

How accurately can medical parts be manufactured today?



SINUMERIK – CNC machining for the ultimate in precision and workpiece surfaces.

Answers for industry.

SIEMENS

Precision processes, safety and top quality: SINUMERIK CNC machining	4
SINUMERIK CNC controllers: versatile, economic production	6
SINUMERIK Operate: easy programming for increased productivity	8
This is where quality comes from: SINUMERIK MDynamics – packed with milling expertise	9
SINUMERIK Safety Integrated and Sinorix al-deco PLUS: intelligent safety solutions	10
Manufacturing IT: optimizing production with integrated IT processes	12
Condition Monitoring: condition-based maintenance to increase productivity	13
Technological support and CNC training: always up-to-date	14
True-to-process: with an integrated CAD/CAM/CNC process chain	16
The CAD/CAM/CNC process chain: a knee implant shows how optimized manufacturing works	18



State-of-the-art medical technology brings mobility



No matter if you are manufacturing knee joints, hip implants, bone plates or screws – medical part production demands sophisticated manufacturing solutions. Implants and prostheses can maintain personal mobility through one's senior years, and enhancements in surgical methods and products will bring increased demand for such products. The future of medical part production will mean manufacturing the highest-quality surfaces from the most resilient materials, such as titanium or cobalt chromium. Medical parts will also require short machining times. This is where intelligent CNC technology comes into play in the manufacturing and machining of high-grade molds to ensure reliable high-speed processes throughout the entire process chain.

Precision processes, safety and top quality: SINUMERIK CNC machining



Short machining times, reduced changeover times, and surfaces that require no refinishing – these are the demands that medical part production requires of CNC machining. As part of a comprehensive integral concept, SINUMERIK CNC equipment supports all manufacturing technologies and makes its mark when perfect surfaces, superior precision and reduced changeover times are needed. The bottom line is increased productivity, better quality, greater versatility and enhanced safety.

Siemens provides tailored solutions over the entire lifecycle of a medical product, from CT imaging to CAD/CAM system design, and through to part manufacturing and packaging. Besides high-precision machining, a primary focal point lies with the fail-safe processes required for compliance with the high ISO standards and stringent regulations that apply to medical part production. The increasingly individual nature of medical components means that the number of small batches required will rise. The flexibility to produce large batches quickly and cost-effectively is always a must. SINUMERIK's high-speed data processing capability, even for complex five-axis machining, is a major consideration in this context.



SINUMERIK in medical part production – the benefits at a glance:

- CNC solutions to meet every requirement and to support every technology in medical part production
- Fast and easy operation and programming thanks to the intuitive SINUMERIK Operate user interface
- Innovative motion control, together with SINUMERIK MDynamics (milling) technology packages, produce a surface quality that needs no refinishing
- Superior process reliability through integrated CAD/CAM solutions
- Intelligent IT solutions (for parts tracking, for example)

Intelligence starts with IT

Intelligent IT solutions in the field of SINUMERIK CNC permit integrated networking of machines, and allow for integrated data and tool management, fail-safe processes, and order tracking in manufacturing.

The highest priority for top quality and the utmost precision

Thanks to its 80-bit computational accuracy in position, speed and current control, SINUMERIK CNC meets even the most taxing demands when the highest surface quality is required. SINUMERIK high-performance technology covers the full range – whether turning, milling, grinding or laser machining.

Precision milling is handled by the Advanced Surface function. Its optimized path velocities further refine the surface quality and also reduce machining times.

SINUMERIK CNC: versatile, economic part production

Patients' individual needs call for an accurate fitting of medical implants, and exactly the right instruments.

When manufacturing single parts or low part quantities, fast changeover is essential for economical results. The SINUMERIK 840D sl and SINUMERIK 828D from Siemens are two powerful CNC systems, which ideally meet and exceed the demands of medical part production. Each system provides a variety of setup functions for both workpieces and tools.



SINUMERIK 828D: compact, powerful, easy-to-operate – simply ingenious.

