B]

The very rigid support system of today's sliding headstock lathes allows extreme part accuracy of up to four decimal places, in the low µ-range. [C]

SWISS-TYPE OVERVIEW

Many common sliding headstock models can be equipped with an additional B-axis, which also enables very complex milling operations with up to 5 axes.



Kinematics SV-20RIV
Illustration: Star Micronics Co., LTD.

Conventional lathes and short lathes usually have only 3 or 4 axes and are sometimes not capable of machining a workpiece in a single cycle. Thus, even less complex parts have to be machined on several machines. On the one hand, this increases the cycle time and also frequently leads to tolerance problems.

Short cycle times

CNC lathes, on the other hand, typically have 7 to 13 axes and two to four channels. Each channel reads an independent set of machine commands, which enables advanced multitasking capabilities. This allows multiple operations to be performed on the workpiece in a single machining cycle: Tapping, face piercing, drilling, slotting, milling, parting off and reverse drilling in a single pass.

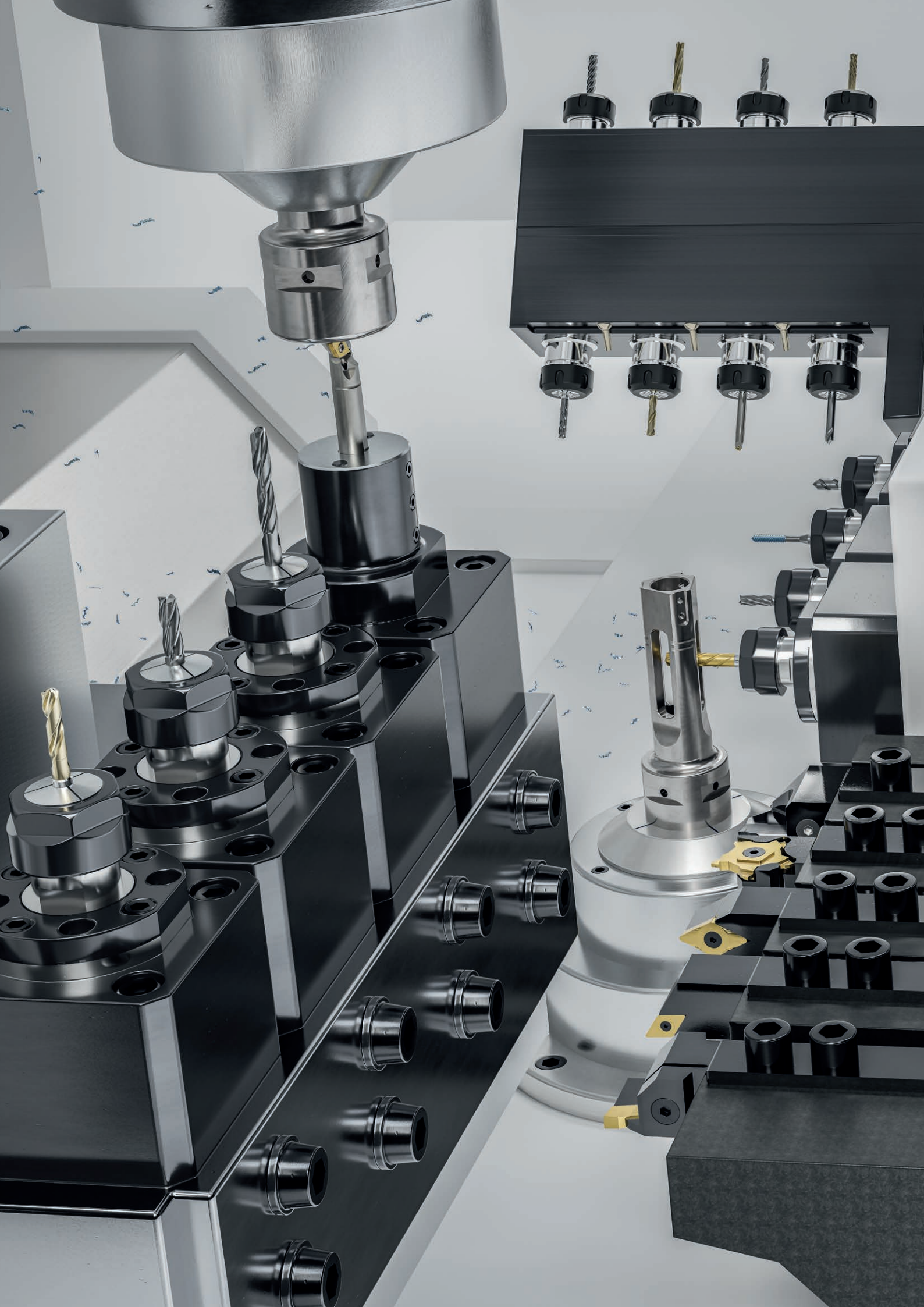
The increased productivity of Swiss-Type Machines is directly related to a significant reduction in spindle downtime, as the dual-channel NC code keeps the machine in constant motion, often performing multiple operations simultaneously. Modern CNC Swiss-Type lathes also feature advanced tool path strategies, such as superimposed turning (also known as balanced turning or pinch-turning) and double-sided drilling and milling of workpiece footprints on more than one side of a part at a time.

