



HEXAGON
MANUFACTURING INTELLIGENCE

MoveInspect Pilot

VERSION 7.12

MANUAL

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1 Introduction

MoveInspect Pilot is a software for the recording of 3D points with one or several cameras. For all cameras, Microsoft® Windows® 10 64Bit and Microsoft® Windows® 7 Professional 64Bit are possible, but the use of Microsoft® Windows® 10 64Bit is recommended.

The software provides to capture images directly with the cameras of the product lines MoveInspect HF, MoveInspect HR and MoveInspect XR. The software allows to import the images of other cameras as image files and evaluate them. MoveInspect Pilot can be used with various camera arrangements. The cameras can either be mounted in a fixed position (e.g. on a camera bar) or freely positioned (e.g. on tripods). To work with a MoveInspect XR8 system, the software provides a specialised user interface.

For each measurement epoch, the software determines the 3D coordinates of single points which are signalled by targets or adapters. In addition, tactile measurements can be performed with the measuring probe MI.Probe.

MoveInspect Pilot is available in the following languages:

- Chinese
- English
- French
- German
- Italian
- Japanese
- Polish
- Russian
- Slovakian
- Spanish



1.1 About this manual

This user manual is an integral part of the product and is available in German, English and Chinese.

Carefully read and follow the instructions given in this manual. Keep this information and all product-related documents in a safe and easily accessible place to allow all relevant persons access to it as a reference guide at any time. Hand the user manual and any other product related documentation to each person using the product. Carefully study and follow all safety advices. Failing to do so will result in voiding the warranty and losing the entitlement to warranty claims. Maintenance and repair work of the system must only be carried out by an authorised service technician or a staff member of AICON 3D Systems GmbH.

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Version 7.12.00, Subject to alterations.

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2 Installation of the software

The installation of MoveInspect Pilot must be carried out with a user account with administration rights.

Start the installation by selecting the file `Setup_MoveInspect.exe` in the folder `Software` from the USB data carrier or the file `Setup_MoveInspect.exe` delivered by file transfer (ftp or similar). The user is guided through the installation step by step.

It is recommended to close all programmes prior to the installation.

2.1 Configuration of the installation

After having selected the language for the installation assistant and afterwards having confirmed the terms of license, the provided software packages for the installation can be selected (Figure 1).

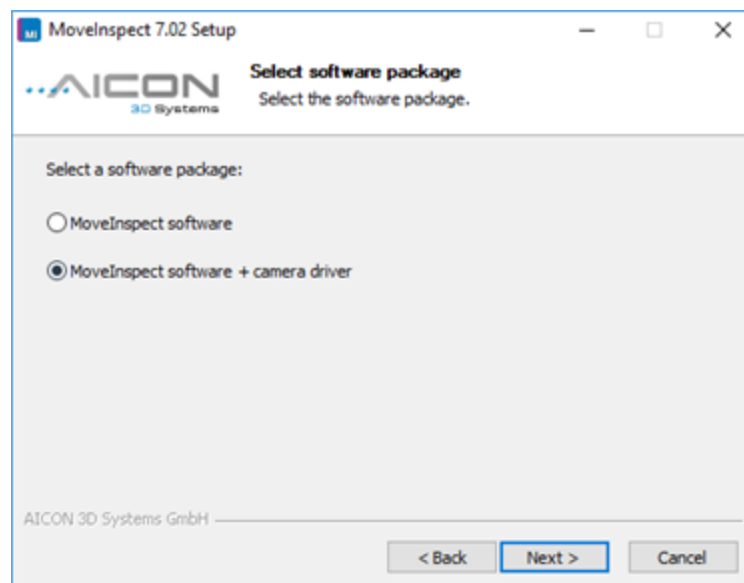


Figure 1: Selecting the software package

The selection *MoveInspect Pilot* installs the software *MoveInspect Pilot* and the required hardlock drivers.

The software package *MoveInspect Pilot + camera driver* contains additionally the camera drivers of the product lines MoveInspect HF, MoveInspect HR and MoveInspect XR.

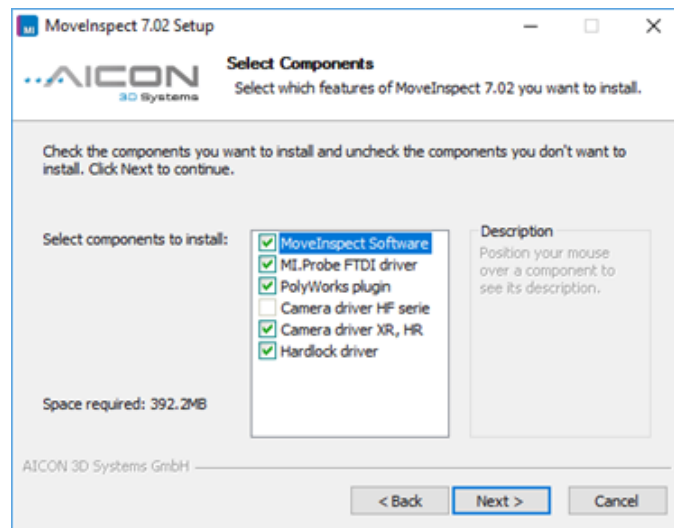


Figure 2: Selecting the software components

The required software components are selected automatically. It is recommended to install these proposed software components to make sure that the most up-to-date components and drivers are installed that are required for the respective software version (Figure 2). If needed, the selection can be adapted.

In the next step, an installation directory has to be specified to install the software MoveInspect Pilot (Figure 3).

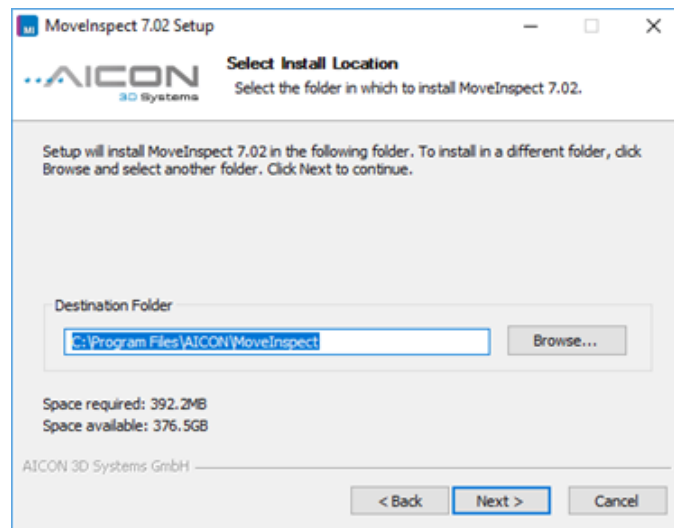


Figure 3: Selecting the user-specific installation directory

As an option, the installation assistant creates a desktop icon and a link in the Start menu. After having confirmed all required entries, the selected components are installed.

Note: If an older version of the software is already installed in the selected directory, the content of this installation directory is saved in a ZIP archive before the current installation starts.

