METROTOM Check Nano

Test piece for METROTOM

Operating instructions

Read the following information first!

– Please read these operating instructions before using the test piece.

– For your own safety, always keep all relevant accompanying documents ready to hand.

This manual is subject to change and the CT described therein as well as its components are subject to technical modifications.

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METROTOM Check Nano
Operating instructions
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Marking elements

The texts may be displayed differently in this document. Examples and the meaning of the representation type are described below:

Example	Meaning
not	Words to be emphasized are represented in *italics*. The italicized print is sometimes used to mark a subheading, e.g. *Type of measurement:*
Main switch	Any reference to operator's controls in the text is highlighted typographically.
Tolerance field	Designation of subdomains in software windows.
Cancel	Marking of buttons
RETURN	Keys of the keyboard are represented as small capitals.
"InstallShield Wizard completed"	Software messages
File → Open	Representation of menu items
`Code`	Source code
…\Calypso\opt\om\protform	File and directories
CALYPSO	Product name
ZEISS	Company name
CAUTION! The measuring table must be clean.	Safety instruction embedded in the text.
[1]	Representation of position numbers in texts

Marking elements

1 Introduction

This chapter contains:

General specifications 1-2
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General specifications

Delivery package

The delivery package of the METROTOM Check Nano includes:

- Test piece with accessories in transport case
- USB stick
- Operating instructions
- Calibration certificate
- CALYPSO measurement plan
- Recommended scan parameters for METROTOM.

System requirements

Use of the METROTOM Check Nano requires the following prerequisites:

CMM	METROTOM CT scanner
Data system	Computer with Windows 10 operating system
Measuring software	CALYPSO 2019
Programs	Microsoft Excel

Warranty

With regard to warranty, the same conditions as for the CT scanner apply.

- Observe the corresponding information in the operating instructions for the METROTOM.

Security

Intended use

METROTOM Check Nano is used to determine the sphere distance error SD as per VDI 2630 page 1.3. With a maximum measuring length of 3.6 mm, it is suitable for a high magnification and a small measuring volume.

Monitoring requires a test piece to be set up on the rotary table of the CT scanner and a CT measurement to be performed. The test piece may only be used for this purpose.

Reasonably foreseeable misuse

The test piece must not be used for purposes contrary to the information given in these operating instructions.

Safety instructions

Basic safety instructions

The test piece is used on a CT scanner.

– Please observe the safety instructions for the use of the CT scanner. See METROTOM operating instructions.

2 Description

This chapter contains:

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What is the purpose of the METROTOM Check Nano?

The METROTOM Check Nano is used to monitor the sphere center distance error SD. In connection with the separately available P-Check, it allows you to monitor the length measuring error E of the METROTOM CT scanner. The length measuring error describes the three-dimensional deviation behavior of the measuring system according to DIN EN ISO 10360.

Purpose of monitoring

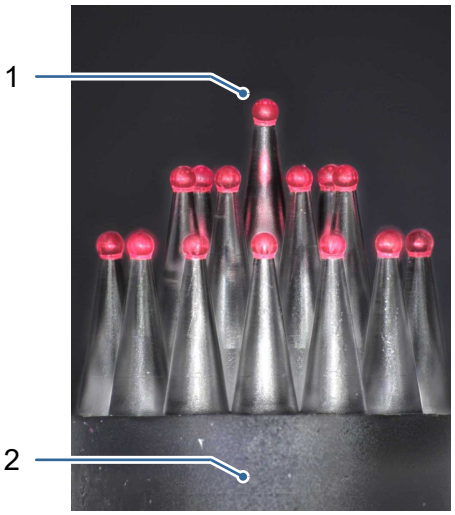
The monitoring function guarantees the compliance of the CT scanner with the limit values requested by the operator.

How often is monitoring necessary?

The operator is responsible for the monitoring of the CT scanner, which has to take place at appropriate intervals.

Components

Test piece



1 22 ruby spheres (diameter: 300 µm)

2 Base body made of quartz glass

Files for evaluation

Special files are required for evaluation of the measurement results. These are stored on the supplied USB stick.

– CALYPSO measurement plan

– Report header files

– Nominal value file for the test piece

– **Excel** evaluation table

Detailed information ➤ *See [⇨ 4-5]*

3 Technical data

This chapter contains:

Specifications 3-2

Specifications

Test piece

Calibration	Calibrated by the Swiss Federal Office of Metrology (METAS, Switzerland)
Base body material	Quartz glass
Base body expansion coefficient	0.5 x 10^{-6} 1/K
Sphere material	Ruby

4 Operation

This chapter contains:

CT measurement 4-2
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CT measurement

Notes

METROTOM operating instructions

To perform a CT measurement, you must be familiar with the METROTOM operating instructions and comply with them.

Temperature influence

Due to their very low volume, the test item and holder reach thermal equilibrium with the environment within a few minutes.

1 Before starting the measurement run, allow the test piece to acclimatize to room temperature.

2 Measure the temperature of the test piece and enter it in the CALYPSO measuring software when performing the evaluation.

Preparing a CT measurement

Preconditions for a CT measurement

Qualification procedure

Prior to the CT measurement, you must perform a geometric qualification and an axis qualification. See METROTOM operating instructions.

Setting up the test piece

1 Move to the loading position.

2 Place the workpiece pallet with mounted test piece on the rotary table.

3 A contact measurement of the temperature cannot be performed on the test piece and should be replaced by a contact measurement on the workpiece pallet (after reaching thermal equilibrium).

Damage caused by X-ray radiation.
X-ray radiation may damage the temperature measuring device.

- Remove the temperature measuring device from the interior of the radiation protection enclosure before switching the X-ray source on.

4 Close the loading door.

5 Move the test piece into position.

NOTE

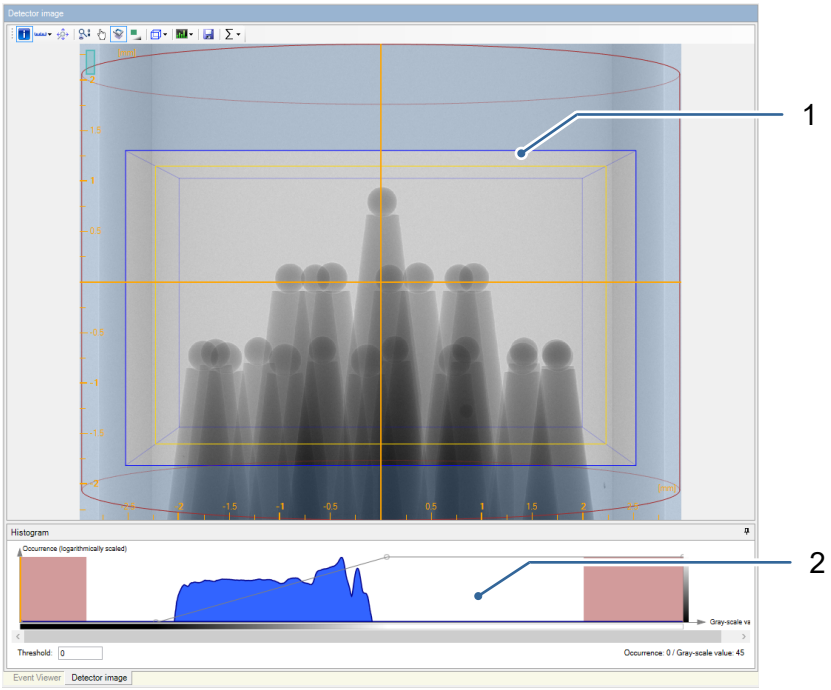
Due to its small size, the test piece is measured very close to the X-ray source. Note the risk of collisions, especially in systems with automatic filter changers.

Making settings

The values for the measurement can be found in the document named *Parameter values*. The current parameter values of the test pieces for the respective METROTOM CMM can be viewed and downloaded on the ZEISS Portal. The parameters valid at the time of delivery can be found in the corresponding document on the supplied USB stick.

Setting the reconstruction area

The reconstruction area must be selected so that all spheres are located within it. Check this for the 0° and 90° rotation angles. The distance between the spheres and the edges of the reconstruction area should be at least 20 pixels in the horizontal and vertical directions.



1 Reconstruction frame

2 Histogram

– Drag the frame for the reconstruction area as large as possible so that all spheres are located within the frame.

Adapting the histogram

The histogram shows the modulation of the detector pixels. The area highlighted in red on the right must be avoided (overexposure or non-linearity). Adapt the parameters of the source and the detector if necessary.

Performing a CT measurement

After the preparatory measures have been carried out, the CT measurement can be carried out.

– Carry out the CT measurement according to the information given in the METROTOM operating instructions.

Evaluation with CALYPSO

General procedure

The evaluation comprises the following steps:

- Open measurement plan.
- Check the nominal values of the characteristics.
- Import the CT volume data.
- Visualize the CT volume data.
- Perform a manual alignment by probing.
- Activate temperature compensation.
- Run the measurement plan.
- Evaluate the measuring results.

The results are shown in a measurement report and a length measuring error diagram.