SINUMERIK 828D, a panel-based CNC, is tailor-made for sophisticated turning and milling machines typically used in the job shop. Its application range includes vertical and basic horizontal machining centers through to slant bed turning machines using one machining slide, equipped with Y-axis and a counter-spindle. The operator panel and CNC have been combined to form a rugged, maintenance-free unit. With its reduced dimensions, the SINUMERIK 828D

provides a number of powerful CNC functions and sets new standards in the class of compact CNCs. Equipped with its comprehensive CNC programming package, the SINUMERIK 828D is the ideal choice for global CNC medical part production. In addition, the technology-specific, pre-configured system software and its intelligent service functions significantly reduce machine commissioning and maintenance costs.



SINUMERIK 840D sl: open, flexible and powerful with impressive innovation

SINUMERIK 840D sl brings modularity, open architecture and flexibility, as well as standardized operating, programming and visualization structures. It provides a system platform featuring trend-setting functions for almost every technology. Integrated into the SINAMICS S120 drive and complemented by the SIMATIC S7-300 automation system, SINUMERIK 840D sl is a full, digital system. SINUMERIK 840D sl stands for enhanced versatility, excellent dynamics and precision, as well as for optimal network integration.

It's made for turning and milling

SINUMERIK MDynamics provides special technology packages for three-axis and five-axis milling. SINUMERIK is perfect for grinding applications, and is also ideal for turning (for example, basic and complex turning operations, rotary milling and longitudinal turning).

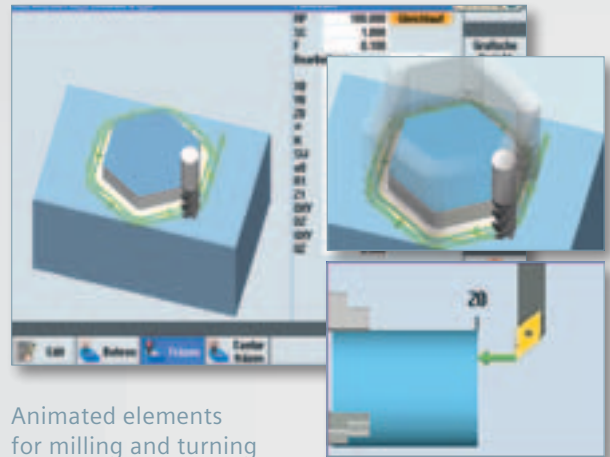
Prospects for longitudinal turning

Simultaneous machining operations using several tools on a main and/or counter-spindle in several channels, for example, is possible in longitudinal turning. Programming is performed either conventionally on the HMI, or offline by transferring curves and tables to the controller. When programming channels individually, axis and spindle movement run automatically in the background. SINUMERIK also offers a wide selection of intelligent functions and technology cycles for every technology.

SINUMERIK Operate: easy programming for increased productivity



User-friendliness at its best –
clear and straightforward



Animated elements
for milling and turning
applications

The new SINUMERIK Operate user interface makes working at your machine much easier and more productive. It is now equipped with all new powerful functions.

