

# Seven Tips

## for a Faster Measuring Process

A high-performance measuring machine is the prerequisite for fast and efficient measuring. Yet many operators are not achieving maximum efficiency with their coordinate measuring machine. Nadine Schwab from Regional Sales in Germany has come up with seven tips to help coordinate measuring machine users increase their profitability.

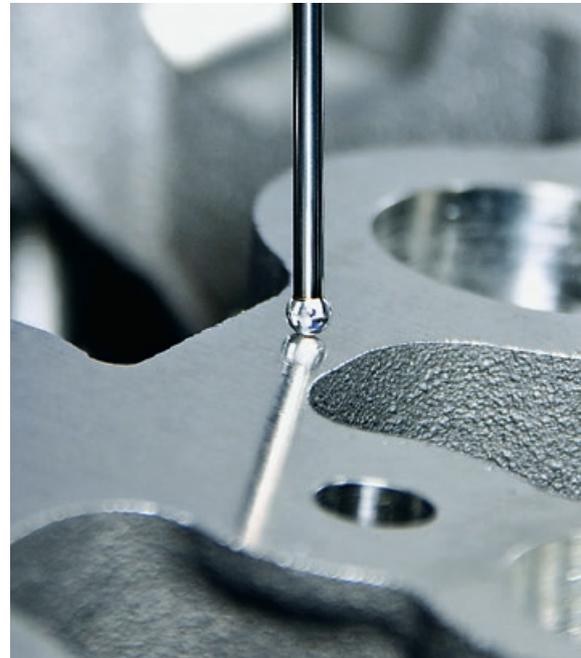
### Tip 1: More stable stylus systems increase the measuring speed

According to Nadine Schwab, using suitable stylus systems is perhaps one of the most important conditions for expediting the measuring process. The lighter and more rigid the styli and stylus extensions are, the faster the operator can measure without negatively impacting the precision of the system through bending or centrifugal forces. That is why, to take one example, the stylus material is such an important factor. Carbon fiber is ideal for measuring technology: it is lightweight, has high flexural strength and, because of its thermal stability, it eclipses other materials like aluminum, stainless steel, steel, titanium and ceramic. ZEISS uses a special carbon fiber, combined with titanium adapters, for its styli and stylus extensions. The high rigidity of these ZEISS ThermoFit systems is especially important when measuring with high throughput because a higher scanning speed also increases the accompanying bending forces which deform the system. At a speed of 8 millimeters per

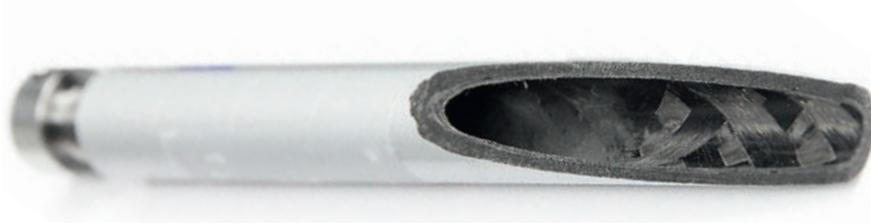
second, a form error of 7.3 micrometers can arise with titanium stylus extensions. If the coordinate measuring machine scans at 12 millimeters per second, the error is already at 13.0 micrometers. Stylus extensions from the ThermoFit carbon fiber-titanium combination, however, only deviate by 1.7 or 2.4 micrometers under the same conditions.

### Tip 2: Diamond styli shorten downtimes

Along with the material used for the shaft, Schwab indicates that the stylus tip material – which glides over the workpiece during measurements – is of central importance. If the sphere is made of ruby or silicon nitride, it loses its roundness over time when it comes into contact with very hard materials like ceramic or very light ones like aluminum alloys. Little by little, scanning hard workpieces wears down the surface of the sphere. The ruby or silicon nitride sphere strips away small amounts of material from soft workpieces. This material then accumulates on the surface of the sphere. Both effects distort



*Unlike with stylus tips made of ruby or silicon nitride, contact with very hard or especially soft workpieces does not compromise ZEISS Diamond!Scan diamond styli. Workpieces can be scanned without the need to regularly clean or replace the stylus tip. Increased measuring certainty means greater throughput.*



*A look at the interwoven carbon fiber structure in the interior of a ZEISS ThermoFit measuring stylus: the lighter and more rigid the stylus systems are, the more quickly the operator can measure without bending or centrifugal forces impairing precision.*

*Pallets reduce downtime: while the measuring machine is still measuring, operators can stage the next set of workpieces to be measured onto the pallet. Calibration pallets with a fixed reference sphere mount and sphere save additional time.*



the measuring results over time. Because of this, the operator has to regularly clean styli made of ruby or silicon nitride and often replace them with new styli when working with extreme materials. The measuring machine cannot be used productively while changing the stylus and redoing measurements. This is why many operators forgo continuously scanning their components; measuring single points means less stylus deformation. Yet in comparison to the scanning process, which generates a large number of measurement data in a short time, the significantly slower measuring of single points has other disadvantages. Operators are faced with a dilemma: they either capture fewer measuring points at the expense of higher throughput and accept greater measurement uncertainty – or the operator measures a lot of single points, reducing measuring uncertainty but increasing the measuring time.