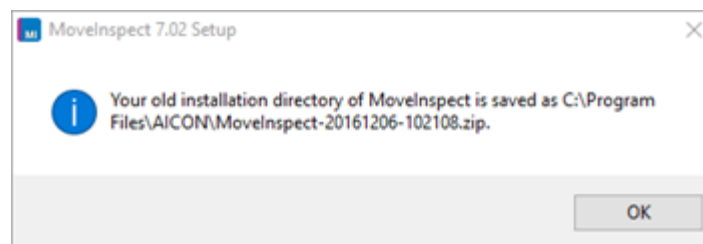


Figure 4: Message about data backup during installation process

The file name of the ZIP archive contains the current date and has the format `MoveInspect-YYYYMMDD-HHMMSS.zip`.



2.2 Installation of camera drivers

The installation assistants of the selected cameras guide through the installation process.

Note for the installation of the Mikrotron drivers (eBUS Vision Package):

As soon as the window *eBUS Driver Installation Tool* appears, it is mandatory to select the *eBUS Universal Driver* for the MoveInspect **HF cameras** (see Figure 5).

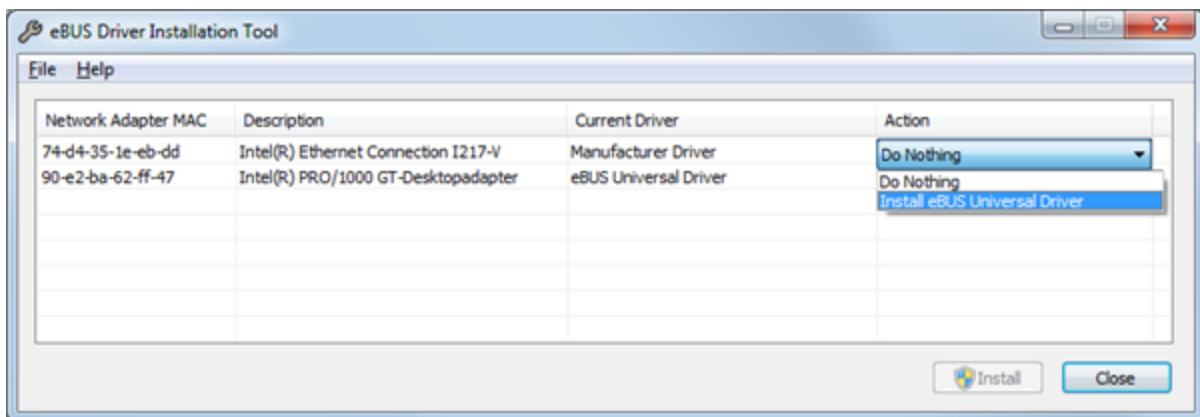


Figure 5: Selecting the driver in the eBUS Driver Installation Tool

If HR and XR cameras are used, the window can be closed without any further driver installation. For HR and XR cameras it is recommended to use the *Manufacturer Driver*.



2.3 Graphic board settings

For NVIDIA graphic boards it is recommended to use the global presets "Workstation App - Dynamic Streaming" in the 3D settings of the NVIDIA Control Panel (Figure 5). Other settings may cause a high processor load which affects working with MoveInspect Pilot.

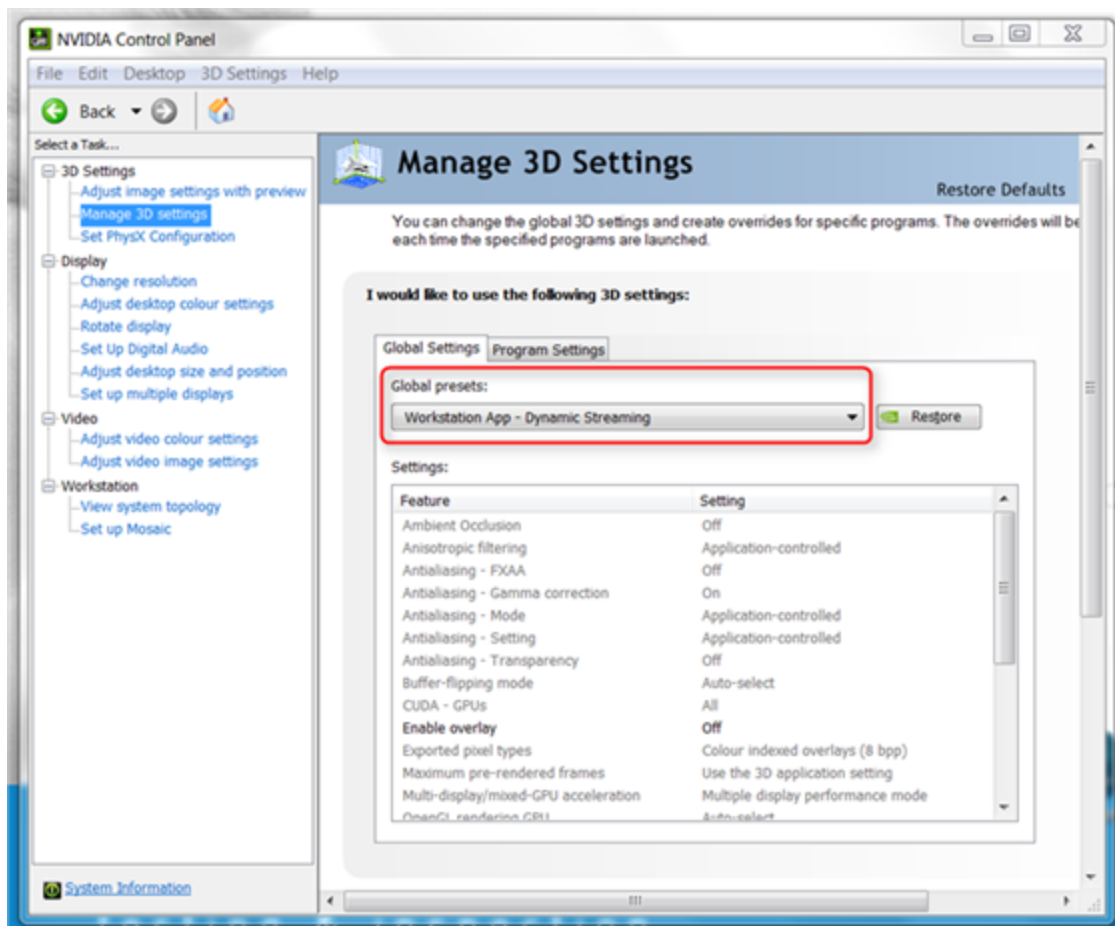


Figure 5: NVIDIA graphic board settings



2.4 First start of the software

At the first start of the software, a database has to be created. The message displayed in Figure 6 appears. Click *New* to create a new empty database or *Select* to load an existing database (e.g. from your USB data carrier).

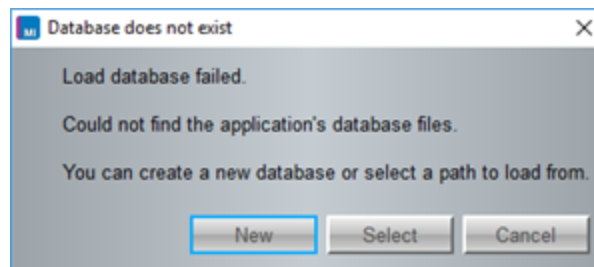


Figure 6: Message to create or load a database

By clicking *Select*, a dialog appears to select the directory with the database files (Figure 7). On your USB data carrier, you can find the database files in the folder `MoveData`. Open the folder in the dialog *Select database* and confirm the selection with *Select*.