Programming has never been easier

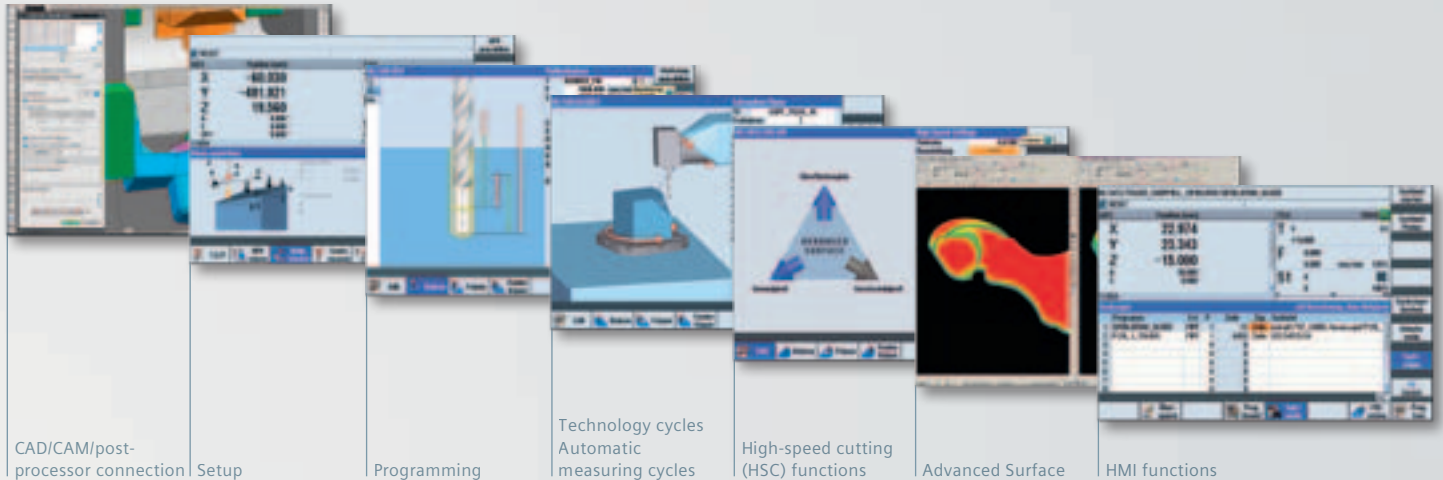
SINUMERIK Operate is a single user interface that offers enhanced user-friendliness and operator convenience for almost every SINUMERIK CNC and CNC technology. Machine steps and high-level languages are programmed using one system interface resulting in extremely fast, efficient and intuitive NC programming and production planning. programGUIDE combines G-code programming and cycle support.

Versatility and short machining times make SINUMERIK Operate ideal for medium- to large-batch production; SINUMERIK also supports ISO code programming. In contrast, ShopMill and ShopTurn work-step programming are the tailor-made programming solutions when manufacturing single parts or small-batch sizes, making them the right choice for jobshop manufacturing.

Fully streamlined to your requirements

No matter how you program, SINUMERIK Operate has numerous setup functions for you to use. Machine setup is clearly and intuitively displayed with graphical support. Animated elements make the CNC easy-to-operate and program, even for technological cycles. Its contemporary Windows style produces an optimal, user-focused representation.

This is where quality comes from: SINUMERIK MDynamics – packed with milling expertise