Preparation

A measurement plan, report header files, a nominal value file and the corresponding evaluation table are required for the evaluation. These files are stored on the USB stick supplied and must be copied to the hard disk.

Folder and file to be copied	Medium	Directory
Measurement plan *METROTOM_CHECK_NANO_PL*	USB stick	*METROTOM_CHECK_NANO\Pruefplan*\
	Hard drive	…*Calypso\home\om\workarea\inspections*\
Evaluation table *METROTOM_CHECK_PR*	USB stick	*METROTOM_CHECK_NANO\Auswertetabelle*\
	Hard drive	…*Calypso\home\om\workarea\results*
File *Metrotom_Check_Nano_Protokollkopfdatei* and other Excel files	USB stick	*METROTOM_CHECK_NANO\Protokollkopf-Dateien*
	Hard drive	*CALYPSO\data\excel_report*

Using the correct nominal values of the test piece

For the evaluation, the nominal values of the test piece must be entered in CALYPSO. The file with the nominal values is stored in the directory of the »METROTOM_CHECK_PL« measurement plan. The name of the file starts with »Kalibrierwerte_Metrotom_Check«. Example: Kalibrierwerte_Metrotom_Check_Nano_29029101B_360_2010-05.txt.

NOTE

The »METROTOM_CHECK_NANO_PL« measurement plan contains files which are not saved if the measurement plan is saved with another name and (or) saved in another directory via **File Save as**. In this case, the file with the nominal values and the »inspection_post_load.bat« file must be copied manually from the previous measurement plan to the newly saved measurement plan.

The file with the nominal values always has to be replaced with a current version after the test piece is recalibrated.

Disabling write protection

The measurement plan cannot be run when write protection is enabled.

– Disable the write protection of the copied files.

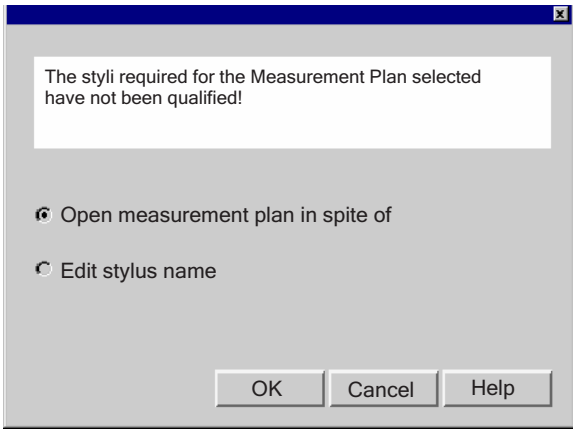
Performing the evaluation

Preparing the measurement plan

1 Start CALYPSO.

2 Open the »METROTOM_CHECK_PL« measurement plan.

When the measurement plan is loaded for the first time, the following message may be displayed:



Message: Stylus not calibrated

3 Select **Open plan as it is**.

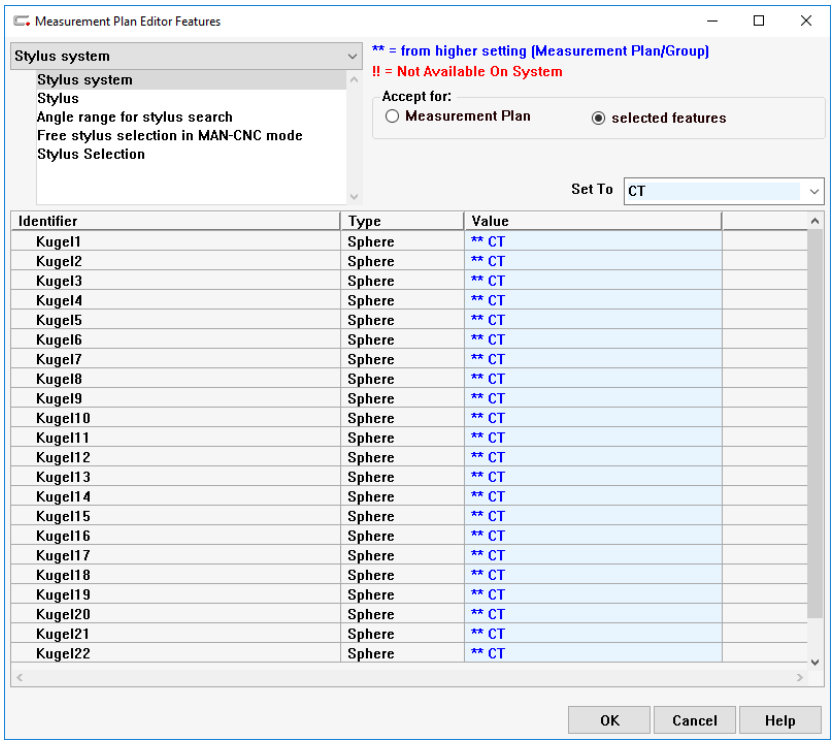
4 Click **OK**.

5 After opening the measurement plan, save it once via **File → Save**.

This is required to ensure that the measurement plan is updated to a new revision.

6 Select **Resources → Measurement Plan Editor Features** to open the Features editor.

The following window opens:

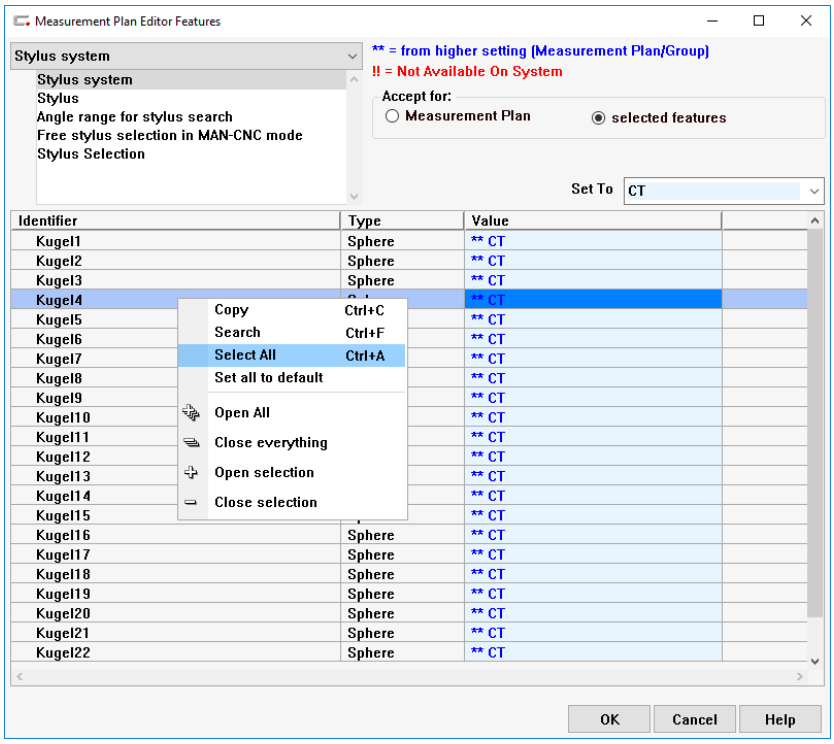


Measurement Plan Editor Features »Stylus system«

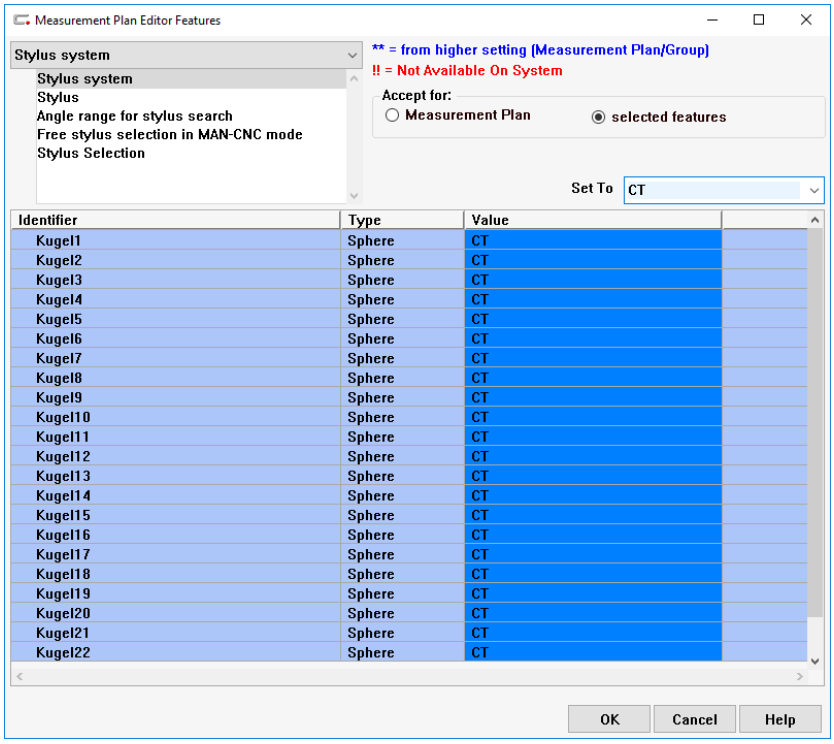
7 Select **Measurement plan** under **Stylus system** and select a suitable stylus system, e.g. «CT».