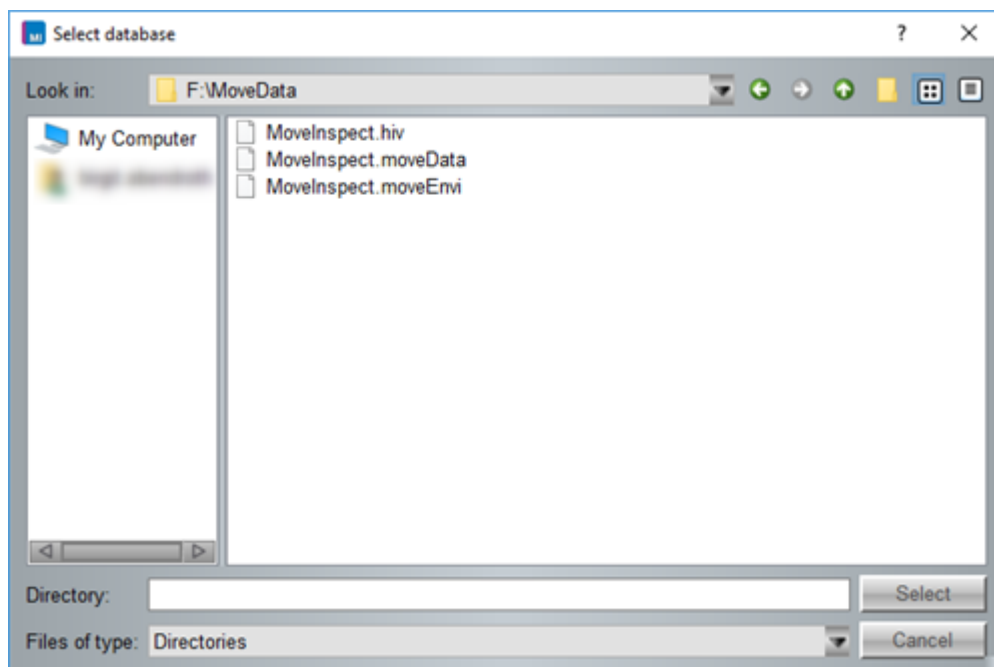


Figure 7: Selecting a database directory

During the first start of the software, please confirm the dialogs of the user account control for the registry console tool with *Yes*.



After having created the database, the software's user interface is adapted to the used camera system. To do so, the following dialog appears (Figure 8):

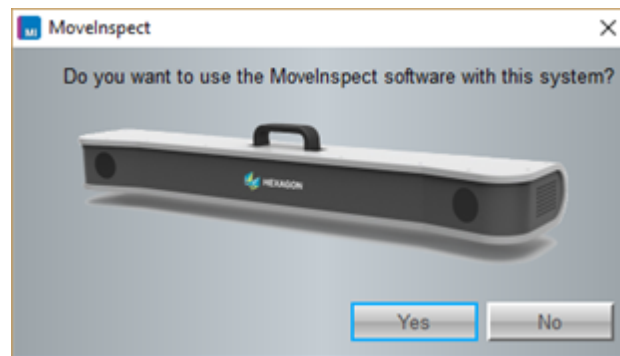


Figure 8: Dialog at the first start of the software



3 Concept of operation

This section describes the structure of and the operating with the user interface. The user interface consists of a 3D window, a menu bar, an activity window, various tool bars, the status bar and a data window, if applicable (Figure 9).

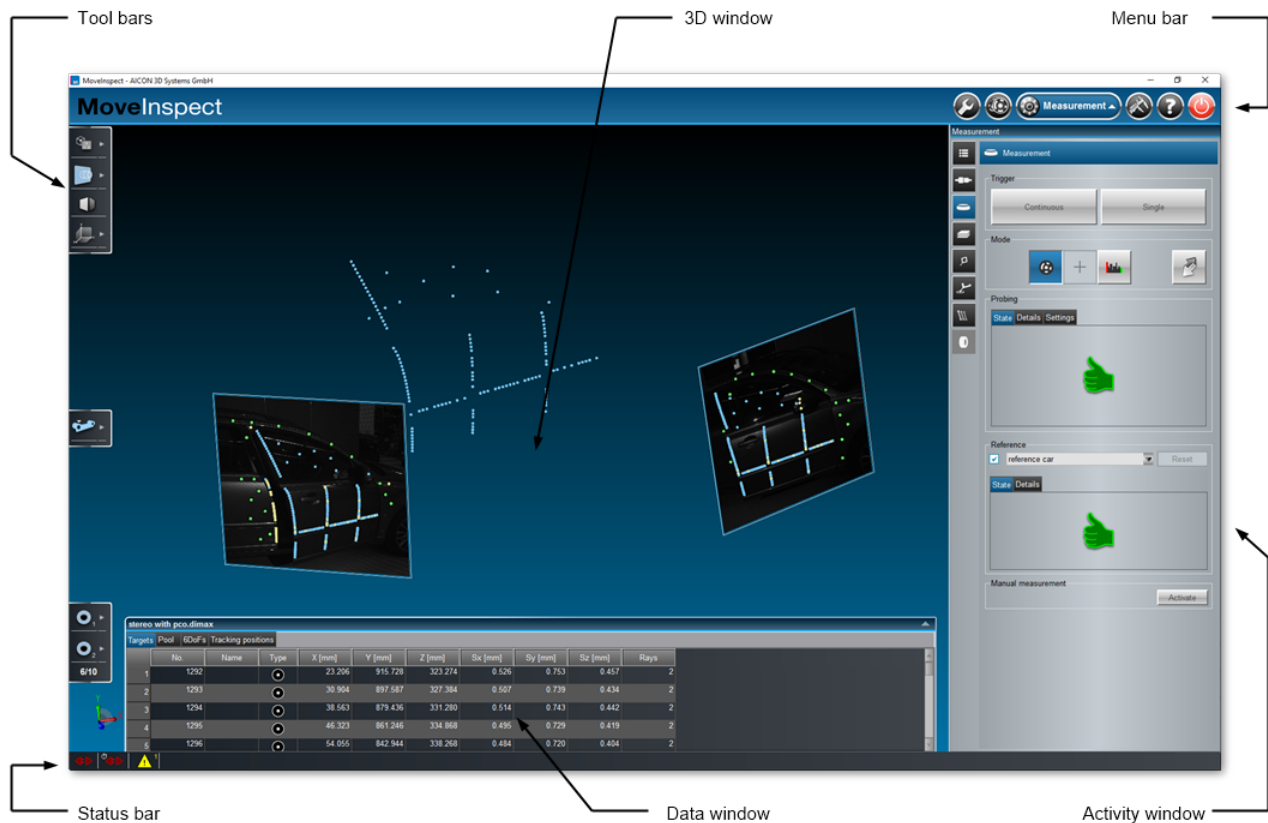


Figure 9: The MoveInspect Pilot user interface



3.1 Menu bar

The menu bar allows to switch between the main functions of the software (Figure 10 and Table 1).