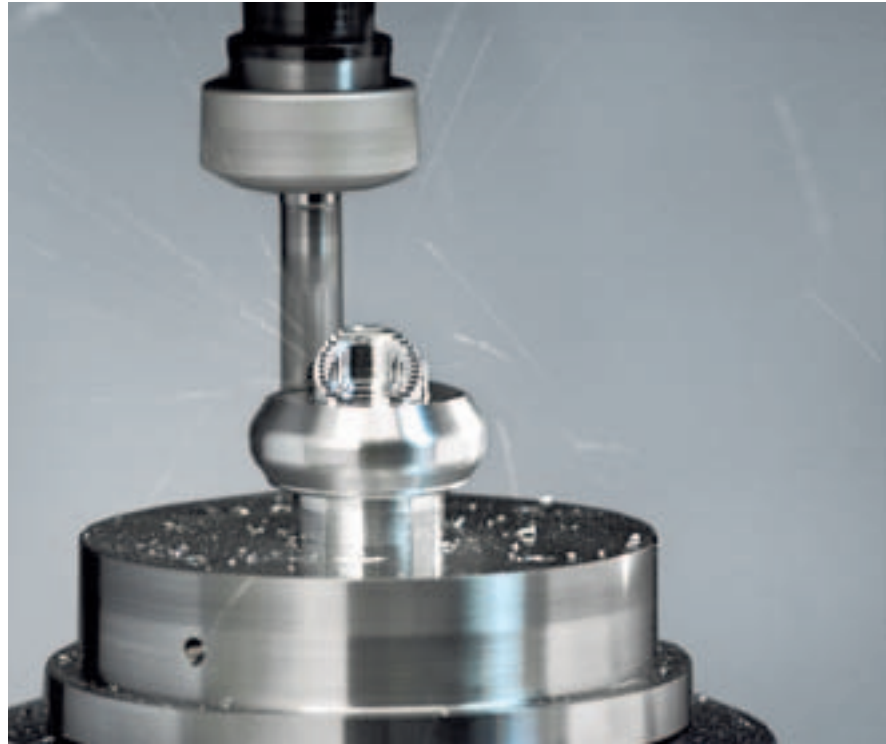


SINUMERIK MDynamics provides special technology packages with CNC hardware, intelligent CNC functions and CAD/CAM solutions for three-axis and five-axis milling machines controlled by our SINUMERIK 828D and SINUMERIK 840D sl CNCs. High-grade, precision implants and prostheses are manufactured in no time at all.

Perfect surfaces – faster

The Advanced Surface functionality integrated into the package stands for intelligent path control and ensures optimal milling results and perfect surface quality. It achieves this by matching the velocity profile in adjacent milling paths precisely. Add to this optimized NC data compression, fast adaptation to the workpiece, tool and program handling, and optimized machining processes with versatile programming – the result is ultimate technological expertise for every requirement of medical part production, Shopfloor manufacturing, and even mold-making. These applications demand excellent milling results and perfect surface quality, ultimate precision, top quality and higher speed; and everything must be easy-to-operate and fully integrated in a process chain.

SINUMERIK Safety Integrated and Sinorix al-deco PLUS: intelligent safety solutions



SINUMERIK Safety Integrated is a comprehensive safety package that protects both your people and your machine. Sinorix™ al-deco STD is a versatile, intelligent object protection system, especially designed for machine tools.

SINUMERIK Safety Integrated is more than just safety

SINUMERIK Safety Integrated ensures functional safety with SINUMERIK. The full integration of safety functions in the controller and drive provides reliable protection for both man and machine, making your machine tool safe and easy to operate under any required operating condition. Every safety function has been certified by globally-recognized inspection authorities and complies with the most recent standards.



Intelligent solutions for fire protection and personal safety

The EU demands specific fire protection measures for machine tools and equipment where there is a risk of fire. This applies particularly to the CNC manufacture of medical parts because very resilient materials (for example cobalt chromium or titan) often need to be processed in such applications. The required oil cooling increases the fire hazard on the machines used. If oxygen-suppressing fire extinguishing agents are used, the operating personnel must be protected against escaping agents. This is why the new Machinery Directive 2006/42/EG prescribes dual protection for cables and wiring in combination with self-monitoring components.

Sinorix al-deco PLUS is a system technology that fully complies with this Directive and is easy-to-integrate into any fire protection concept. It is the ideal solution both for the machine tool builders at risk and end-users alike.

Extinguish fires quickly and safely

The Sinorix al-deco PLUS object protection system uses pneumatic functions to detect a fire and initiate measures to extinguish it. This makes the system insensitive to technical interference and enables it to detect and extinguish a fire without the need for an electrical power source. In addition, all safety-related data are recorded in a long-term memory, which can be saved at any time via a USB interface.

Further information is available at:
www.siemens.com/sinorix

Manufacturing IT: optimizing production with integrated IT processes



Legislation requires the manufacturers of medical parts to fully document their manufacturing processes. This is especially true when these parts are implanted into the human body. Manufacturing IT provides the right solutions to guarantee parts traceability.

Manufacturing IT supports the integration of machines into the IT production environment. It includes the familiar MCIS Software Suite, comprehensive support during the introductory and operational phase, as well as the relevant IT and data security functions. Specific functions are provided for the tracking of medical parts.

The following range of functions are provided for production planning and controlling:

- Order management and provision
- Machine data acquisition and evaluation
- Parts tracking and archiving
- Tool management
- NC program management and transfer
- Preventive maintenance
- Data backup and archiving

Cost-optimized production

Manufacturing IT helps you refine your manufacturing processes, reduce costs and ensure quality, thus increasing the efficiency and profitability of your manufacturing processes. We provide you with all the expertise you may need during consultation, when implementing the project and when applying your solution. Our products feature versatile best-practice processes and our service portfolio provides you with superior investment security, bringing you a quick return on your investment.

