Zfx™ Mill inhouse

User manual

Zahn success formula

Content

1. General Information

1.1 The Manual

This manual will enable you to use the CNC machining system Zfx™ Mill inhouse as well as the accessory equipment safely and reliably. In this manual we want to advise especially about the possible sources of danger that stem from the systems and to emphasise the correct use of the systems. Accordingly, we request you to read this manual attentively and to heed the advice given.

1.2 Characteristics of the Machines

The system Zfx™ Mill inhouse is universally applicable CNC machining system for dental technology. This compact table housing contains the four-axis mechanism, the high frequency spindle SF 170P as well as the integrated controller. The software package DentalCAM for the generation of output data and the control software for the output of the data sets generated by the CAM completes the particular system.

The integrated high frequency spindle admits high feed rates. Due to the precision bearing of the spindle axis a top surface-quality of the treated workpiece is achieved. The rotary axis with collet chuck is equipped with a harmonic drive which offers highest true running accuracy for processing workpieces on their full circumference of 360 degrees. The automatic measurement of the rotary axis and the automatic axis compensation ensure a consistently high precision of the machining process.

1.3 Technical Data

1.3.1 Basic System

- ✕ dimensions (W/D/H): 400 x 385 x 410 mm
- ✕ four-axis mechanism; positioning range (x/y/z): 100 x 100 x 40 mm
- ✕ precise ball screw spindles for the 3 linear axes with 4 mm lead
- ✕ motor resolution < 1 μm
- ✕ repetition accuracy ± 0.005 mm
- ✕ complete encapsulation of working area with closable front cover with front lid switch
- ✕ working area illumination
- ✕ prepared dust extraction through openings in the rear panel of the working area (requirements: external industrial vacuum cleaner and switching unit PSW 01)
- ✕ weight: approx. 45 kg
- ✕ very low noise-level

1.3.2 Rotary Axis

- ✕ rotary axis free from backlash with harmonic drive
- ✕ circular spline diameter 40 mm
- ✕ automatic measurement of rotary axis and the automatic axis compensation for absolutely exact results

1.3.3 Spindle

- ✕ high frequency spindle with rotational speed range up to 60,000 RPM
- ✕ automatic tool change for 6 tools

1.3.4 Controller

- ✕ four-axis microstep controller
- ✕ simultaneous interpolation of 4 axes
- ✕ great smoothness of running and highly accurate due to microstep operation
- ✕ high processing speed due to exponential acceleration ramps and automatic change-over to full step mode
- ✕ look-ahead feature for continuous velocity along the path
- ✕ included control software for a comfortable output of the data which has been generated by the post processor
- ✕ speed limitations
- ✕ minimal feed rate: 0.3 mm/s
- ✕ maximal feed rate: 55 mm/s

1. General Information

1.4 Production Software

A productive CAM system includes a high quality production software that will effortlessly import your projects from different CAD design programs. When designing you projects you can use each CAD program. For the subsequent preparation of data for the machining process you get the included software package DentalCAM. For operating the production software, please see the corresponding manuals.

1.5 Scope of Delivery

- CNC machining system Zfx™ Mill inhouse
- USB connection cable
- 230V power supply cord
- external emergency stop button including connection cable
- calibration plate and measuring pin
- service unit for compressed air connection plus hose Ø 6 mm
- spindle service set for SF 170P
- integrated fixing device for round universal blanks with a thickness of 10 to 26 mm and a diameter of 98 mm
- 2,5 mm hexagon socket screw key for exchanging blanks
- hose connection for external vacuum cleaner
- USB dongle
- software package DentalCAM
- control software
- software manual
- operating instructions

2. Installation

2.1 Placement

This machine must not be set up in moist rooms. The surface must be sturdy and even. The room temperature should be between 18° and 25° C as this is the best range for the gliding quality of the employed lubricants. The relative air humidity may be max. 80%, non-condensing. For connecting the machine, an A. C. power supply with 230 V respectively 110 V, fused with 10 A, is needed.

Caution!
The machines are internally set to 230 V as default. Machines with a 110 V setting are marked accordingly with a sticker. Please also take care not to connect the machine to the same power net with other, insufficiently shielded, devices as these could electrically interfere with the high end controller and cause a failure of the system.

2.2 Setting up the Machine

✕ Unwrap the milling machine and its accessories. Remove the accessories placed in the working area. Please keep the packaging for future service reconsignments.

✕ Connect the emergency stop button to the machine and make sure that it is situated within reach.

✕ Connect your compressor to the service unit using the standard compressed air connection plug and the machine using the 6 mm connection hose.

✕ Connect the existing or provided production computer to the machines using the USB cable.

✕ Insert the suction hose with the hose connection into the connection sleeve of the machine. Connect the power supply cord of the suction unit into the switching unit PSW 01 (see also chapter 2.5).

✕ Insert the dongle into a USB port of the production computer.

✕ Plug the power supply cord of the machine into the machine.