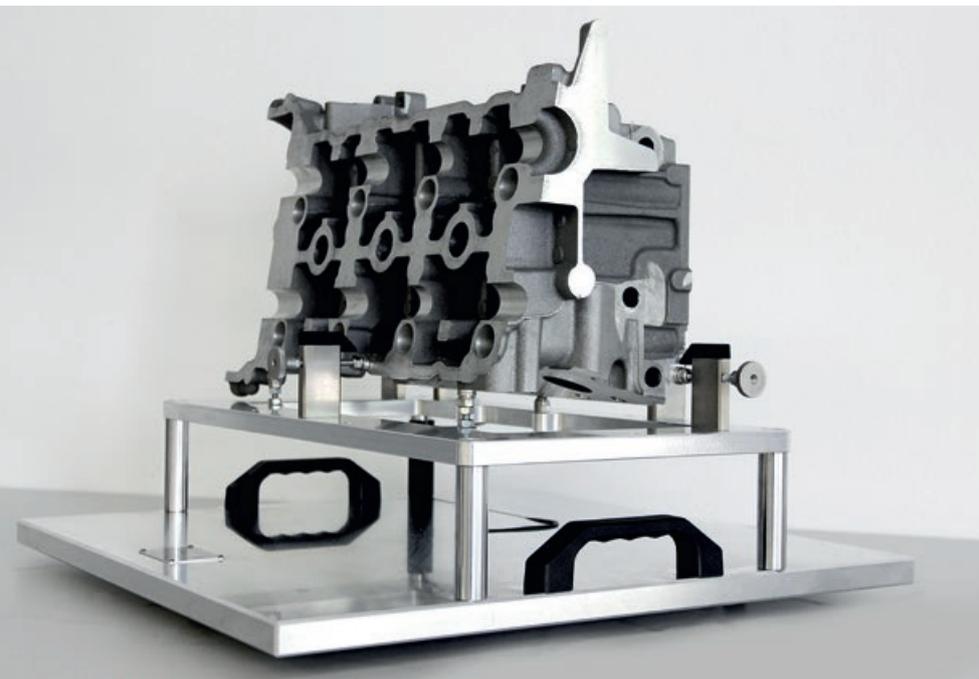
ZEISS offers a way out of this dilemma with the Diamond!Scan brand stylus tip made of diamond or, alternatively, with

a special diamond coating. What is the benefit? There is no need to inspect and clean the stylus tips because no material remains stuck to the sphere's surface and they do not wear down. Schwab explains: "You don't even need to replace them because the styli retain their original shape for years. There's also no need to capture the measuring points individually because scanning workpieces no longer adversely affects precision. The end result: increased throughput."

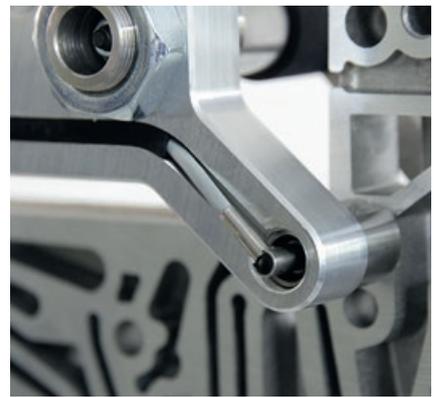
**Tip 3: Pallets reduce changeover times**

Schwab knows that quality assurance can become a bottleneck even if you are using the most high-performing measuring machine with the most suitable styli. One possible cause is that the coordinate measuring machine is always stopped for minutes on end while the workpieces are loaded. No matter if it is a series of cellphone housings or sensors, loading can take several minutes, especially when multiple workpieces need to be mounted at the same time. It also takes

a lot of time and effort when different components require the operator to frequently change the fixtures. "Pallets are a simple but often underrated solution," says Schwab. "While the measuring machine is still measuring, the operator stages the next set of workpieces onto a pallet outside of the measuring machine. Once that's done, it's easy to load the pallet onto the machine." Pallets can be correctly positioned in seconds without the need for realignment. For example: by using a pallet, the operator can save around 15 minutes of downtime during loading and calibration every time the fixture is changed. If you assume that measuring, loading and/or calibration take the same amount of time, it is possible to measure twice as many workpieces per measuring machine by using pallets. In Schwab's experience, a calibration pallet can save additional time – even prior to the first measurement. On these pallets, there is a fixed reference sphere mount with a sphere and, if necessary, a calibration ring and a glass artifact. To calibrate, the operator just has to place the pallet onto the



Fixtures resting on a metal frame mean the stylus can easily access the workpiece, making it easier to generate measuring programs.