Reverse offset

On conventional lathes, the turning tool can move in both the X- and Z-directions to contact the workpiece. The material protrudes a certain length and the side of the workpiece facing away from the chuck is called the „zero" of the Z-direction.

The direction along the workpiece toward the collet is the „- (negative)" Z-direction. In the sliding headstock lathe, the material moves in the Z direction, and the tool cuts with the feed coming from the X-direction. The side of the workpiece facing away from the guide bushing is considered the „zero point" of the (Z) axis. The direction along the workpiece toward the guide bushing is now considered the „+ (positive)" Z-direction.

This „polarity" difference alone often leads to collisions when machine operators and programmers switch from conventional turning to sliding headstock turning. Particularly, the programming of components directly at the control places high demands on the machine operator because of the confined space and risk of collision. More complex surfaces and components cannot be implemented without CAM support and are not economical for smaller batch sizes.



HOW DO YOU GET STARTED IN SWISS-TYPE TURNING?

Modern mill-turn machines are a great way to expand the capacity of your manufacturing operation, extending and saving space at the same time. In addition, workpieces rarely need to be set up on more than one CNC machine. The high rigidity of CNC sliding headstock lathes, coupled with their multitasking and 5-axis milling capabilities, results in higher machine throughput and therefore significantly higher profit per spindle hour.

CNC sliding headstock lathes are ideal for manufacturing companies specializing in medical devices, automotive or aerospace components, among others. Any workpiece with a diameter of 50 mm or less can be machined on a CNC sliding headstock lathe.

Nevertheless, many companies are hesitant to purchase a CNC sliding headstock lathe because, to date, it has been relatively difficult to create the multi-channel NC programs required for efficient operation or to find experienced programmers and machine operators.

Why do many companies still dare to take the first step? For us at SolidCAM, one of the reasons is that word has slowly spread about what many companies did not know until now:

„SolidCAM speaks Swiss!“

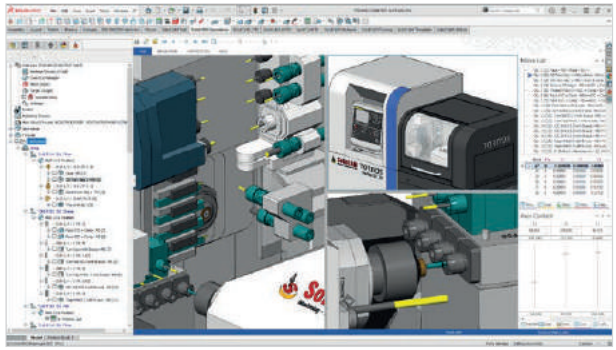
The days of low productivity, bleak ROI forecasts and reliance on outdated single-operation machines are numbered. SolidCAM is a driving force behind the Swiss-Type revolution, where manufacturing companies will be optimally positioned for the future.

Programming of CNC sliding headstock lathes with already existing CAM systems

The CNC programming of the complex machine kinematics is not supported at all or only very inadequately by older CAM systems due to outdated technologies. Numerous takeovers and mergers in the CAM industry have led, among other things, to some, formerly powerful companies completely ceasing to support or further develop Swiss-Type programming.