✕ Now you can insert all power supply cords and the switching unit in separately fused power sockets. Caution! Do not use a multiple socket!
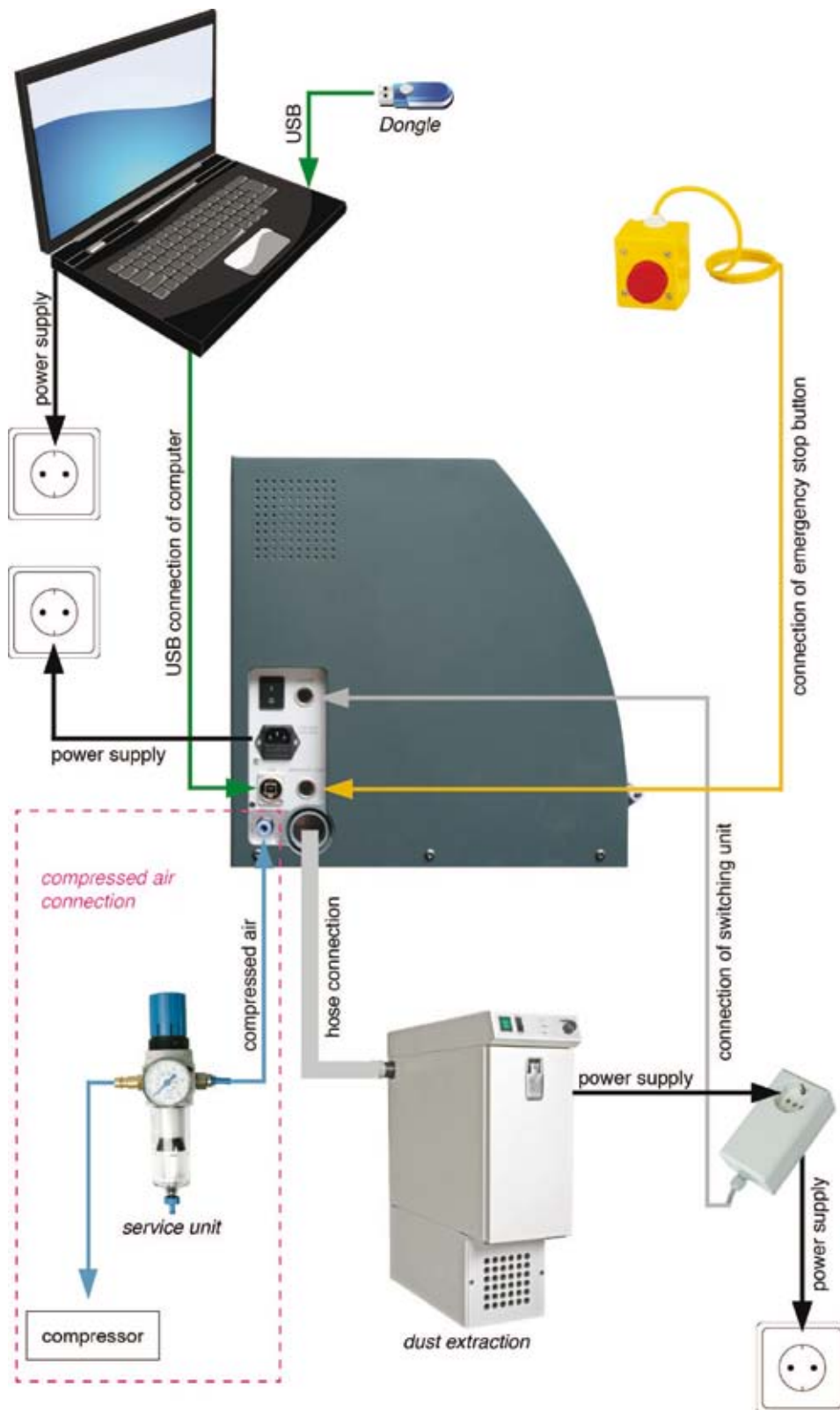
Caution!
Before starting the control software, make sure that the emergency stop button is released (by a slight clockwise turn of the button) and the front cover closed.

1 USB 2.0 connection

2 power switch

3 A. C. power supply with 230 V (resp. 110 V)

4 connection for switching unit PSW 01 for external vacuum cleaner

5 connection for emergency stop button

6 connection sleeve for suction hose

7 pneumatic connection 6 mm for blocking air and tool changing unit

2. Installation

power supply

USB

Dongle

power supply

USB connection of computer

connection of emergency stop button

power supply

compressed air
connection

compressed air

hose connection

connection of switching unit

power supply

service unit

compressor

dust extraction

power supply

2.3 Components of the Machines

1   front lid with safety contact

2   high frequency spindle SF 170P with quick chucking device

3   integrated fixing device for universal blanks with tool change station

4   openings in the rear panel for dust extraction
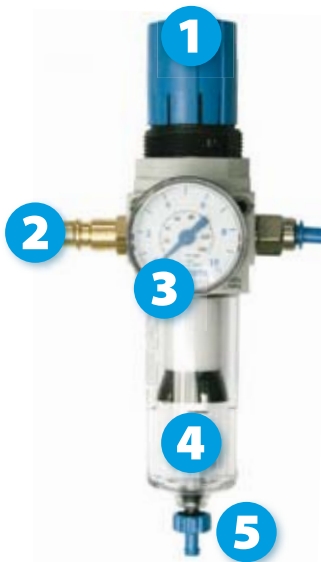
2.4 Compressed air

The high frequency spindle SF 170P needs compressed air as spindles with an automatic tool change need compressed air for operating the pneumatic collet chuck. It also needs blocking air to prevent particles from getting into the spindle. The air consumption of the machine is at max. 80 l/min.