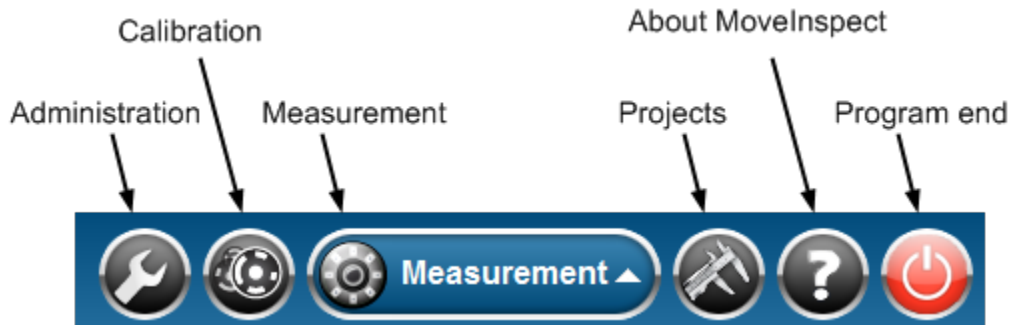


Figure 10: The MoveInspect Pilot menu bar







Function	Description
 <i>Administration</i>	Setup of different measurement configurations and administration of general software settings.
 <i>Calibration</i>	Calibration of camera systems.
 <i>Measurement</i>	Performing and recording measurements.
 <i>Projects</i>	Analyses and administration of recorded measurements in projects. This menu is only available if the appropriate module is activated.
 <i>About MoveInspect Pilot</i>	General information regarding the software version, license information (e.g. the expiry date of the license and the unlocked modules), the user manual and the quick guide.
 <i>Programme end</i>	Exit the software.

Table 1: Functions of the MoveInspect Pilot menu bar



3.2 3D window

The 3D window provides a spatial view of the measurement situation and of various objects (e.g. calibration panels, adapters, cameras).

In the 3D window the view can be rotated, zoomed in or shifted by using the functions of the mouse described in Table 2. Besides this, points in the 3D window can be selected. The marked points are also marked in the corresponding table. With this, you can easily allocate the coordinates in the table to the points in the 3D view. The view in the 3D window is controlled via the [3D tool bar](#).

Function	Description
<i>Zoom in</i>	<p>Move the mouse up and down while pressing the right mouse button or use the mouse scroll wheel.</p> <p>By simultaneously pressing the Alt key and the right mouse button a window can be drawn to zoom onto a certain section. Expanding the window from left to right zooms into the window, expanding it from right to left zooms out of the window.</p>
<i>Shift</i>	<p>Move the mouse freely while simultaneously pressing the Shift key and the left mouse button.</p>
<i>Rotate</i>	<p>To rotate around the screen axis, move the mouse to the left and right while pressing the right mouse button.</p> <p>To rotate around further axes, move the mouse freely while pressing the left mouse button.</p>
<i>Selecting a point</i>	<p>Click a point with the left mouse button while simultaneously pressing the Ctrl key.</p> <p>The point is selected if it had not been selected before; the point is deselected if it had been marked already. Already existing point selections remain unchanged.</p>



Function	Description
<i>Selecting an area</i>	Using the left mouse button while simultaneously pressing the Ctrl and Shift keys allows to draw a polygon to select all points within this form. If a selection already exists, the points in the polygon are added to or subtracted from the selection, depending on their previous status.

Table 2: Functions of the mouse in the 3D view

The context menu of the 3D view (click with right mouse button in the 3D window) provides the functions described in Table 3.



Function	Description
<i>Fit to window</i>	Automatic centering of the 3D scene and adaption of the size to visualise all objects of the 3D scene.
<ul style="list-style-type: none">• <i>XY projection</i>• <i>XZ projection</i>• <i>YZ projection</i>	Direct selection of the desired plane for the projection of the 3D scene.
<i>Select all</i>	Select all 3D points in the 3D view. This function is only displayed in the context menu, if 3D points are available in the 3D view.
<i>Invert selection</i>	Invert the selection of the 3D points in the 3D view. This function is only displayed in the context menu, if 3D points are available in the 3D view.
<i>Remove selection</i>	Deselect the 3D points in the 3D view. This function is only displayed in the context menu, if 3D points are available in the 3D view.
<i>New reference</i>	Create a new reference with the selected 3D points. This function is only available in the measurement menu (see Dynamic referencing).
<i>Load reference</i>	Create a new reference with loaded 3D points. To load the 3D points, the file with the reference points has to be selected in the file selection dialog which opens next. This function is only available in the measurement menu (see Dynamic referencing).

Table 3: Functions of the context menu in the 3D view

The points are colour-coded according to their type in the images as well as the 3D visualisation. Table 4 gives an overview of the various point colourings.



Colour	Description
Blue	Uncoded points
Green	Coded points
Yellow	Points with invalid point number, e.g. not allocated points
Red	Invalid points, which for instance are of bad accuracy, are located outside the measuring volume or are detected as blunders during adapter measurement or referencing.

Table 4: Point colourings in the 3D view

3.3 3D tool bar

The 3D tool bar allows to control how the objects in the 3D window are displayed.

The tool bar consists of buttons and dialog boxes for controlling the display of points, the camera model, the 3D display and the camera images (Figure 11).

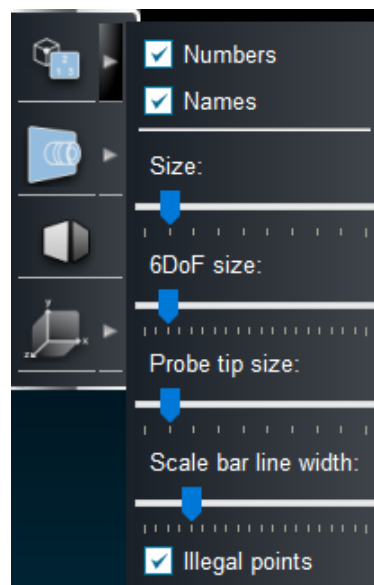


Figure 11: The 3D tool bar of MoveInspect Pilot with the settings of the point display



3.3.1 Representation of point information

By clicking the button it can be controlled whether additional point information to a point is displayed in the 3D window. The display of the button changes correspondingly (Table 5).



Symbol	Description
	Indicate point information
	Hide point information

Table 5: Button for displaying point information in the 3D window

In the dialog box for displaying the point information, the point size and the extent of displayed point information in the 3D window can be adjusted (Figure 12).