Condition Monitoring: condition-based maintenance to increase productivity



Increased manufacturing productivity stands for business success and ensures a sharp competitive edge. This is where our service portfolio “SINUMERIK Manufacturing Excellence” makes its mark. Applying it reduces machine downtime over the long term, and Condition Monitoring adds a major contribution with its condition-based maintenance functions.

Condition Monitoring uses standardized test procedures to support machine operators, maintenance staff and service technicians in determining the machine status and evaluating machine wear over time.

Always fully in the picture

The maintenance module helps optimize maintenance downtimes by considering preventive and/or condition-based maintenance as a whole. This allows selection of the appropriate time to perform maintenance, thereby further enhancing availability. By utilizing all aspects, you can optimize your machine maintenance costs incurred during production, as well as the total cost-of-ownership.



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Power & Energy

NAME	VALUE	UNIT
1. CURRENT	1.000000	1.000000
2. CURRENT	1.000000	1.000000
3. CURRENT	1.000000	1.000000
4. CURRENT	1.000000	1.000000
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Technological support and CNC training: always up-to-date



At our locations worldwide, we can always provide the right solutions for your machine tools or assist you in every aspect of CNC training.

Technological expertise

At our Technology and Application Center in Erlangen, Germany, we inform machine tool operators and manufacturers about products and solutions for every aspect of SINUMERIK CNC technology. Here you will meet experienced application engineers, who have practical experience and expertise in medical part production. Here you can learn how to use specific technology cycles for CNC machining. Our approach focuses on the uncomplicated and versatile operation of the SINUMERIK CNCs.

Practical training courses

In addition to practical CNC training and technology courses, Siemens offers a comprehensive range of services (for example online learning modules, self-learning software and technical literature). Siemens provides practical training that is perfectly tailored to every training level, ranging from basic training to programming and operation courses – through to professional-level training. More information can be found online at: www.siemens.com/cnc4you.

True-to-process: with an integrated CAD/CAM/CNC process chain

When manufacturing medical workpieces, the primary focus is on the workpiece-specific process chain – from the blueprint all the way to the finished part. This is where we can provide innovative solutions to cover the entire design and production process. Optimal integration of every component within the process chain ensures the dynamic manufacturing of medical implants and prostheses. This process encompasses production planning using CAD/CAM systems, simulation and setup at the CNC, as well as manufacturing.