2.4.1 Compressed Air Supply

The scope of delivery of your CNC machining system includes a service unit for the compressed air connection. The integrated water separator for the com-pressed air supply. The water separator with its 5-µm superfine filter is used to prevent that air which is contaminated with humidity or dust particles may damage the sensitive bearings of the spindle. However, the compressor must supply dry and oil-free air as the water separator is only able to filter small rests. Compressed air which is not dry may lead to a damage of the spindle bearing and to electrical defects.

2. Installation

① knob for pressure regulation

② standart compressed air connection plug

③ manometer

④ water separator

⑤ discharging screw

2.4.2 Connection / Installation

Connect the pressure regulator of the machine to your compressor using a standard compressed air connection plug. The supply of compressed air has to be dry, oil-free and must deliver at least 7 bar of pressure continually. The machine will be connected via the thinner hose on the right side. Please note that the service unit has to be mounted in an upright position.

2.4.3 Settings

After you have connected your compressor with the service unit, please check if the manometer shows a pressure of 7 bar. If this is not the case, the knob has to be pulled up a little bit – only then can it be adjusted. By turning the knob toward "+" you can increase the pressure, turning toward "-" will decrease the pressure. Afterwards, please press the knob back down to prevent unintentional misadjustment.

2.4.4 Maintenance

Control regularly whether liquid has accumulated in the water separator and, if so, empty it by opening the discharging screw. The condensate will be blown out under pressure. In case of strong dirt accumulation the micro-filter element in the water separator has to be cleaned or exchanged. A strongly foiled filter element may cause a loss of working pressure. Disconnect the air pressure by unplugging the main compressed air supply hose. Then you can screw out the beaker. After you have screwed out the supporting spring from under the filter element you can pull out the filter element.

2.5 Dust Extraction Unit

The Zfx™ Mill inhouse is prepared for the dust extraction with an external industrial vacuum cleaner. For this purpose, the machine is equipped with openings in the rear panel of the working area. For operating the dust extraction unit you need the provided hose connection, an external vacuum cleaner and the switching unit PSW 01. Please observe that the vacuum cleaner is always switched on during the milling process. The dust extraction is activated and deactivated automatically, but it can also be manually switched via the software.

Caution!
✕ Please keep in mind that your vacuum cleaner must be suited for this application (protected against the danger of explosion when using inflammable cooling liquids, micro-filter for processing hazardous materials etc.).
✕ Empty the dust bag of the vacuum aggregate regularly and if it is equipped with a fine particle filter, replace it at regular intervals.

In all cases, heed the instructions and the safety regulations given by the manufacturer of your vacuum cleaner. The vacuum cleaner is connected at the side of the machine housing. An illustration of connections is provided in chapter 2.2 "Setting up the Machine".

2.6 Installing the Software

✕ Connect your production computer and start it.
✕ Insert the dongle into the USB port of the computer which you will use for operating the milling machine.
✕ Unpack the ZIP file.
✕ Start setup.exe and follow the instructions of the installation program.
✕ For further information see the software manual.

Attention!
✕ Installing and operating the software and milling machine is only possible with inserted dongle.
✕ Please visit our website on a regular basis, check whether there is an update
✕ available and update your software.

3. Running the System

3.1 Operation

After you have ensured that all cables have been connected, you can turn on the machine using the power switch on its side. For a milling job you only need the blanks which you want to use as well as the required tools. As the machine is operated through the software, you can find further details on the handling of the machine in the software manual. The machine is equipped with a safety contact at the front lid. When opened during the machining process, the machine switches into the halt mode at its current position. After closing the front cover, the machining process is continued at this position.

The emergency-stop button is used to immediately stop the system in case of danger. The power supply of the axes and the spindle is interrupted and the spindle coasts to standstill. Place the emergency stop button in such a position that it is always easily within reach during the machining process. The machine is already calibrated on delivery. As long as your milling results are correct, there is no need for a further calibration. If your results should become inaccurate, a calibration could become necessary. In such a case, please contact a service technician before recalibrating the machine.