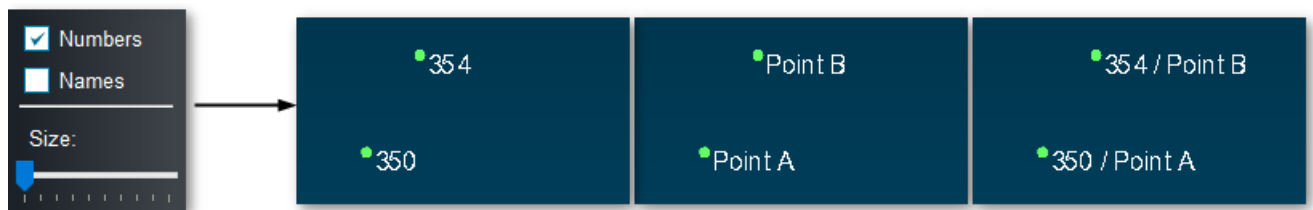


Figure 12: Display of different point information and point sizes

In addition, the coordinate system size of the 6DoF adapters, the probe tips' size and the line width of scales in the 3D view can be adjusted.

As an option, invalid points can be displayed by activating the checkbox.



3.3.2 Representation of the camera model

By clicking the button, the representation of the camera model in the 3D window can be controlled. The cameras can be displayed as 3D models or by the image taken by themselves (Figure 13). The representation of the button changes correspondingly (Table 6).

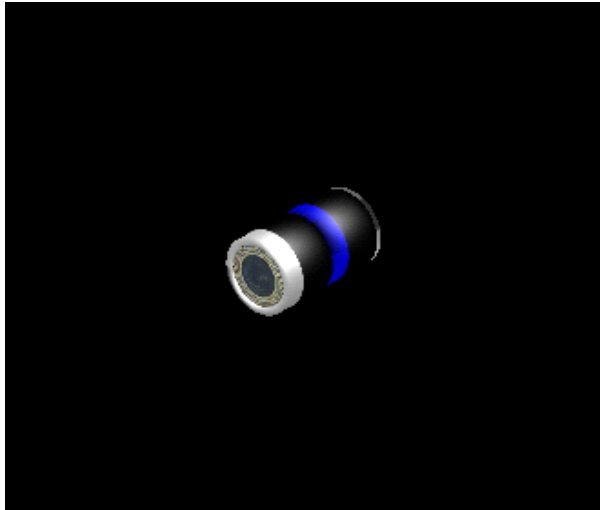


Figure 13: Camera representation as 3D model and as camera image




Symbol	Description
	Displays a 3D model of the camera
	Displays the current image of the camera
	Hide camera

Table 6: Button for the camera representation in the 3D window

In the dialog box of the camera model representation, the size of the current camera image can be adjusted (Figure 14).

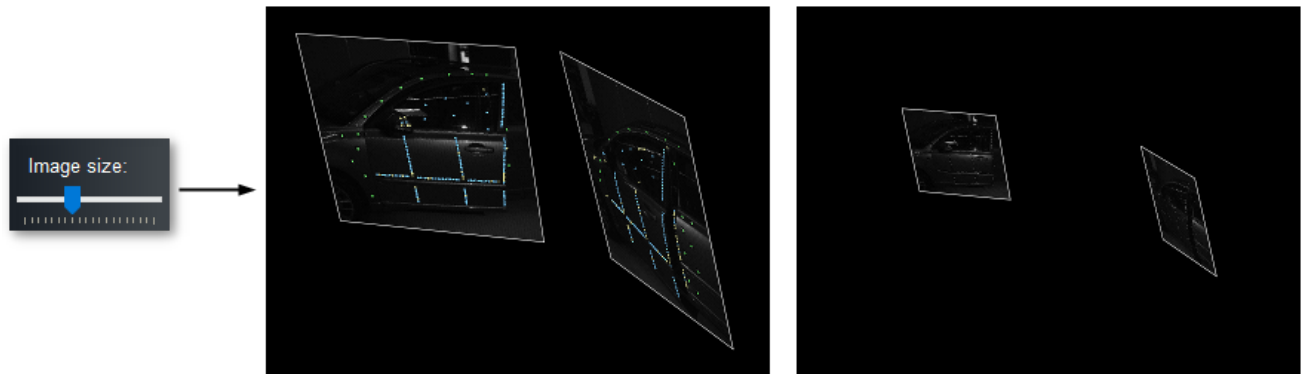


Figure 14: Different sizes of camera images representations in the 3D window

In addition, the image quality for the image representation in the 3D view can be adjusted (Figure 15). By default, the images are displayed in low resolution in the 3D view. When image quality is increased to full resolution the application can slow down. This parameter does not influence any calculation, but just changes the image representation in the 3D view.

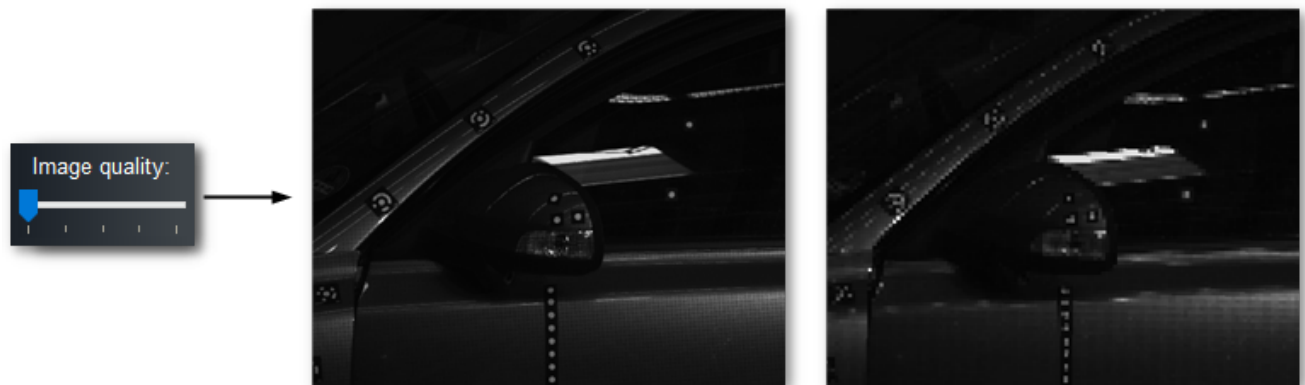


Figure 15: Camera image representation in the 3D view with different image qualities

3.3.3 Display of 3D view / camera images

By clicking the button it is possible to switch from the display of the 3D scene to an image overview with the images of all cameras side by side (Figure 16). The display of the button changes correspondingly (Table 7).