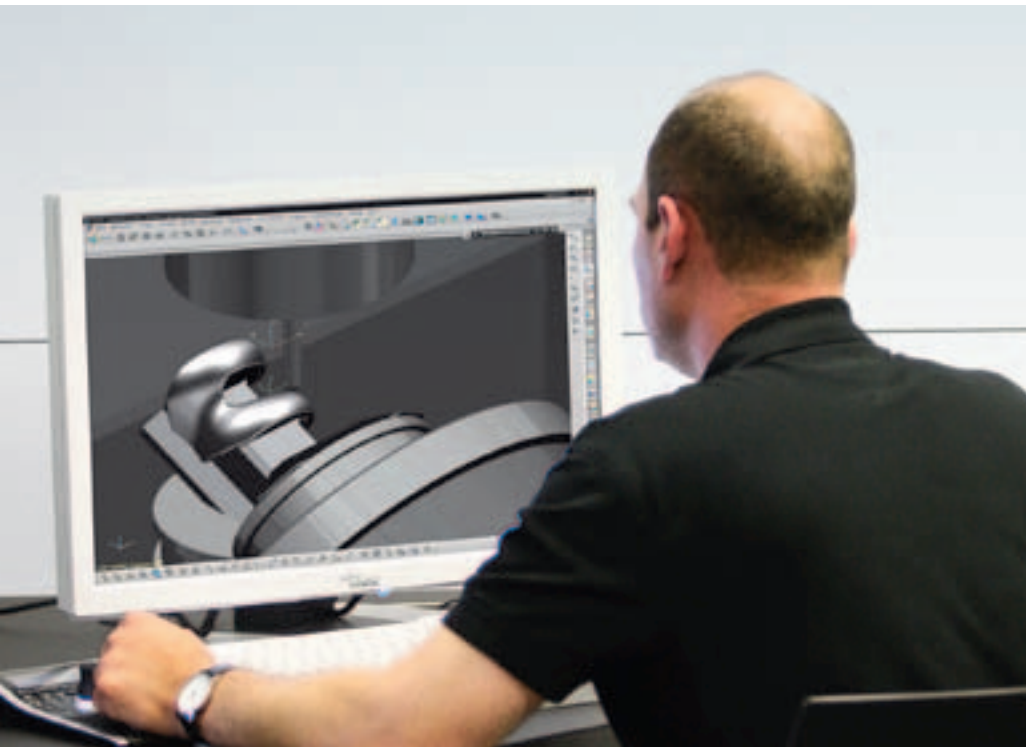


Simulation perfected

Computer-aided design utilizes the NX CAM CAD/CAM system, for example. MCIS software solutions are applied to perfectly integrate the machine tools into Teamcenter, which allows access to production data and the direct transfer of NC programs and tool information. Parameterization of the functions, cycles and options provided by SINUMERIK for the relevant machining is already carried out on the CAM level.

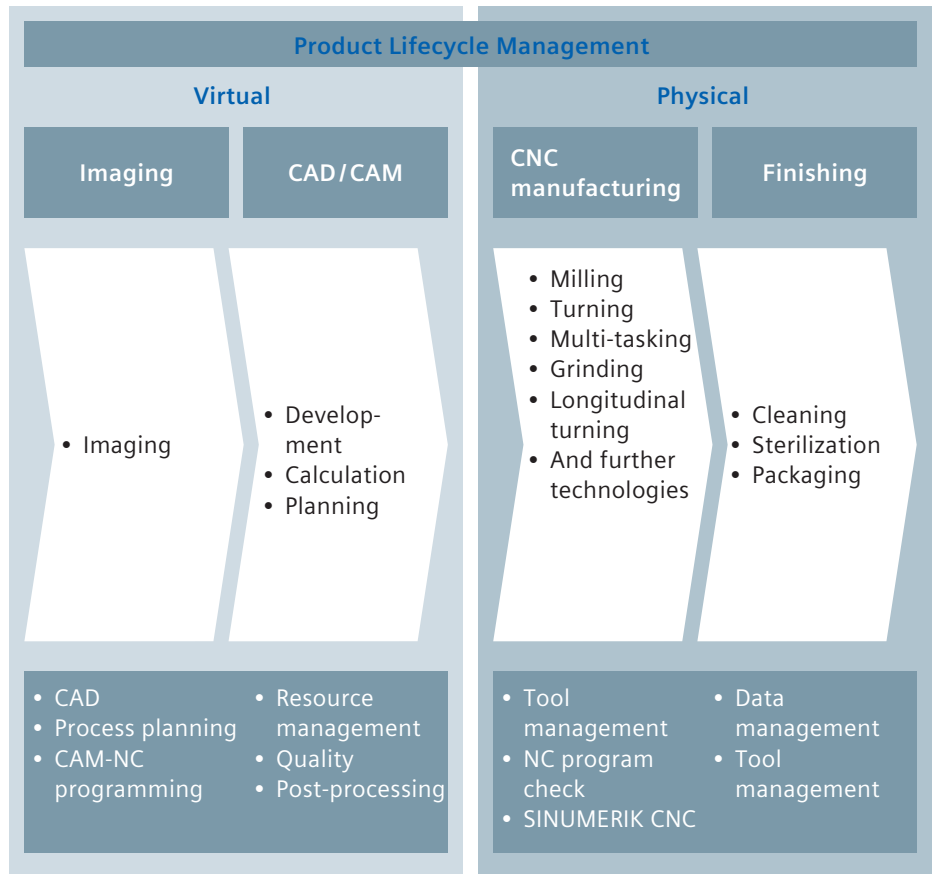
NC programs produced in this way automatically use the state-of-the-art SINUMERIK manufacturing cycles, which are available for effective manufacturing processes in a variety of technologies. The integrated SINUMERIK virtual NC kernel (VNCK) permits simulation and optimization of the manufacturing sequences before part production actually starts on the machine.