3.2 Security

3.2.1 Intended Use of the Machine

The machines of the type CAM 4-K1 and CAM 4-K2 Impression have been designed for all kinds of easy to medium milling works. For milling works, it has to be considered that the machine cannot withstand all powers that can possibly occur. The machines are suitable for processing wax, most synthetic plastics (e. g. PMMA), nanocomposites as well as zirconium. Please keep always in mind not to use too high values for the cutting depth and the rate of feed. This could lead to ripping loose the workpiece and jamming the tool. This can cause irreversible damage to the machine and/or the spindle. Using the DentalCAM software, the software automatically calculates the optimal parameters.

3.2.2 Security and Protective Regulations

- ✕ The working personnel must be trained in the proper handling of the machine and in the following security and protective regulations.
- ✕ The machine may be operated by only one person at a time.
- ✕ The working place must be kept clean and orderly. Disorder in the working environment can be a cause of accident.
- ✕ Keep children and animals away from the machine.
- ✕ Check the machine for possible damage. Before starting to work with the machine, ensure that all safety devices and their components are in place and in good working order. Damaged safety devices or parts thereof must, if not stated otherwise in the user manual, be repaired or replaced by authorised service personnel.
- ✕ While working with the machine in maintenance mode or when the front lid is opened, the working personnel and all persons within reach of the machine must wear protetive safety glasses and a hairnet in case of long hair.
- ✕ Do not let the machine run unobserved.
- ✕ Loud noise can arise from certain modes of work. In this case do wear ear protection. Loud noise is often a sign for wrong operating circumstances. Ensure that the workpiece is fixed properly and check the values for rotational speed, cutting depth, feed rate, tool endurance and the material.
- ✕ The safety devices of the machine are designed for practical use. During the conception of the machine special attention was given to the working practice of the user. Safety features that would inhibit the usability were not implemented. Thus it is prohibited to circumvent or set out of use present safety devices.
- ✕ During the use of the machine there is the danger of squeezing fingers when grasping into the working area.
- ✕ Place the emergency stop button in a position where it is always easily reachable. Memorise the position of the button before starting the machine. Please note that it is not possible to set the machine to work without an installed emergency stop button.
- ✕ Before starting the automatic output process, make sure once more that all settings and parameters are correctly set. If in doubt, a "dry run" (without diving into the workpiece) may make sense. Be certain that the tools in the changing station are set in entirely straight and that they are in exactly the same positions that have been programmed in the production software.
- ✕ The machine may only be operated with closed encapsulation.
- ✕ Make sure to read the preceding passage "Intended Use of the Machine" in the user manual.
- ✕ A damaged cable may not stay in use. An original spare cable must be used to replace it.

3. Running the System

Spindle

For the operation, installation and maintenance of the spindles follow the regulations for the prevention of accidents. Improper handling or operations differing from the intended use of the machine greatly diminish the security of usage!

- ✕ Always take care that the tool and the workpiece are tightly fastened. Due to high centrifugal forces improperly fixed parts can be thrust outwards.
- ✕ Use no unbalanced tools at high rotational speeds. This applies to e.g. single tooth cutters and gravers. Such an imbalance makes itself heard by a loud running noise and puts a great strain on the ball bearing of the spindle.
- ✕ If possible, use no tools with cutting edge diameters that exceed the shank diameter. If it cannot be avoided you should work with a lower abrasive rate.

Caution!

- ✕ Do not grasp into the range of the tool.
- ✕ Please be aware of the information about the choice of tool and the adjustment of tool parameters given in chapter 4.3.
- ✕ When processing materials containing asbestos or other hazardous or harmful materials the usage of a fine particle filter must be observed.

Fixing Devices

- ✕ In each case, ensure and check that the workpiece is properly fixed before starting the work.
- ✕ In general, you should start with a relatively small cutting depth and increase it in small steps. A higher abrasive rate in milling works leads to stronger forces acting on the workpiece. If these forces exceed the fixing power of the fastening device the workpiece may come loose.
- ✕ Empty the dust bag of the vacuum aggregate regularly and if it is equipped with a fine particle filter, replace it at regular intervals.

Please also note further advice given in the chapters dealing about the components you have in use.

3.3 Maintenance

Please clean the cone of the spindle about every 100 operating hours and heed the advices given in chapter 4 "Spindle". Please also clean the fixing device for workpieces at regular intervals.

In general, the machine is already calibrated on delivery. A recalibration is only necessary if your milling results are bad or if problems occur. In such a case, please contact a service technician before recalibrating the machine.

3.4 Cleaning

3.4.1 Internal Cleaning

Clean the machine regularly to prevent dirt and chips to accumulate in the guiding rails and other sensitive components of the system. Do not use compressed air for this, as it could blow the shavings into the guiding rails. Therefore, use a vacuum cleaner to remove the dirt.

3.4.2 External Cleaning (Housing)

- ✕ The cleaning of powder-coated surfaces should generally be done first with a soft dry cloth.
- ✕ If pollution cannot be removed in this way, the cloth can be moistened and also if necessary a ph-neutral cleaner can be used.
- ✕ Basically any contact between the powder coatings and alkaline or acid substances has to be avoided. Especially metallic powders show a high sensitive reaction.
- ✕ If the usage of a special cleaner is necessary to eliminate certain pollutions we recommend to check the applicability of the cleaner at a hidden place first.
- ✕ Please especially take care of the affixed machine labels, so that you don't remove them while cleaning the housing. They are especially sensitive to intensive rubbing and harsh detergents.