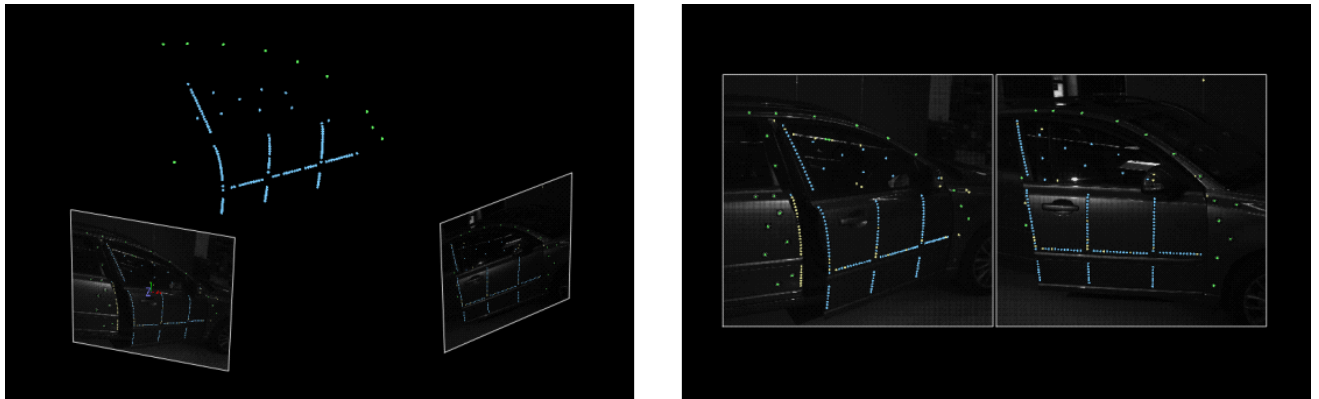


Figure 16: Display of the camera images in the 3D scene and in the camera image overview





Symbol	Description
	Displays the 3D scene
	Displays the camera images

Table 7: Display of the button

Both in the 3D scene and in the camera image overview it is possible to switch to the single image view by double clicking an image or a camera. By double clicking in the single image view it is switched back to the 3D scene or to the camera image overview.

Within the camera image overview and within the single image views the functions of the mouse described in Table 8 allow to zoom in or shift the view.

Function	Description
Zoom in	<p>Move the mouse up and down while pressing the right mouse button or use the mouse scroll wheel.</p> <p>By simultaneously pressing the Alt key and the right mouse button a window can be drawn to zoom onto a certain section. Expanding the window from left to right zooms into the window, expanding it from right to left zooms out of the window.</p>
Shift	<p>Move the mouse freely while pressing simultaneously the Shift key and the left mouse button.</p>

Table 8: Mouse functions in the single image view

In addition, the images in the camera image overview and in the single image view can be rotated. For cameras mounted upside down or turned by 90 degrees, the image can be rotated in such a way that the images are displayed correctly in the software. Clicking with the right mouse button onto a picture opens a context menu which allows to rotate the image by 90 degrees, 180 degrees and 270 degrees. This setting is saved and the image of this camera is automatically displayed in the rotated view.



The functions of the 3D tool bar for the camera and coordinate system display are not active in the camera image overview and the single image view.

3.3.4 Adjustment of the 3D view

By clicking the button the 3D scene can be fitted in the 3D window or displayed as a projection on one of the three planes of the coordinate system. The button shows the view which is displayed next (Table 9).





Symbol	Description
	Fit to window
	XY projection
	XZ projection
	YZ projection

Table 9: Button for the coordinate system display in the 3D window

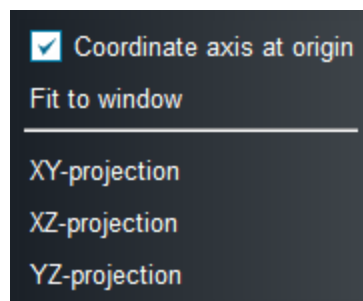


Figure 17: Dialog box of the coordinate system display

The dialog box of the coordinate system display (Figure 17) offers the functions in Table 10.



Function	Description
<i>Coordinate axes at origin</i>	If this option is switched off, the coordinate axes are always visibly displayed in the bottom left corner of the 3D window. If this option is switched on, the coordinate axes are displayed at the origin of the coordinate system in the 3D window.
<i>Fit to window</i>	By clicking this function the 3D scene is automatically centred and enlarged in such a way that all objects are visible in the 3D scene.
<ul style="list-style-type: none">• <i>XY projection</i>• <i>XZ projection</i>• <i>YZ projection</i>	By clicking these functions it is possible to directly select the desired plane for the projection in the 3D scene.

Table 10: Dialog window functions to adapt the 3D view



3.4 Activity window

Every menu item has its own activity window. In this window the activities corresponding to the respective menu item are prompted via the tool bar.

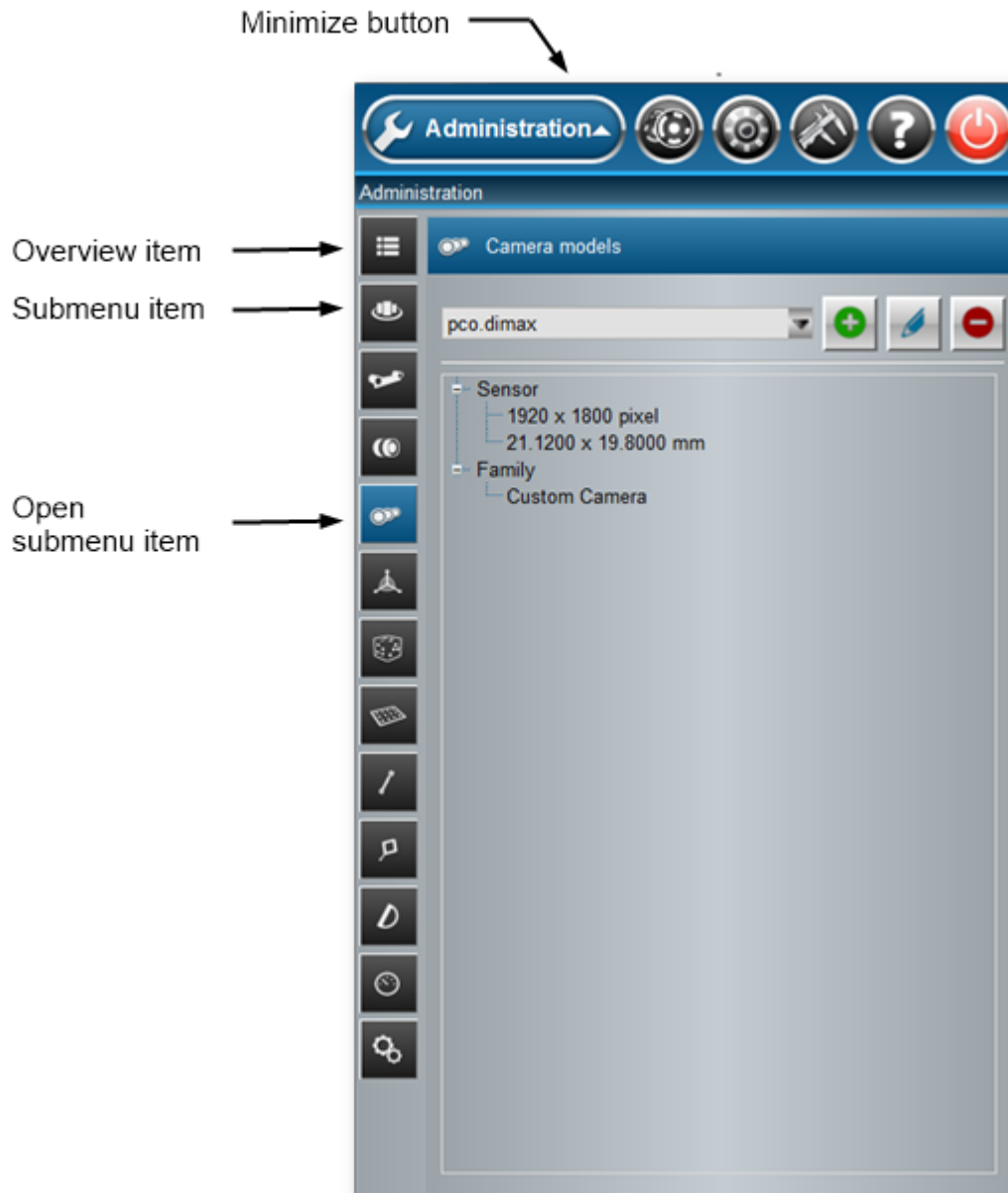


Figure 18: Activity window of the menu item *Administration*

The activity window mostly consists of various submenu items (Figure 19). In the overview all submenu items are listed with their titles. Clicking the first button in the tool bar opens the overview. A submenu appears by clicking the corresponding symbol in the tool bar or the corresponding text button in the