All features of the test piece are displayed in the window.

8 Open the context menu by right clicking and select **Select All**. All elements are highlighted in blue.



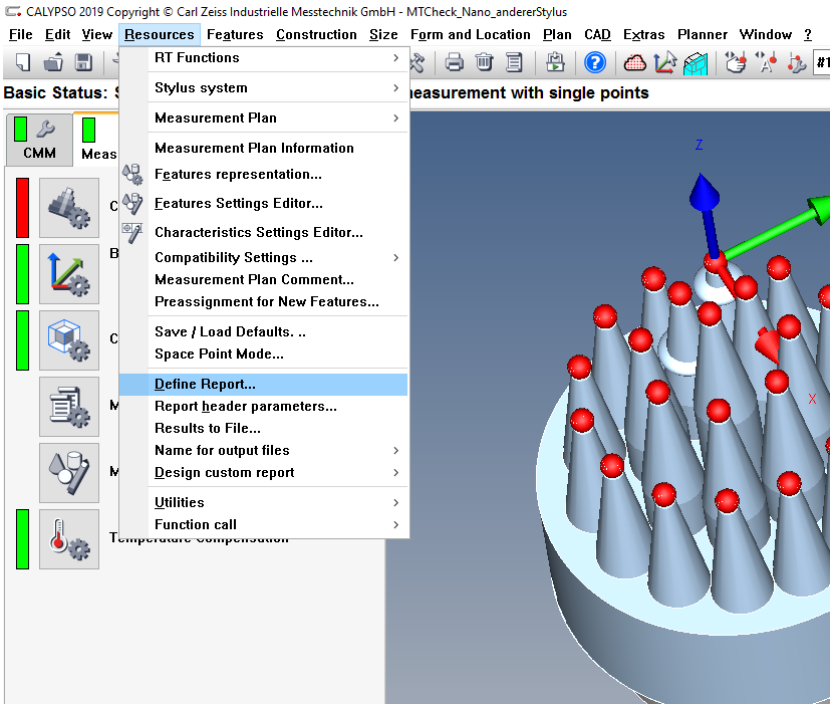
Measurement Plan Editor Features »Stylus«: Menu for selecting the features



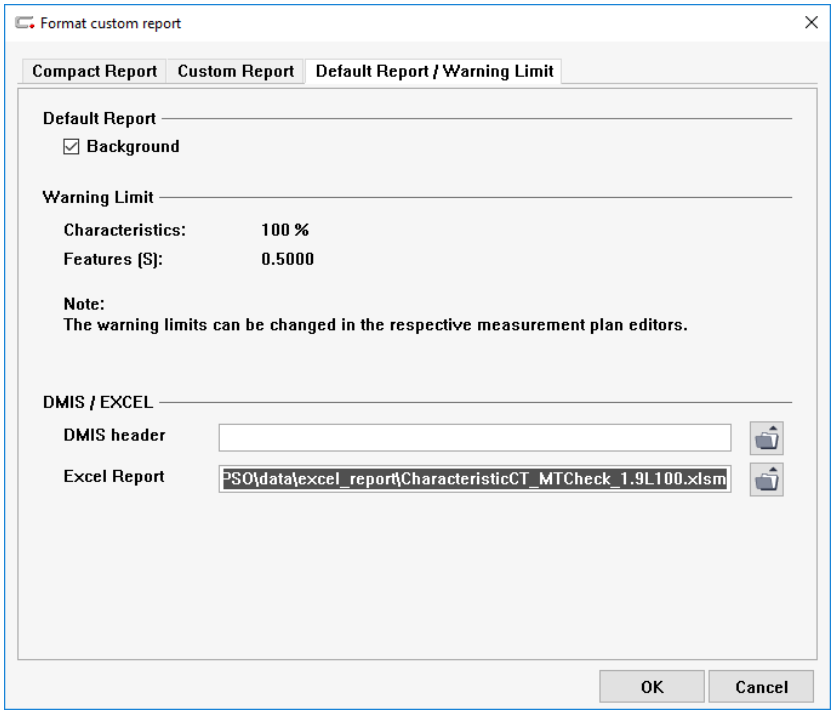
Measurement Plan Editor Features »Stylus«: Menu for selecting the features

9 Select a suitable stylus, e.g. «#1 ct», under **Stylus**.

10 In the **Resources** menu, select **Define report**.



11 The following window opens.



Change to the **Default report/Warning limit** tab.

12 Select the right Excel evaluation template in the **Excel Report** field. The use of another Excel template enables you to show a graphic display immediately together with the measurement plan results.

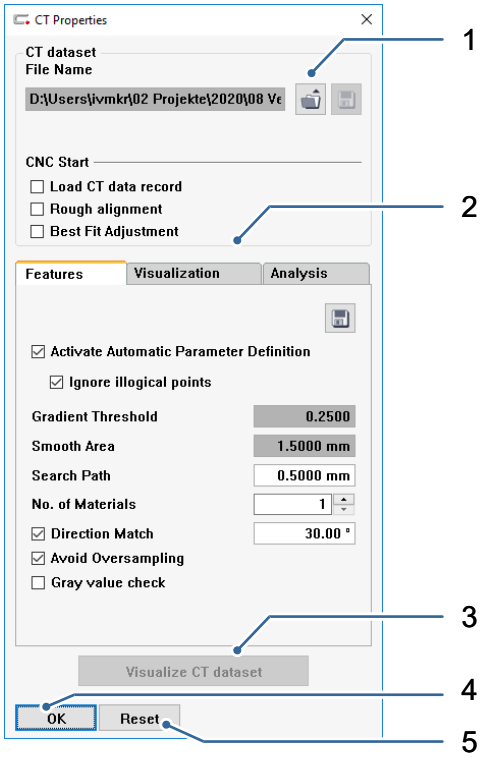
Checking the nominal values of the characteristics

The calibrated nominal values of the sphere center point distances of the test piece are loaded from a file into the measurement plan. To ensure correct evaluation, it is important to save the correct nominal value file in the directory of the measurement plan. See ➤ *Preparation [⇨ 4-5]*

Importing CT volume data

1 Click the red button for CT volume data in the window showing the preparation functions.

The following window opens.



1 Opens a file

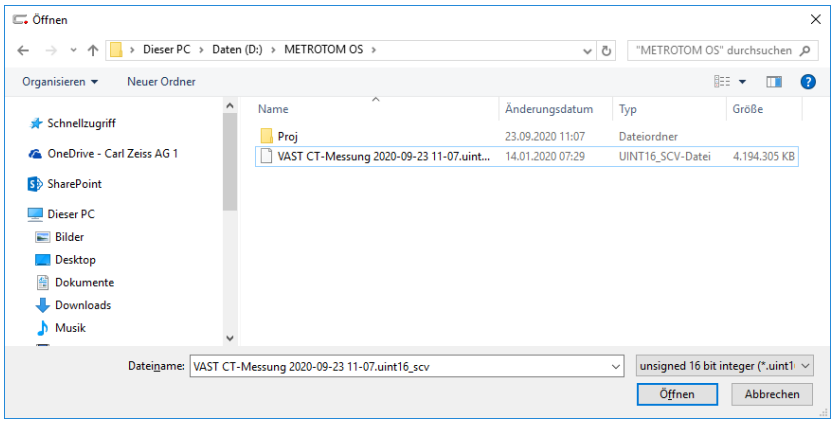
2 Settings for the CT volume data
The »Properties« tab under »Settings« is only available when CT volume data has been loaded.

3 Visualizes the CT volume data

4 Applying settings

5 Returns to CALYPSO without applying the settings

2 Click the button shown here.



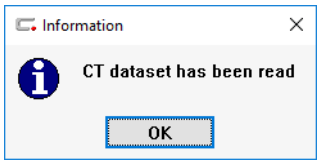
3 Select the «*.uint16_scv» **file type**.

4 Select the directory and the file.

5 Click **Open**.

While the data is being imported from network sources, a local copy is created; this may take several minutes. It is recommended to copy the data to a local hard disk beforehand to save time.

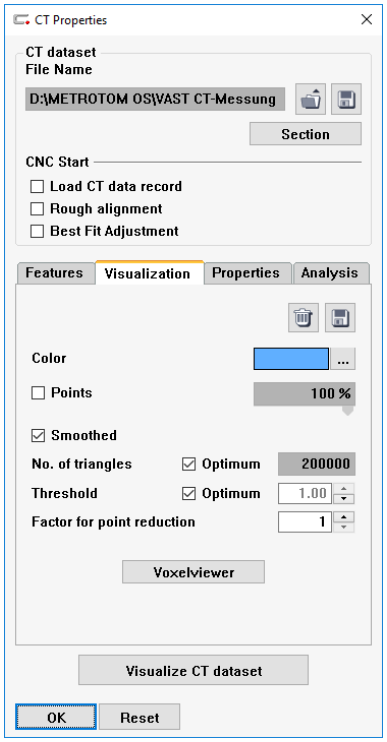
A message is displayed after the data has been imported. The message is displayed immediately if no CT volume data has been imported before. The message is displayed with a delay if the old CT volume data has to be deleted first to ensure that the new CT volume data can be imported.