4. Spindle

4.1 SF-Spindel SF 170P

4.1.1 Features

✕ nominal power under continuous load (S1): 170 Watt

✕ maximal power (P max.): 240 Watt

✕ rotational speed range: 5,000 – 60,000 RPM

✕ pneumatic collet chuck 3 mm

✕ precision shaft with double bearing

✕ automatic tool change station for 6 tools with automatic length detection

Caution!

The high frequency spindle SF 170P is a high precision device that may never be subject to any form of raw force like strikes and impacts, excessive pressure on the shaft, forcible fastening in the spindle support (spindle fastening block) or eccentric thrust through too much tolerance in the spindle support! Please note that the spindle may only be operated if the blocking air is switched on.

4.1.2 Automatic Tool Change

The tool change of a SF 170P is carried out automatically. There you dispose of a tool magazine with 6 tools. An adequate frequency converter is integrated in the Zfx™ Mill inhouse. Thus all spindle features are comfortably controlled by the production software.

For the usage with an automatic tool changer your tools must necessarily be equipped with a stop ring. If you have any tools without stop rings, they must be fitted with stop rings. It is self-evidently that all inserted tools must suit the positions stored in the production software. Only tools with a shank diameter of 3 mm may be used. Take all dimensions regarding the tools from the following drawing. The cutting edge diameter may be 3 mm maximal.

For storing the tool in the tool changing station an unmachined shank with a length of at least 6 mm is required As stop ring a retaining ring has to be installed into the existing slot.

Caution!

Install only retaining rings according to DIN 471-A3!
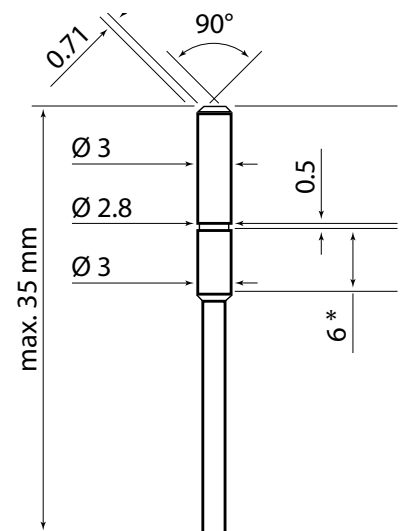
Tool dimensions

4.1.3 Maintenance and Cleaning

To guarantee a safe and precise operation of the HF spindle, the collet chuck has to be cleaned at appropriate intervals depending on the grade of staining. No grease or oil may enter the bore of the collet chuck. The inside cone of the spindle shaft has to be free of chips or any other dirt. Also the tool shafts have to be free from oil, grease and dust to ensure optimal tension force and to guarantee an accurate tool change. Do not use compressed air to clean the spindle, as dust could be blown into the sensitive bearing area otherwise!

Tool: clean and soft cloth, soft brush, spindle maintenance set ❶
Duration: ca. 5 minutes
Frequency: This maintenance should be carried out about every 100 hours.

Procedure:

✕ Start the control software and choose the control panel. In order to executea spindle maintenance, click on the button „Spindle maintenance". The spindle will then be moved to a position, where it is easy accessible. In order to open the collet chuck, confirm the according message with "OK".

✕ Now take the measuring pin, insert it into the collet chuck and keep hold of it. Put the knurl cap of the service set over the measuring pin onto the edge of the collet chuck. By turning the knurl cap, you can unscrew the collet chuck from the spindle. The measuring pin thus avoids that the collet chuck is compressed and that the knurl cap can turn the collet chuck. ❷

✕ Clean the internal cone of the shaft with the felt cone of the service set. The internal cone must be free of dirt.

✕ Clean the collet chuck with a clean and soft brush respectively the brush of the service set.

✕ Subsequent to the cleaning, apply a thin grease film on the outside of the collet chuck. This improves the conductivity and increases the clamping force of the collet chuck. **Attention!** No grease or oil may enter inside of the collet chuck. ❸

✕ Reinsert the collet chuck including the measuring pin and tighten it slightly hand-tight with the knurl cap. It should be possible to move the tool within the collet chuck without resistance.

Attention!

✕ Do only use the grease of the service set. No other greases or oils must be used.

4. Spindle

4.2 Tool Parameters

In order to set the optimal values for lowering speed, cutting depth, rate of feed and rotational speed for processing your workpiece, a number of factors have to be observed.

- ✕ what kind of material does the workpiece consist of?
- ✕ the kind of cooling and/or lubrication
- ✕ power and range of rotational speed of the spindle
- ✕ minimal/maximal feed rate of the machine
- ✕ features of the controller

In the software DentalCAM all processing and tool parameters are already preset for works in the field of dental technology. If you use another CAM software or work in another field of application, you are provided with general advice and hints about the employment of tools in the vhf tool catalogue. In any case, the safety and protective regulations mentioned in chapter 3.2 have to be observed.