overview. It is not possible to open simultaneously more than one submenu item. Mouse over a symbol to open the corresponding tooltip.

To enlarge the visible area of the 3D window the activity window can be minimised by clicking *Minimize*.

3.5 Data window

For some menu items the data window is displayed, e.g. for a measurement or for the administration of adapters and calibration panels. In the data window points and other geometric elements are displayed with their coordinate values. At the same time, these points are visible in the 3D window. A data window may contain several tables with coordinate values. By clicking the respective tab, the desired table is brought to the front (Figure 19).

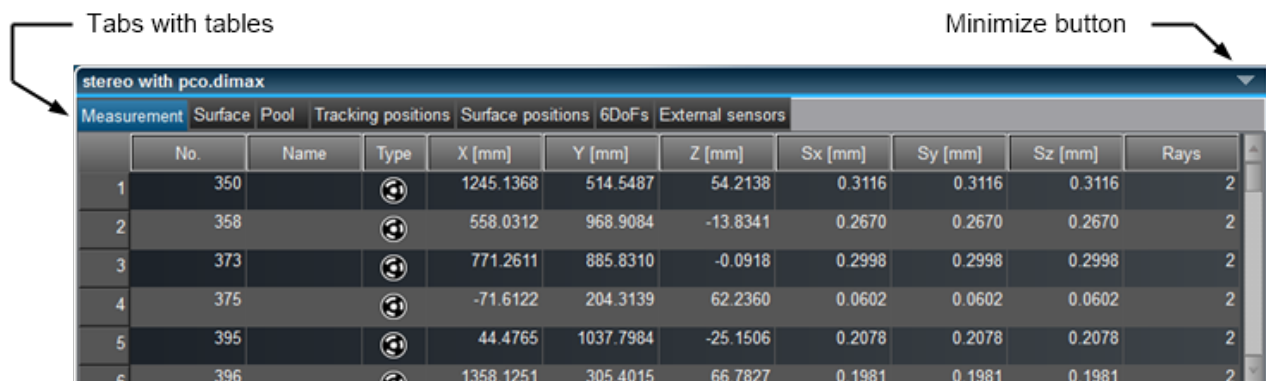


Figure 19 shows a screenshot of the 'Data window' in the software. The window title is 'stereo with pco.dimax'. It contains several tabs: 'Measurement', 'Surface', 'Pool', 'Tracking positions', 'Surface positions', '6DoFs', and 'External sensors'. The 'Measurement' tab is currently active, displaying a table with 11 columns: 'No.', 'Name', 'Type', 'X [mm]', 'Y [mm]', 'Z [mm]', 'Sx [mm]', 'Sy [mm]', 'Sz [mm]', and 'Rays'. The table contains 6 rows of data. An arrow points to the tabs with the label 'Tabs with tables', and another arrow points to the minimize button in the window's title bar with the label 'Minimize button'.

	No.	Name	Type	X [mm]	Y [mm]	Z [mm]	Sx [mm]	Sy [mm]	Sz [mm]	Rays
1	350			1245.1368	514.5487	54.2138	0.3116	0.3116	0.3116	2
2	358			558.0312	968.9084	-13.8341	0.2670	0.2670	0.2670	2
3	373			771.2611	885.8310	-0.0918	0.2998	0.2998	0.2998	2
4	375			-71.6122	204.3139	62.2360	0.0602	0.0602	0.0602	2
5	395			44.4765	1037.7984	-25.1506	0.2078	0.2078	0.2078	2
6	396			1358.1251	305.4015	66.7827	0.1981	0.1981	0.1981	2

Figure 19: Data window with several tables

The height of the data window can be changed with the mouse. For enlarging the visible area of the 3D window the activity window can be completely minimised.

The table's context menu (right mouse click in the table) provides the functions described in Table 11.













Function	Description
<i>Load</i>	Load a file. This function is only available in editable tables.
<i>Save</i>	Save the data into a file.
<i>Copy</i>	Copy selected cells to the clipboard.
<i>Insert</i>	Insert the clipboard content into the table. This function is only available in editable tables.
<i>Cut</i>	Cut out selected cells. The content is copied to the clipboard and deleted in the current table. This function is only available in editable tables.
<i>Delete</i>	Delete selected cells. This function is only available in editable tables.
<i>Select all</i>	Mark the complete table.
<i>Invert selection</i>	Invert the selection in the table. This function works only if whole rows are selected.
<i>Clear selection</i>	Cancel the selection in the table.
<i>New reference</i>	Create a new reference with the selected 3D points. This function is only available in the measurement menu (see Dynamic referencing).
<i>Load reference</i>	Create a new reference with loaded 3D points. To load the 3D points, the file with the reference points has to be selected in the file selection dialog which opens next. This function is only available in the measurement menu (see Dynamic referencing).

Table 11: Context menu functions in the 3D view



3.5.1 Table columns

It depends on the respective menu item which columns of a table are displayed. Table 12 lists the most important columns. By clicking a header, the rows of the table are sorted by the values in this column.

Column header	Description
<i>No.</i>	Number of a point
<i>Name</i>	Name of a point
<i>Type</i>	Type of target: <div> uncoded</div> <div> coded (Type AICON Bitcode)</div> <div> coded (Type Anco)</div> <div> position coded</div>
<i>X,Y,Z</i>	Coordinates of a point
<i>Sx, Sy, Sz</i>	Default deviation of the coordinates
<i>State</i>	State of a point <div> Successful measurement, all criteria are fulfilled.</div> <div> Not enough targets or rays measured.</div> <div> The geometrical distribution of the targets is not good enough.</div> <div> The standard deviation or the Sigma0 is too high.</div> <div> The point is outside of the measuring volume.</div> <div> The relative or exterior orientation is not valid.</div>




Column header	Description
	 Invalid measurement for other reasons.

Table 12: Frequently used table columns

3.5.2 Edit table

Some menu items require editing the table (e.g. when creating adapters or calibration panels). The values can be directly entered in the table or loaded from a file. For loading values from a file, open the context menu of the table (by clicking with the right mouse button into the table) and there clicking *Load...*. In the following dialog, select the file and the corresponding file format (Figure 20). A selection of the supported file formats is described in section [File formats](#).