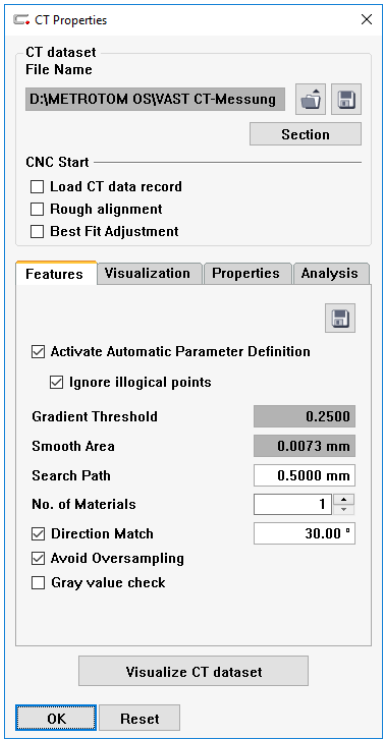
6 Click **OK**.

Visualizing CT volume data

1 Select all options on the »Measurement« index card.



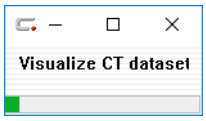
2 Switch to the »Visualization« index card.



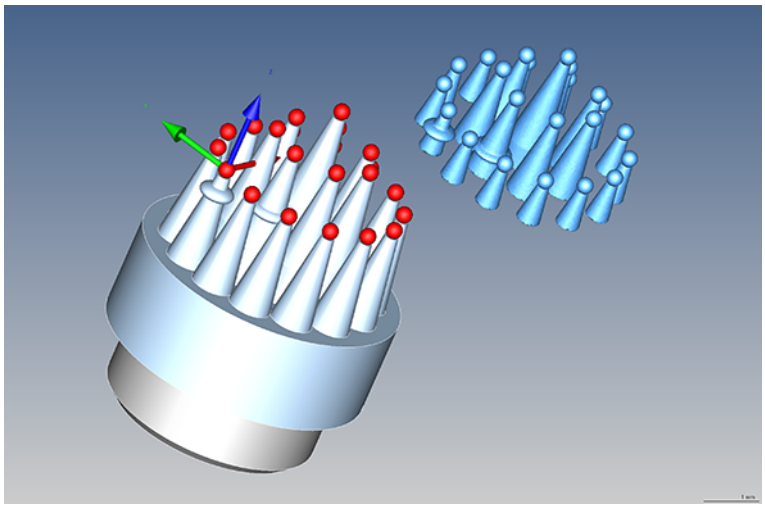
3 Select the color to be used to represent the CT volume data on the »Visualization« index card.

4 Click **Visualize CT volume data**.

The visualization of the CT volume data can take a few minutes.



The visualized surface must be aligned with the CAD data to compensate for any existing offsets (see the following chapter CT-Datensatz ausrichten).



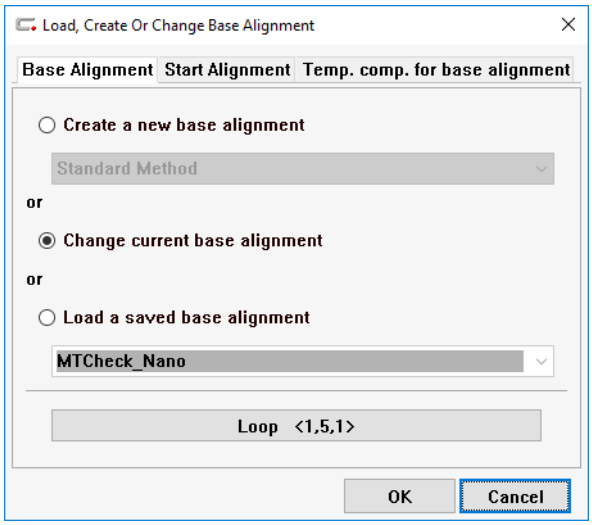
Aligning CT volume data

When CT volume data is loaded for the first time, its alignment does not correspond to the alignment of the CAD model. This, however, is required for running the measurement plan automatically. Therefore, you must first perform a manual alignment.

1 In the list of prerequisites, click the Base/Start Alignment button.

If a base alignment has already been defined, the button is green.

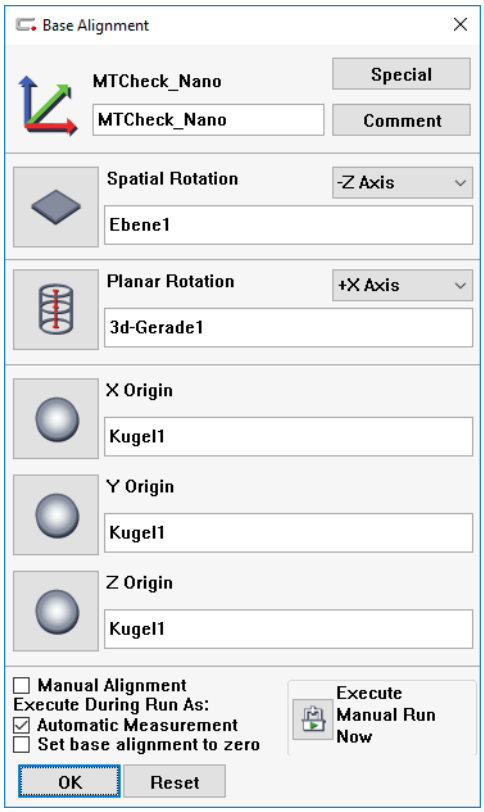
The following window opens. The »Base Alignment« tab is in the foreground.



2 Select the **Change active base alignment** option.

3 Click **OK**.

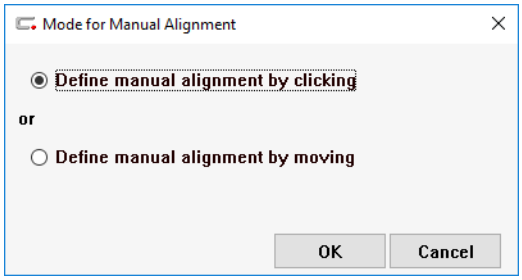
The following window opens:



4 Activate the **Automatic Run** and **Set Base Alignment to zero** functions.

5 Then click the **Execute Manual Run Now** button.

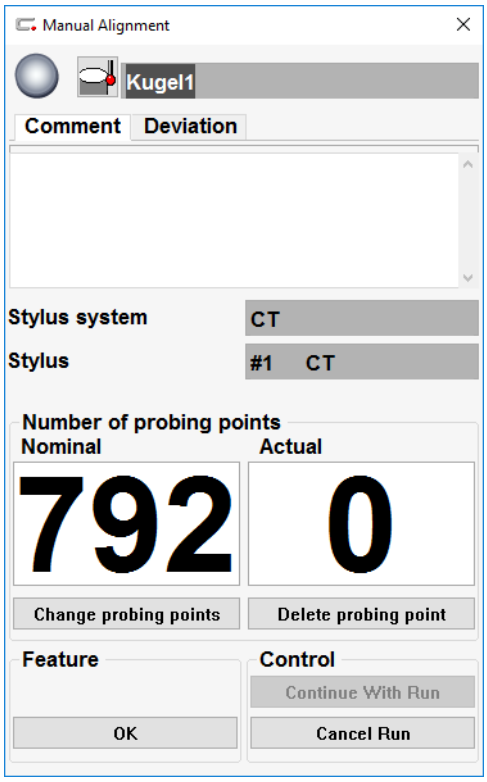
The following window opens:



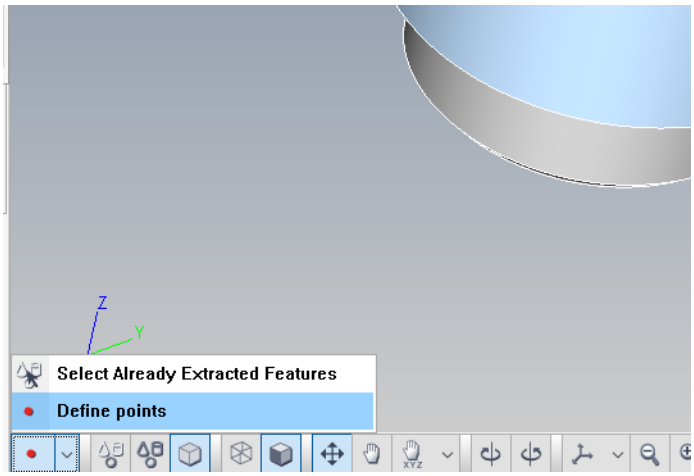
6 Select **Define manual alignment by clicking**.

7 Click **OK**.

The following window shows the feature to be probed.