5. Digital Workflow
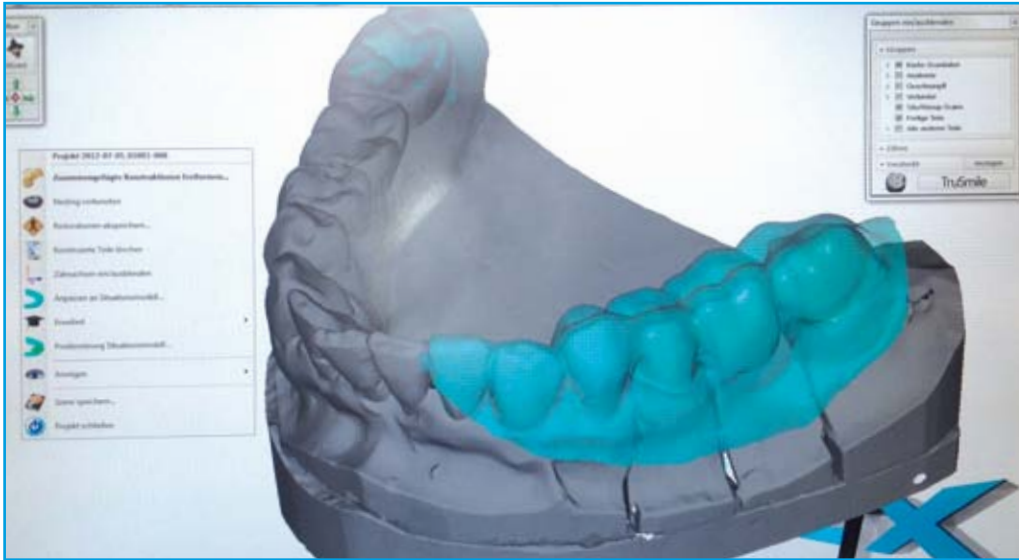
After having finished the job within the Design Software, click on the right mouse button to get access to the operating interface.
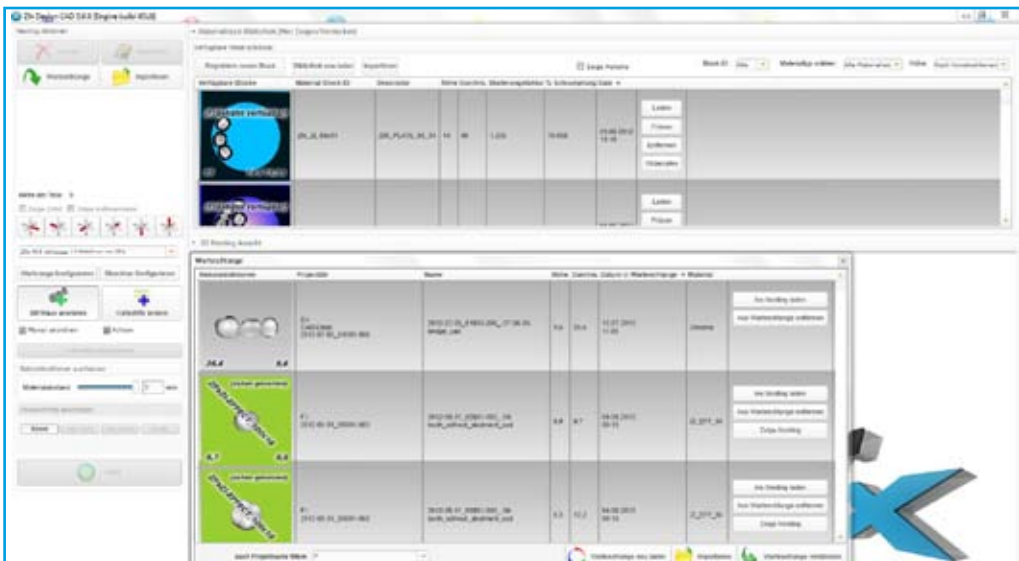