SolidCAM, as the last fully independent CAM company in the market, is determined to continuously improve and redefine the standards of machining technology by providing advanced CAM solutions.

Do not hesitate! SolidCAM's CAM experts are always ready to help you realize the maximum potential of your current CNC machines and any complex multitasking machines you may want to add in the future.



THE RIGHT CAM PARTNER FOR YOUR COMPLEX CNC-MACHINING CENTERS

CNC programmers around the world rely on SolidCAM, the leading integrated CAM system for SolidWorks and Autodesk Inventor. With SolidCAM, they create error-free, fully synchronized CNC programs for their complex mill-turn machines and sliding headstock lathes, all without making adjustments to the CNC programs on the machine controller.

SolidCAM takes the guesswork out of making the right settings and helps avoid costly programming errors and machine collisions. Imagine being able to reduce the number of setups required to produce your parts from three or more to just one operation! Better CNC programs and shorter cycle times on multitasking machines result in significant profit increases for every dollar turned over on the machine.

Over the past five years, SolidCAM has made significant investments in completely revamping and evolving its SolidCAM software into the leading all-in-one solution for modern CNC manufacturing. Here are the latest achievements:

New Tool Library (ToolKit)

- Full-featured support for multi-channel tool assignments
- Robust components library for accurate collision checking against the tool, holder, and turret/tool post assembly

New Full Machine Simulator

- SolidCAM's VMID (Virtual Machine ID) is a 1:1 digital copy of your machine, including the kinematic structure and alignment of all machine components
- Precise collision avoidance

MCO (Machine Control Operations)

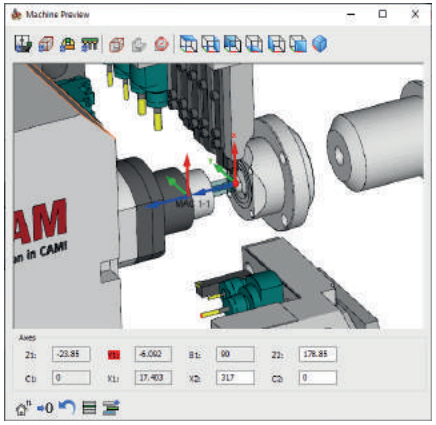
- They allow SolidCAM to accurately simulate out-of-path tool path motion and take the guesswork out of part support and transfer operations

Continuous improvement of SolidCAM's iMachining technology

- 70% or more reduction in cycle time
- 5 - 10x increase in tool life

New channel synchronization manager

- Guides the programmer to the optimal channel synchronization
- Prevents collisions by constantly checking for kinematic interference with the VMID, which contains the exact kinematics of your CNC machine



THE iMACHINING-ADVANTAGE

SolidCAM‘s patented iMachining is another magic bullet for taking CNC machining centers, including Swiss-Type Machines and Mill-Turn Centers, to a new level of productivity. iMachining is the most efficient technology for fast material removal on the market.

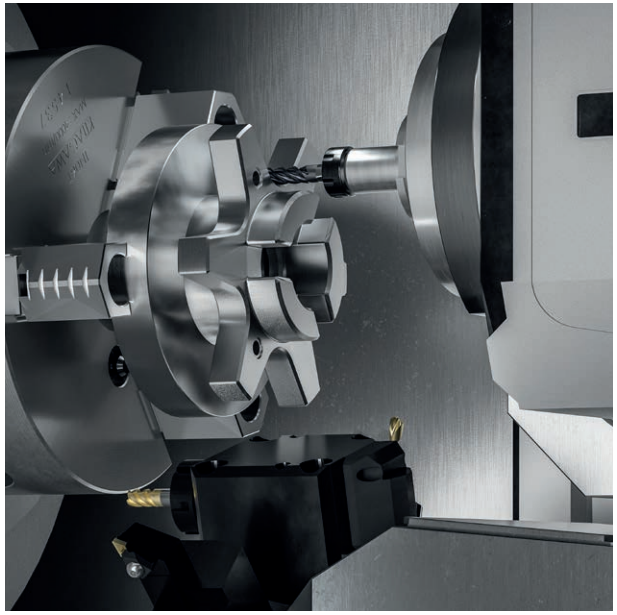
The key to the highest possible metal removal rate lies in the generation of optimized, spiral tool paths with variable cutting angles and feed rates - at every single point along the tool path. iMachining generates uniform chips of identical thickness throughout the entire cut, thus guaranteeing constant spindle load. The usual high forces that occur when material engagement changes abruptly in conventional milling, for example when the tool changes direction in a corner, are avoided with iMachining.