8 Select the **Define points** mode before you select the probing points.



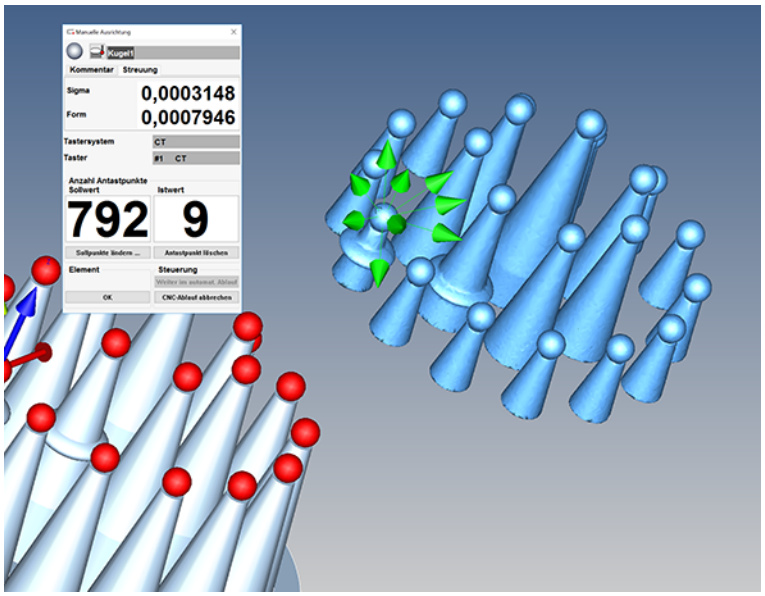
9 On the CT volume data, click several points of the «Kugel U1» feature requested by CALYPSO.

The first sphere is marked by a bulge on its shaft.

- Take care to spread the probing points as evenly as possible.

The probing points are marked as green dots.

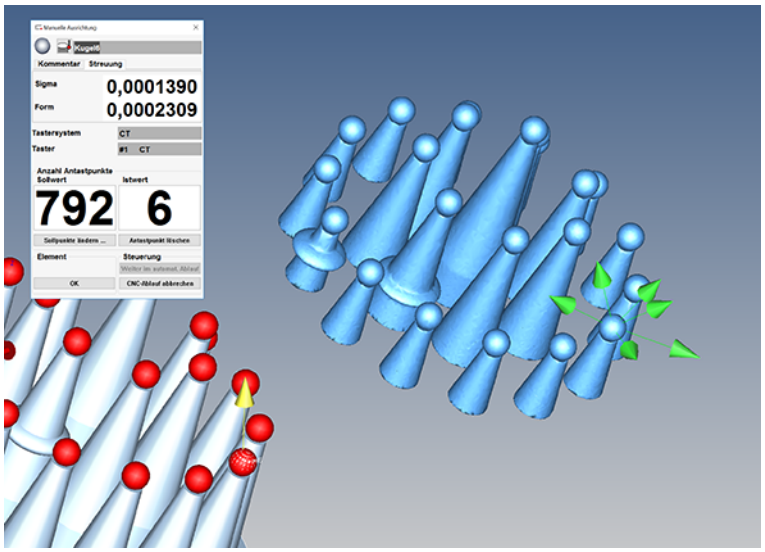
Click as many points as necessary until a plausible form error is indicated for the sphere.

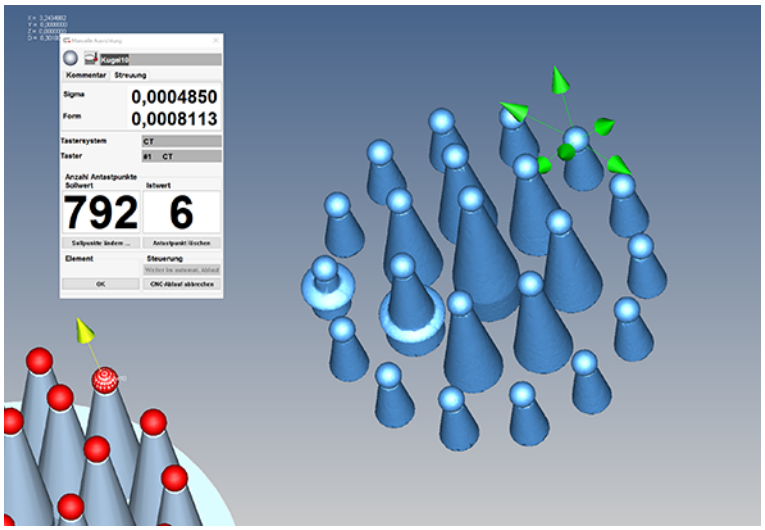


10 Click **OK**.

The same window is displayed again. However, this time probings for «Sphere6» are requested.

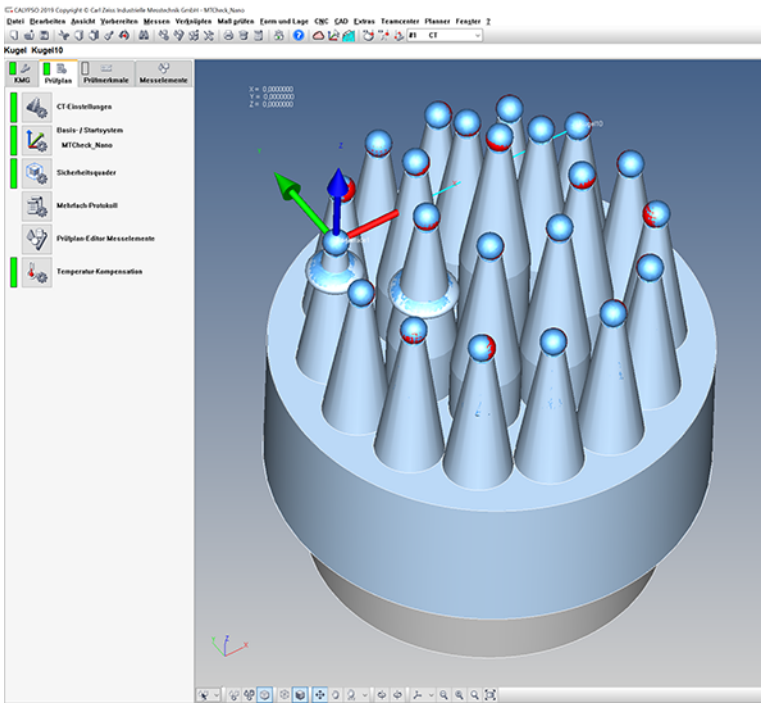
11 Repeat the previous two steps for «Sphere U6» and «Sphere10».





12 In the »Manual Alignment« window, click **OK** under **Feature**.

The CT volume data is aligned with the CAD model.



13 Click **OK** in the »Base Alignment« window.

NOTE

Even if the manually set probing points are selected very carefully, it is not possible to achieve the maximum possible accuracy. This is why the alignment definitely should be performed again automatically.

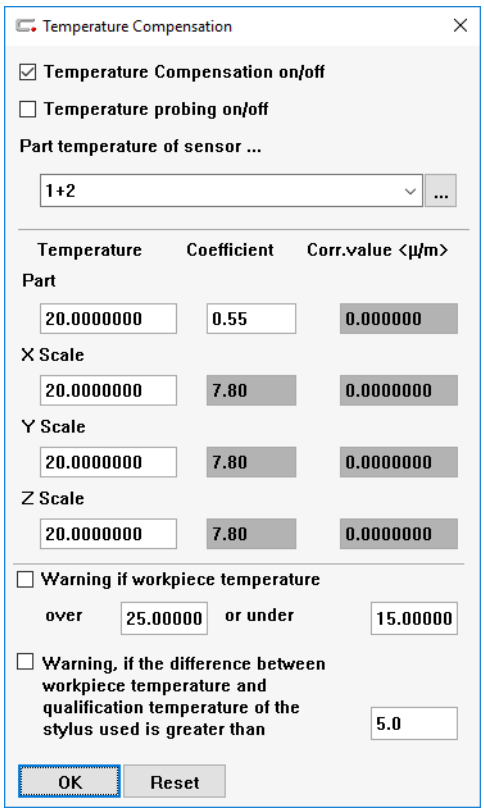
Automatic alignment

The loop counter must be set for automatic alignment. Recommendation: 3 loops. Activate also **Clear existing results** and **All Characteristics**; this is done in the »Start Measurement« window. Further information is provided elsewhere ? CALYPSO operating instructions and METROTOM operating instructions.