After the job has been up-loaded into the nesting queue, please open the Zfx™ Design CAD Software in which you have the opportunity to edit the job.
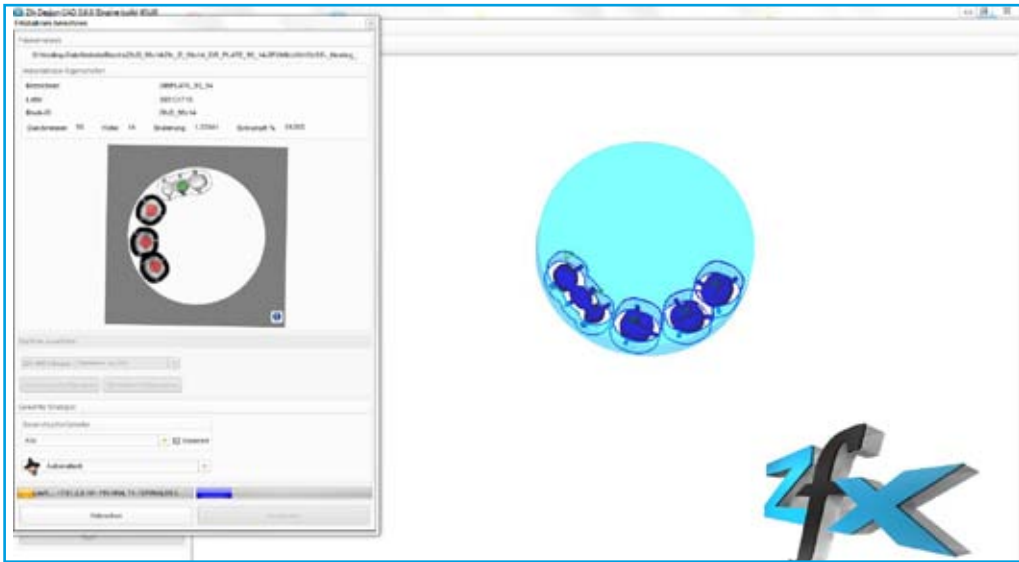
5. Digital Workflow

Then you select a material for your milled job, if applicable you can also create a new blank, therefore please click **"register new blank".** There you can choose the material and dimension and furthermore you need to enter the ID (Zfx_Zirkon_98x12), Lot and shrinking factor. Finally please confirm by **"apply".**
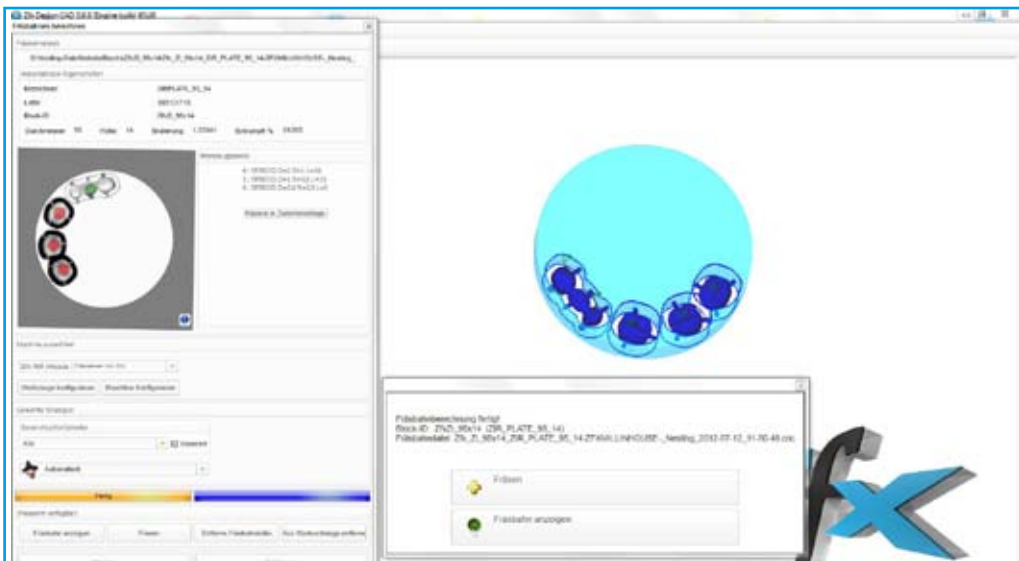