Without iMachining technology, cutting parameters and feed rates must be adjusted to the worst cutting conditions to prevent tool breakage or high wear. This unnecessarily lengthens cycle times. In turn, the always constant spindle load thanks to iMachining significantly reduces vibrations at the cutting edge, resulting in a drastic increase in tool life as well as a much better surface finish. With iMachining, it is proven you can achieve not only higher metal removal rates than with any other tool path technology, but also amazing increases in tool life.

Behind this is SolidCAM‘s iMachining Wizard, which automatically calculates the optimal feeds and speeds - taking into account the cutting tool, the material and the machine parameters. This reliably leads to surprising successes from the very first workpiece - error-free and completely without long experimentation. iMachining has the intelligence to automatically select the most efficient milling tool path for each part geometry feature.

In addition, iMachining 3D can easily replace multiple standard roughing operations on complex 3D shapes with a single mouse click. For machining on turn-mill centers and sliding headstock lathes, the use of iMachining means that the small tools commonly used there can be used much more efficiently, quietly and with greater process reliability.

Particularly in the case of materials that are difficult to machine, such as implant steels or titanium, which are used in medical technology, for example, advantages can quickly add up to a significant competitive edge.



WE SUPPORT YOU!

Your success is our success. We welcome every opportunity to work with you. Try SolidCAM and see firsthand how SolidCAM users benefit from the industry's best CAM software and world-class support.

If you have any questions or are considering the purchase of a mill-turn center or CNC sliding headstock lathe, give us a call!

For more information or to schedule a personal demonstration, visit us at www.solidcam.com and get ready for the Swiss-Type revolution with SolidCAM!

SolidCAM in Your Country
Contacting a SolidCAM office or reseller is easy. The complete list of our worldwide, dedicated distribution and support network is available on solidcam.com

AMERICAS

SolidCAM Inc.
E-Mail: infonorthamerica@solidcam.com
Phone: +1 866 975 1115

ASIA-PACIFIC

SolidCAM ANZ
E-Mail: info@solidcam.com.au
Phone: +61 7 3805 7518

SolidCAM India
E-Mail: info.india@solidcam.com
Phone: +91 11 49425170

SolidCAM China
E-Mail: marketing.china@solidcam.com
Phone: +86 10 8599 7302

SolidCAM Japan K.K.
E-Mail: info.japan@solidcam.com
Phone: +81 3 6300 6730

SolidCAM Korea
E-Mail: info_korea@solidcam.com
Phone: +82 32 876 8762

SolidCAM Singapore Pte Ltd
E-Mail: snges@solidcam.com.sg
Phone: +65 9737 8116

EUROPE

SolidCAM GmbH
E-Mail: info@solidcam.de
Phone: +49 7422 2494-0

SolidCAM UK
E-Mail: info@solidcamuk.com
Phone: +44 1226 241744

SolidCAM France
E-Mail: info@solidcam.fr
Phone: +33 3 4457 1385

SolidCAM Baltics
E-Mail: info@solidcam.lv
Phone: +371 26882932

SolidCAM Italia
E-Mail: info@solidcam.it
Phone: +39 051 0952911

SolidCAM Spain
E-Mail: info@solidcam.es
Phone: +34 900 909 878

SolidCAM CZ
E-Mail: ivan.cimr@solidcam.cz
Phone: +420 603 893 701

SolidCAM Ltd.
E-Mail: info@solidcam.com
Phone: +972 3 5333 150

SolidCAM

The Solid Platform for Manufacturing

The unique, revolutionary Milling technology

iMachining®

patent by SolidCAM

MILLTURN

SolidCAM Power for Turn-Mill | Mill-Turn | Swiss-Type

The SolidCAM brochure with detailed information is available on solidcam.com

www.solidcam.com

© 2022 SolidCAM GmbH. Errors and technical changes reserved. V05.22