Activating the temperature compensation

1 Click the button shown here.

The following window opens:



Settings for temperature compensation

2 Activate the **Temperature Compensation on/off** check box.

3 Enter the temperature of the test piece under **Workpiece**.

4 Enter 20 degrees for the X, Y and Z scale temperatures.

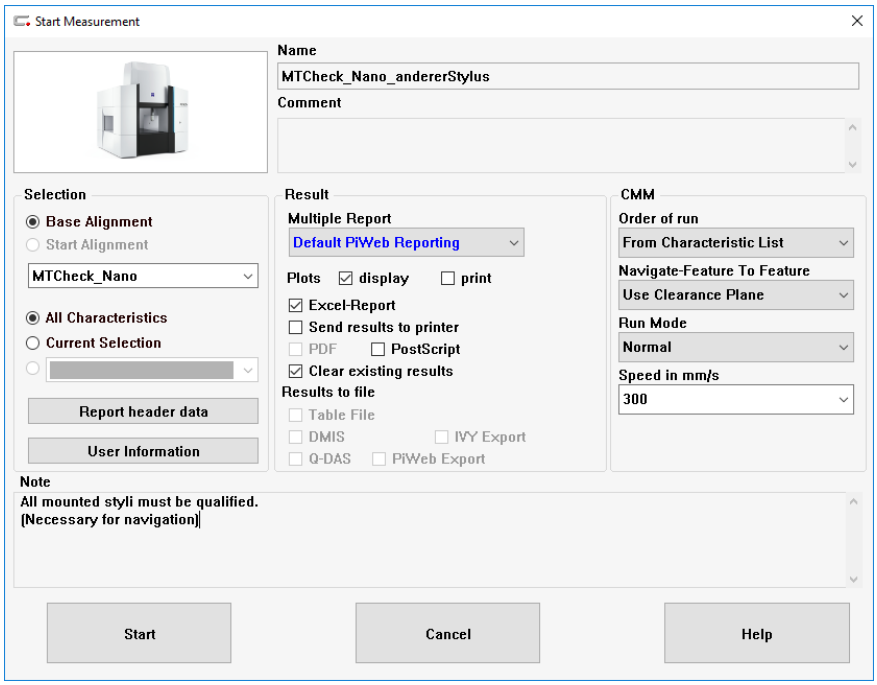
5 Click **OK**.

The button is highlighted in green.

Running a measurement plan

1 Select **Plan → CNC-Start**.

The following window opens:



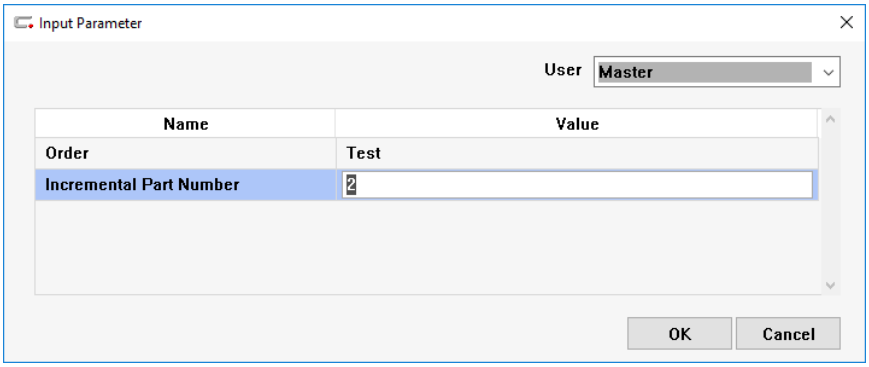
Starting the measurement plan

2 Select **All Characteristics** and **Clear existing results**.

To create a diagram of the sphere distance error, you must also select **EXCEL report** and **Table File**.

3 Click **OK**.

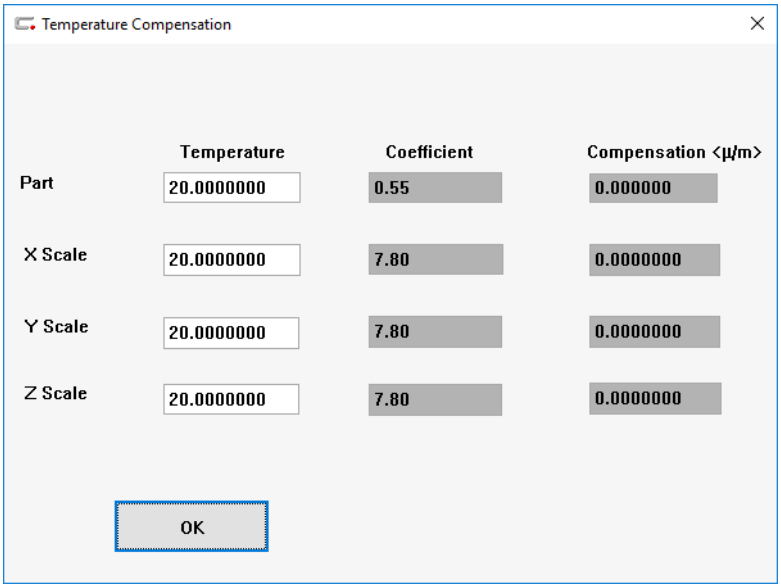
The following window opens:



4 Enter the number and the name under **Calibration certificate no.** and **Customer**.

5 Click **OK**.

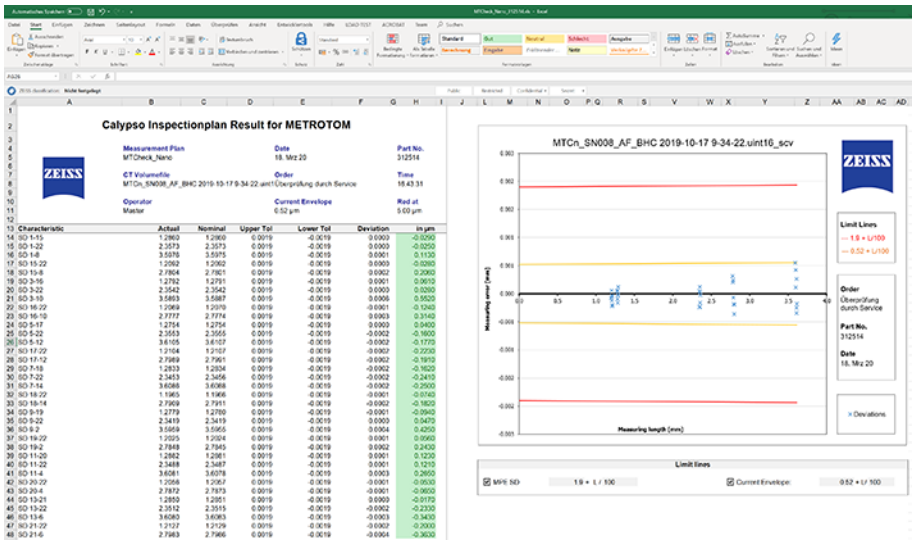
6 Check the temperature values in the following window and correct them if necessary.



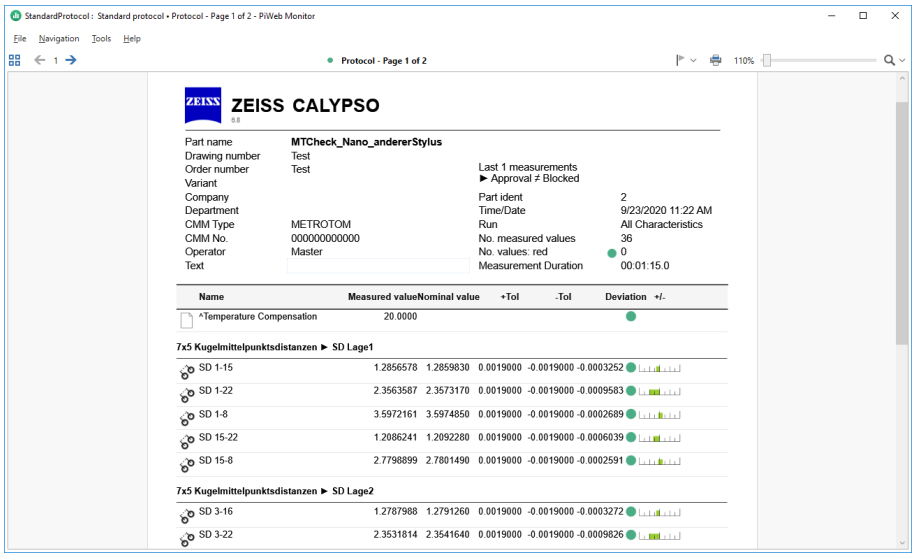
7 Click **OK**.

Then the CNC run starts.

At the end of the CNC run, a report is output. In addition, an Excel sheet is created and opened automatically. Values must be copied from the sheet. The Excel sheet requires that **Excel** is installed on the METROTOM user computer. If Excel is not installed, then you must copy the existing table file and open it on a computer on which Excel is installed. By default, the table file is saved to: *»…\calypso\home\om\workarea\results«* in the following directory. This path can be changed in the system configuration of CALYPSO.