Now you can move the object to be milled by pressing the right mouse button and by using the strg or shift key. Furthermore in the left toolbar you can place your retainer pins and state its thickness.
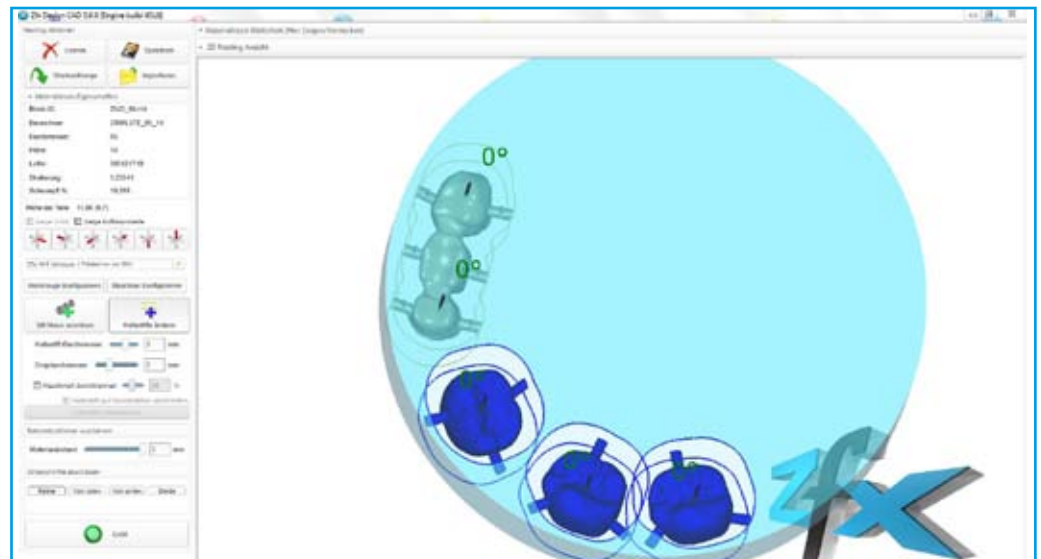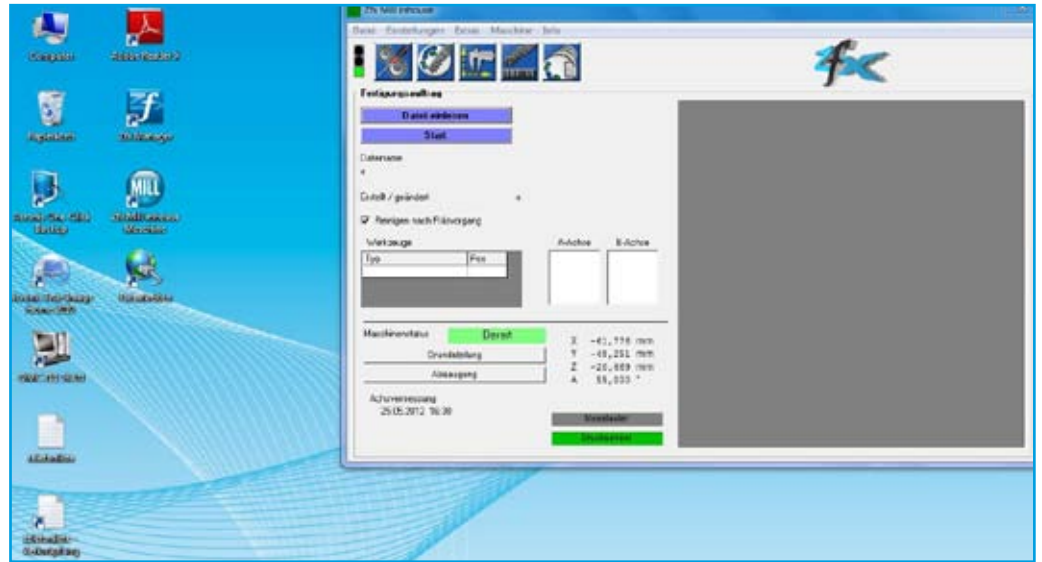
Click on CAM to determine the milling path,…

…if this job is done, the opportunity is offered to either have a look at the milling path or to release the job for milling
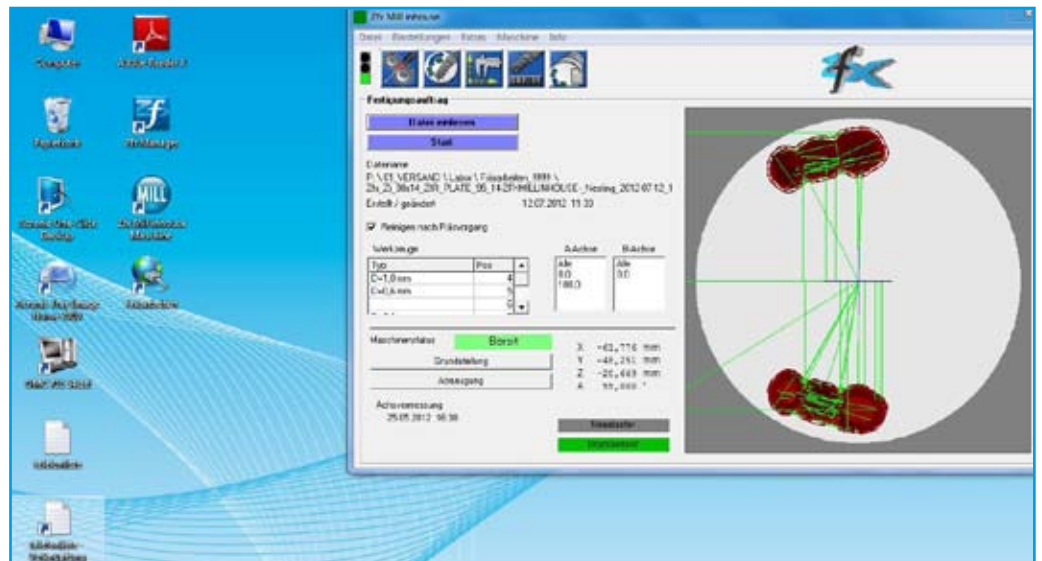
5. Digital Workflow

Please open now the Zfx™ Mill inhouse Machine software, click on **"upload file"…**

…and select your CNC file, which you have created just before.

Confirm by **"start"** and the Zfx™ Mill inhouse is starting to mill the work.

Notes

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Zahn success formula

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