For more information about NX CAM, visit www.siemens.com/plm



Fault-free manufacturing

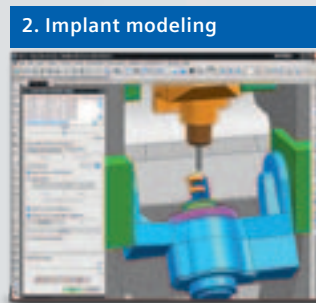
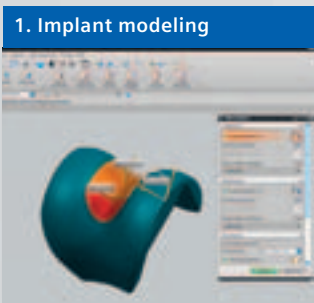
Upon completion of the simulation, fault-free and collision-free manufacturing commences without loss of material. Rejected parts made of expensive materials are now a thing of the past. You benefit from reduced development times and a short time-to-market, fast manufacturing cycles and increased productivity. Above all, however, the real advantages of integrated CAD/CAM are the fast and coherent process sequences, coupled with enhanced reliability of the process chain. The following example illustrates this:



The CAD/CAM/CNC process chain: a knee implant shows how optimized manufacturing works



From blueprint to the finished part



Integrated processes up to the finished implant –

The following example illustrates how proper manufacturing of medical parts works: highest-grade knee joints from the CAD/CAM/CNC process chain.

High-Speed Cutting (HSC) handles the complex machining processes.

Ready-to-use implant



5. CNC machining



SINUMERIK – a good choice

Machine operators, who decide to use SINUMERIK, want to use the same CNC for the entire facility. It satisfies every requirement for quality, productivity, flexibility and safety. The SINUMERIK CNC is therefore the ideal choice for the demanding tasks found in medical part production.

Quality means ...

- Perfect surfaces
- Precision
- Quality check

Productivity means ...

- Machine time
- Fast changeover
- Machining time

Safety means ...

- Reliability/service
- Process reliability
- Mature machine concepts

Flexibility means ...

- Optimal usability
- Flexible reaction to new regulations
- Fast changeover

From blueprint to the finished implant

1. Implant modeling in NX CAM.

2. **NC programming is now possible in NX CAM.** NX CAM stores its programming expertise in five-axis machining, strategy and technologies. Feasibility of the planned manufacturing process is determined by on-screen simulation of the graphical parts and the machine room using NX CAM.

3. **Machine room simulation also includes the virtual SINUMERIK NC kernel (VNCK).** This allows one-to-one integration of the controller's NC kernel into the CAM system, thereby permitting precise simulation of all machining operations in advance.

4. **A post-processor with NX CAM, perfectly tailored to SINUMERIK, takes care of producing the perfect NC program and ensures that the controller can optimally process the CAD/CAM data.**

NC programs produced in this manner can automatically handle even the most advanced SINUMERIK machining cycles, and thereby guarantee cost-effective manufacturing.

5. **The SINUMERIK CNC incorporates every function required to produce high-precision, cost-effective medical parts.** The HSC Cycle832, whose technology supports the machining of free-form contours (surfaces) in three-axis and/or five-axis HSC machining, is addressed directly via the CAD/CAM system.

The Cycle832 combines all the functions required for HSC machining in one cycle; it supports the creation of structured NC programs and ensures high dynamics, complete accuracy, perfect surface finishes and maximum speed.

The Advanced Surface function of SINUMERIK MDynamics ensures perfect surfaces at unprecedented machining speeds.

The finished implant exhibits convincing surface quality and a perfect fit. Special IT solutions guarantee traceability over the entire process.

Want more information?

Everything you want to know about SINUMERIK CNC:
www.siemens.com/sinumerik

Everything about shopfloor production:
www.siemens.com/cnc4you

Everything about our value-added services:
www.siemens.com/sinumerik/manufacturing-excellence

Information about CNC training:
www.siemens.com/sinumerik/training

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