Excel sheet after execution of the CALYPSO CNC run



Custom report

Creating a diagram for the sphere distance error length measuring error

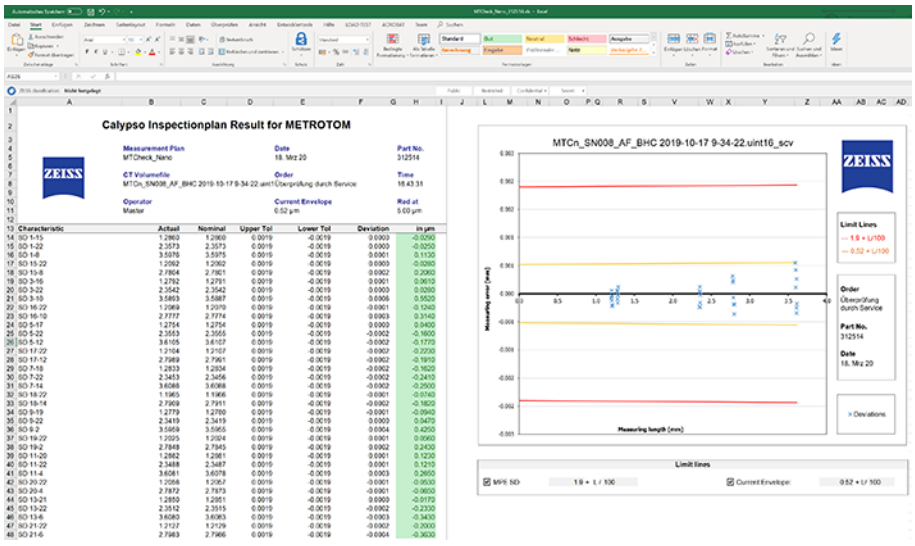
Preparing an Excel spreadsheet

CALYPSO transfers values to an Excel sheet after the CNC run. These values must be copied and the »METROTOM_CHECK_PR« Excel sheet must be added. This file must be copied from the supplied USB stick to the hard disk beforehand. See ➤ *Preparation [⇨ 4-5]*

In total, three measurements must be performed. For all three measurements, the values must be transferred manually from the Excel sheet. As the result, you obtain a diagram of the sphere distance and length measuring errors.

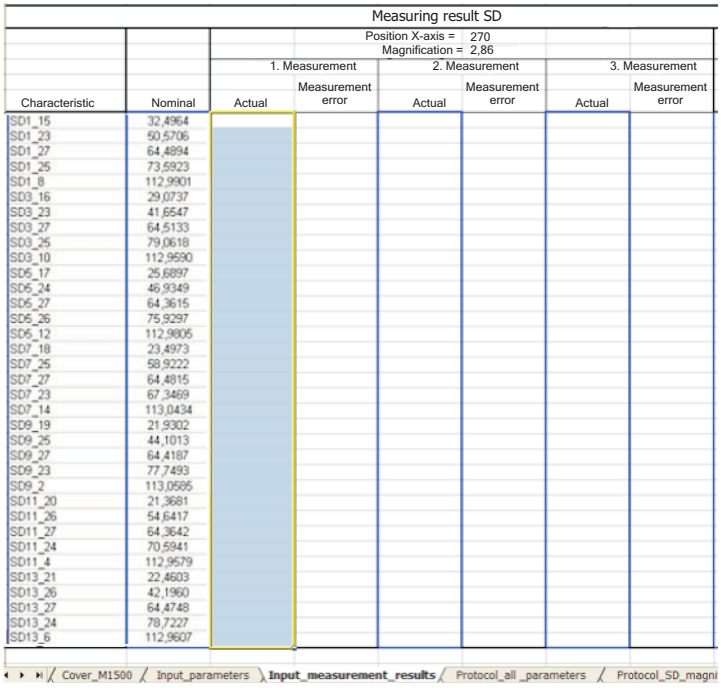
Conditions

– You must make the required settings prior to the start of the CNC run in order to create the following Excel sheet. See ➤ *Running a measurement plan [⇨ 4-21]*



Excel sheet after execution of the CALYPSO CNC run

1. Copy the values in the column named »ACTUAL« (actual values).
2. Open the »METROTOM_CHECK_PR« Excel file.
3. Switch to the »Input_Measure_results« spreadsheet.
4. Insert the copied values in the left of the three »Actual values« columns which are framed in blue.



Measuring result SD

Position X-axis = 270
Magnification = 2,86

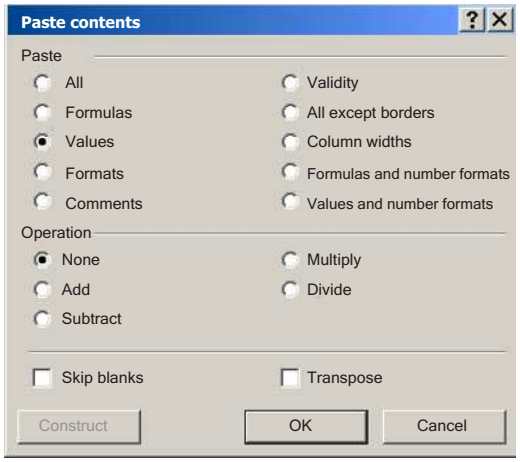
Characteristic	Nominal	1. Measurement Actual	1. Measurement Measurement error	2. Measurement Actual	2. Measurement Measurement error	3. Measurement Actual	3. Measurement Measurement error
SD1_15	32,4964						
SD1_23	50,5706						
SD1_27	64,4894						
SD1_25	73,5923						
SD1_8	112,9901						
SD3_16	29,0737						
SD3_23	41,6547						
SD3_27	64,5133						
SD3_25	79,0618						
SD3_10	112,9590						
SD6_17	25,6897						
SD6_24	46,9349						
SD6_27	64,3615						
SD6_26	75,9297						
SD6_12	112,9805						
SD7_18	23,4973						
SD7_25	58,9222						
SD7_27	64,4815						
SD7_23	67,3469						
SD7_14	113,0434						
SD9_19	21,9302						
SD9_25	44,1013						
SD9_27	64,4187						
SD9_23	77,7493						
SD9_2	113,0585						
SD11_20	21,3681						
SD11_26	54,6417						
SD11_27	64,3642						
SD11_24	70,5941						
SD11_4	112,9579						
SD13_21	22,4603						
SD13_26	42,1960						
SD13_27	64,4748						
SD13_24	78,7227						
SD13_6	112,9607						

Cover_M1500 | Input_parameters | Input_measurement_results | Protocol_all _parameters | Protocol_SD_magni

»Measuring_results« spreadsheet

- Open the context menu by right clicking and select **Paste Contents**.

The following window opens:



»Paste Contents« window, selection options for pasting contents

- Select **Values** and click **OK**.

5 Check the nominal values in the table.

These values must correspond to the current calibration values of the test piece. If necessary, you may copy the calibration values from the CALYPSO Excel sheet. The calibration values are located in the »Nominal« column.

6 Evaluate two additional CT data sets in the same way.

- Copy the actual values to the other two columns.

7 Switch to the »Input_parameter« spreadsheet in the »METROTOM_CHECK_PR« Excel file.

- Select the desired language in the topmost selection field: German or English.
- Select the CMM type and the test piece in the following two selection fields.
- Under *Test uncertainty* (line 6), select add or subtract in order to demonstrate compliance or non-compliance. To prove compliance, subtract the test uncertainty (TU) from the MPE values; to prove non-compliance, add the TU to the MPE values.
- In lines 27 to 34, enter the test piece information from the calibration certificate.
- The MPE values to be checked have to be entered in lines 40 and 41. These are usually the values specified by the manufacturer.

2	Sprache / Language	English		
3	**Please fill in the fields framed in blue!**			
4	Device type	METROTOM 800 130kV		
5	Calibration phantom	METROTOM-Check nano / XRM-Check		
6	Test uncertainty	Subtrahieren / subtract		
7				
8	**Device**			
9	Device type	METROTOM 800 130kV		
10	Serial no.	ENTER_SN		
11				
12	**Customer**			
13	Name	ENTER_CUSTOMER_NAME		
14	Street	ENTER_CUSTOMER_STREET		
15	City	ENTER_CUSTOMER_CITY		
16	Customer	ENTER_CUSTOMER_OPERATOR		
17	Phone no.	ENTER_CUSTOMER_PHONE		
18	E-mail	ENTER_CUSTOMER_EMAIL		
19				
20	**Calibration phantom**			
21	Type of calibration phantom	METROTOM-Check nano / XRM-Check		
22	Material of calibration phantom	Ruby		
23	Nominal diameter of spheres [mm]	0.3		
24	Maximum measurement length [mm]	3.6		
25	Coefficient of thermal expansion [10^-6/K]	0.55		
26	Expanded uncertainty of the coefficient of thermal expansion [10^-6/K]	0.1		
27	Calibration phantom no.	ENTER_PHANTOM_NO		
28	Date of calibration	ENTER_CERT_DATE		
29	Calibration protocol no.	ENTER_CERT_NO		
30	Calibration department	ENTER_CERT_SERVICE		
31	Expanded (k=2) calibration uncertainty [µm]			
32				
33	**Software**			
34	CT-Software	ENTER_CT_SW		
35	Version	ENTER_CT_SW_VERSION		
36	Evaluation software	ENTER_EVAL_SW		
37	Version	ENTER_EVAL_SW_VERSION		
38				
39	**Maximum Permissible Errors (MPE)**			
40	SD_{MPE} [µm]		+ L /	
41	E_{MPE} [µm]		+ L /	

- For the calculation of length measurement error E, enter the values determined for P_S and P_F on the P-Check test piece via CT measurement in lines 44 and 46. Likewise, enter the corresponding extended test uncertainties (TU) in lines 45 and 47. All four values are included in the Excel evaluation document for the P-Check.
- Then you must fill out all other relevant fields which are framed in blue.