Companies can save a half hour per eight-hour shift if the workpiece temperature is captured automatically with an integrated temperature sensor in the pallet.

machine and then start the measuring process. Since all calibration instruments are a part of the pallet, it only takes a few seconds to clear away these aids.

**Tip 4: Fixtures in the framework design increases throughput**

In addition to using pallets, Schwab also recommends that you carefully consider how you mount workpieces at your own company: “Using standardized fixtures can increase throughput when measuring – and save you time designing fixtures and generating measuring programs during the preparatory stage.” Schwab points out that fixtures in the framework design are more favorable for challenging measurements than column-based measurements because, with this design, the workpiece is fixed on a metal frame. The frame rests on columns and these, in turn, are anchored in a base plate. With traditional equipment, however, every individual element for mounting the workpiece is generally on its own column. These columns limit the stylus’ ability to access the workpiece. This is also true for horizontal and vertical clamping. The measurement program

needs to factor this in. The framework construction, by way of contrast, makes the workpiece easily accessible from all sides, which expedites measuring program development and reduces the measuring times. The framework system has an additional benefit: similar fixtures can be easily designed for different versions of the workpiece because the clamping principle, the base plate and the four columns do not change. The fixtures are relatively uniform and give the operator the opportunity to standardize stylus and measuring programs to a large extent. This enables the operator to use these tools more quickly.

**Tip 5: Integrated temperature capture saves time**

For Schwab, a temperature sensor integrated in the pallet gives you greater efficiency. It automatically captures the workpiece temperature at the beginning of the measurement and relays this information to the measuring machine. The expert explains: “The operator no longer has to load the sensor manually or via the temperature stylus – this is an important criterion for improving

efficiency in serial measurements. Let’s take an eight-hour shift as an example. A total of more than half an hour of time is saved if we assume that a measuring cycle takes 15 minutes, including one minute for the temperature measurement.”

**Tip 6: Software options speed up the measurement**

Hardware is not the only influence on the measuring time; software also plays an important role. Here is an example: a measuring stylus scans a workpiece and comes to a recess in the surface. At this point, the typical procedure would be to travel upwards vertically and past this space and to descend vertically at the next characteristic on the other side of the space. With the ‘FlyScan’ function of the VAST Performance software package from ZEISS, the ‘ascend, travel further, lower’-detour is unnecessary. Instead, the measuring stylus travels straight ahead over the space and continues scanning on the other side without any interruption. The software nevertheless evaluates the right measurement points. In Schwab’s estimation, this procedure can reduce the measuring time by up to



*With the FixAssist angle-setup device, measuring engineers can quickly and accurately align the styli when setting up a stylus system. Higher precision reduces the risk of collisions. And more complex stylus system can be set up, meaning more characteristics can be measured per measuring process.*

70 percent for applications such as the tip circle measurement on a gear.

QuickChange, another software function, enables stylus changes to be twice as fast. Schwab recommends this software option for complex workpieces which require multiple stylus changes: "If eight different stylus systems are used, this software helps the operator save two minutes."

An original adapter plate from ZEISS is a requirement for using these software options. An additional advantage of this adapter plate is that the software identifies the stylus system used via a chip. It also recognizes e.g. if the wrong stylus system configuration is being used and notifies the operator. "It's a big help, especially when you have 10 or 20 stylus systems to choose from," says Schwab. "After all, a collision does more than just consume measuring time."

**Tip 7: An alignment device makes constructing stylus systems easier**

In order to minimize the risk of expensive and time-consuming collisions between the stylus and the workpiece,

Schwab suggests an additional tool: an angle set-up device for styli. The FixAssist XXT and FixAssist VAST set-up devices from ZEISS make it easier for measuring engineers to quickly and precisely align the styli by up to half a degree when setting up a stylus system. They do not just prevent collisions. They also reduce the the coordinate measuring machines' downtime because the stylus systems no longer have to be adjusted on the machine itself. The operator can also construct more complex stylus systems and thereby measure more characteristics per measuring process – another step towards higher efficiency.

Each of these tips saves time and using all seven together will help increase profitability significantly. This means that there is a quick return on the investment in high-quality measuring equipment, especially the appropriate styli. For Schwab, the reasoning is simple: "If you build a race car using cheap wooden wheels, you shouldn't be surprised when you lose."



*Special software options like ZEISS 'FlyScan' can cut the measuring time in half. These enable e.g. the stylus to travel over spaces in the surface more quickly during the scan.*