43	**Probing error (from separate measurement)**	
44	P_S [µm]	
45	Expanded (k=2) uncertainty for P_S [µm]	
46	P_F [µm]	
47	Expanded (k=1.645) uncertainty for P_F [µm]	
48		
49	**Calibration phantom temperature [°C]**	
50		
51		
52	**Measurement position**	
53	X [mm]	ENTER_MEAS_X_POS
54	Z [mm]	ENTER_MEAS_Z_POS
55		
56	**CT volumetric data**	
57	1st measurement	ENTER_CT_DATA_FILE1
58	2nd measurement	ENTER_CT_DATA_FILE2
59	3rd measurement	ENTER_CT_DATA_FILE3
60		
61	**Measurement parameters**	
62	Voltage [kV]	ENTER_TUBE_VOLTAGE
63	Current [µA]	ENTER_TUBE_CURRENT
64	Integration time [ms]	ENTER_INT_TIME
65	Image Averaging	ENTER_IMAGE_AVERAGING
66	Gain	ENTER_IMAGE_GAIN
67	Magnification	ENTER_MAGNIFICATION
68	Prefilter	ENTER_PREFILTER
69	Number of projections	ENTER_NUMBER_PROJECTIONS
70	Binning mode	ENTER_BINNING_MODE
71	Median filter (on/off)	ENTER_MEDIAN_FILTER
72	Noise suppression filter	ENTER_NOISE_SUPPRESSION
73	Focal spot control (on/off)	ENTER_FSC
74	Y shift (on/off)	ENTER_YSHIFT
75		
76	**Settings evaluation software**	
77	ENTER_EVAL_SW	Measurement strategy spheres: 6 circle paths each 130 points
78		Filtering of circle paths by Gauss filter, low-pass, 15 upr
79		
80	**Remarks**	
81		
82		
83		
84		
85	**Zeiss engineer**	ENTER_ENGINEER
86		
87	**Date**	ENTER_DATE

»Input_parameters« spreadsheet

The entries made are automatically transferred to the other spreadsheets.

8 Save the Excel file with a new name.

NOTE

The other spreadsheets show a complete list of all parameters, measurement data, and their representation in the diagram of the sphere distance error.

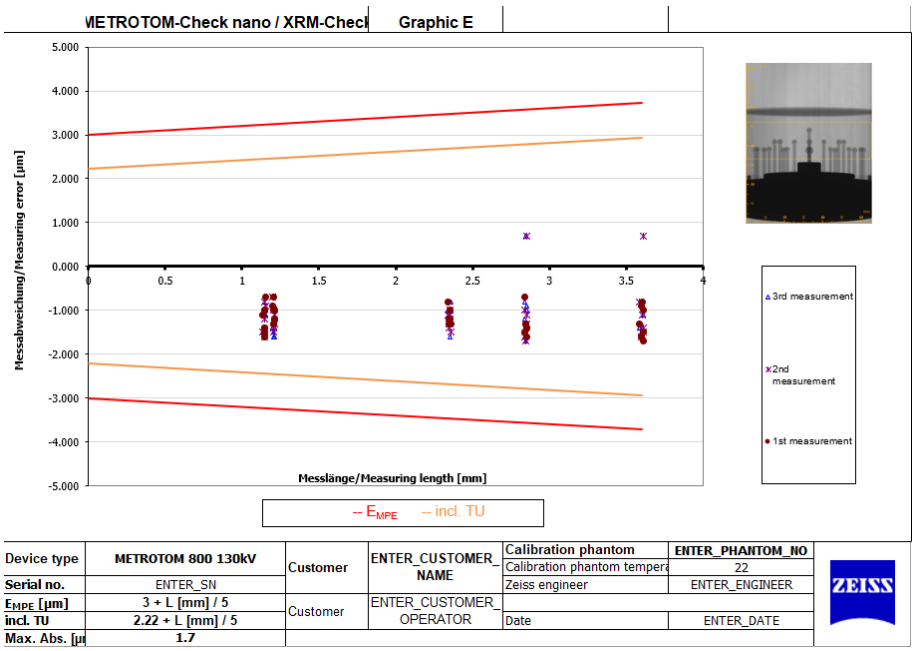
Measurement data

The measurement data is logged on the »Protocol_SD« and »Protocol_E« spreadsheets.

Graphic representation of the measurement data

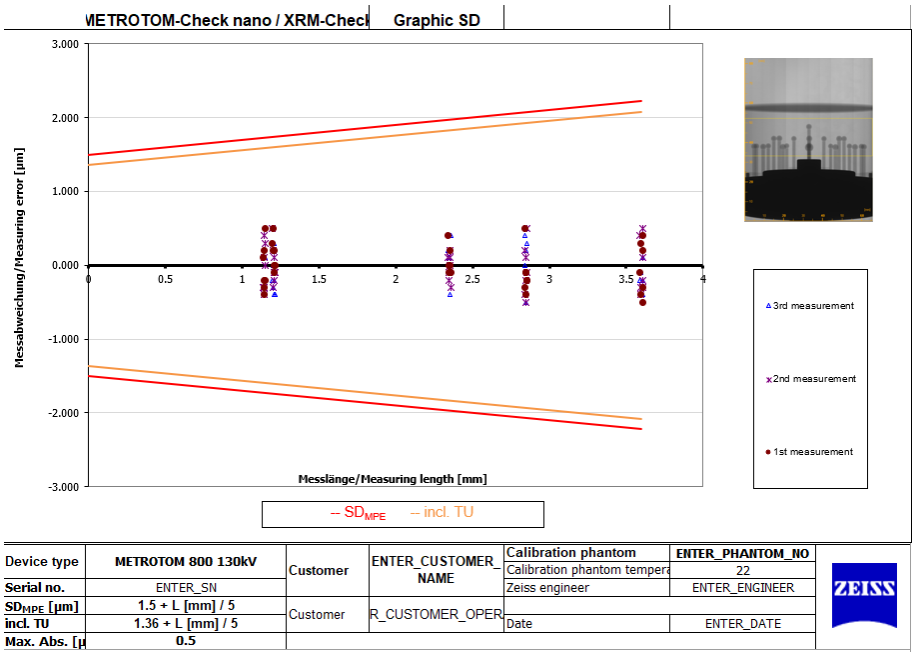
The measurement creates a diagram of the sphere distance and length measuring error on the »Graphic_SD« and »Graphic_E« spreadsheets.

In addition to the output of all parameters, values for the test uncertainty of SD and E are displayed here and these TU values are applied (added or subtracted) to the corresponding MPE values.



Device type	METROTOM 800 130kV	Customer	ENTER_CUSTOMER_NAME	Calibration phantom	ENTER_PHANTOM_NO
				Calibration phantom tempera	22
Serial no.	ENTER_SN			Zeiss engineer	ENTER_ENGINEER
E_{MPE} [µm]	3 + L [mm] / 5	Customer	ENTER_CUSTOMER_OPERATOR		
incl. TU	2.22 + L [mm] / 5			Date	ENTER_DATE
Max. Abs. [µ	1.7				

»Graphic_E« spreadsheet



»Graphic_SD« spreadsheet

Printing the evaluation table

Finally, you can print the spreadsheets.

1. Select the desired spreadsheets including the suitable cover sheet, e.g. »Cover_M800«.
2. Open the print menu and choose **Selected sheets**.
3. Click **Print**.

Causes of measurement errors

If the measurement results are outside the specified tolerances, this may be due to an error in operating the measurement software or to errors in the CT measurement run.

CALYPSO measuring software

Possible reasons:

- The temperature compensation in the measurement plan was not active or an incorrect temperature or expansion coefficient was entered.
- Incorrect nominal values in the measurement plan
- Probing the wrong spheres during manual alignment.

METROTOM CT scanner

Possible reasons:

- No geometry or axis qualification was carried out.
- The geometry or axis qualification dates back quite some time.
- The test piece is loose: screws not tightened
- The reconstruction area is too small.

  Not all styli of the test piece are located within the reconstruction area.
- Parameters were incorrectly set, e.g. voltage, number of projections.

Service

If it is not possible to eliminate the error, inform the ZEISS service department. You will find the phone number in the METROTOM operating instructions.

5 Care

This chapter contains:

Care and storage 5-2

Care and storage

Care

The test piece does not require any special measures for care. Nevertheless, you should observe the following:

– Handle the test piece with care.

– Avoid any impact loads.

Storage

The test piece should be stored in a dry, dust-free and protected place. Ideally, you should store the test piece in its original packaging after the measurement.

METROTOM Check Nano
Operating instructions
2020-10-12
61211-6300102