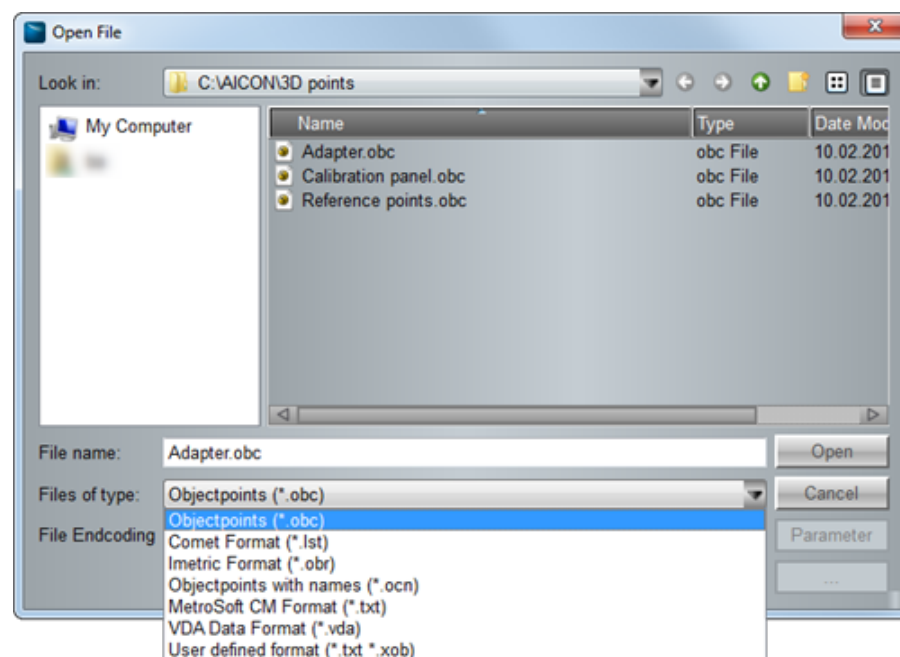


Figure 20: Loading points from a file

To edit the table, the functions of the clipboard are also available. By clicking the index column of the table and subsequently dragging the mouse, it is possible to select several table rows (Figure 21).



Selected rows

stereo with pco.dimax										
	Measurement	Surface	Pool	Tracking positions	Surface positions	6DoFs	External sensors			
	No.	Name	Type	X [mm]	Y [mm]	Z [mm]	Sx [mm]	Sy [mm]	Sz [mm]	Rays
1	350			1245.1368	514.5487	54.2138	0.3116	0.3116	0.3116	2
2	358			558.0312	968.9084	-13.8341	0.2670	0.2670	0.2670	2
3	373			771.2611	885.8310	-0.0918	0.2998	0.2998	0.2998	2
4	375			-71.6122	204.3139	62.2360	0.0602	0.0602	0.0602	2
5	395			44.4765	1037.7984	-25.1506	0.2078	0.2078	0.2078	2
6	396			1358.1251	305.4015	66.7827	0.1981	0.1981	0.1981	2

Figure 21: Table with selected rows

Via shortcuts or the context menu, these rows are copied to the clipboard (Ctrl+C) or cut out (Ctrl+X). These rows can be pasted in another table using the shortcut (Ctrl+V) or the context menu.

In conjunction with the AICON 3D Studio (from Version 11) it is possible to exchange data by Drag&Drop. To transfer data from MoveInspect Pilot into the 3D Studio, mark the table or a selection of the table in MoveInspect Pilot, then move it into an already existing table or the project overview of the AICON 3D Studio by keeping the left mouse button pressed and release it afterwards (Drag&Drop) (Figure 22).

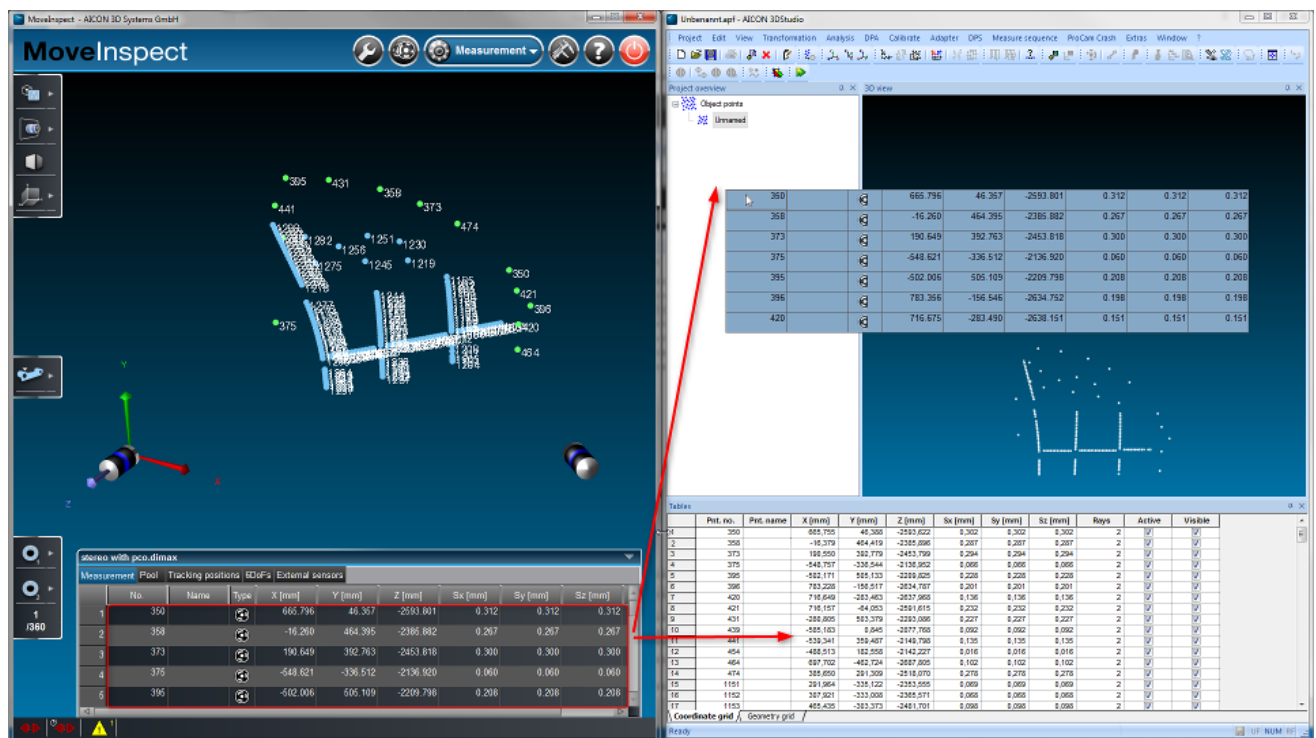


Figure 22: Data transfer from MoveInspect Pilot into the AICON 3D Studio by Drag&Drop

To transfer data by Drag&Drop from the AICON 3D Studio to MoveInspect Pilot, elements of the project tree can be moved into a table in MoveInspect Pilot (Figure 23).

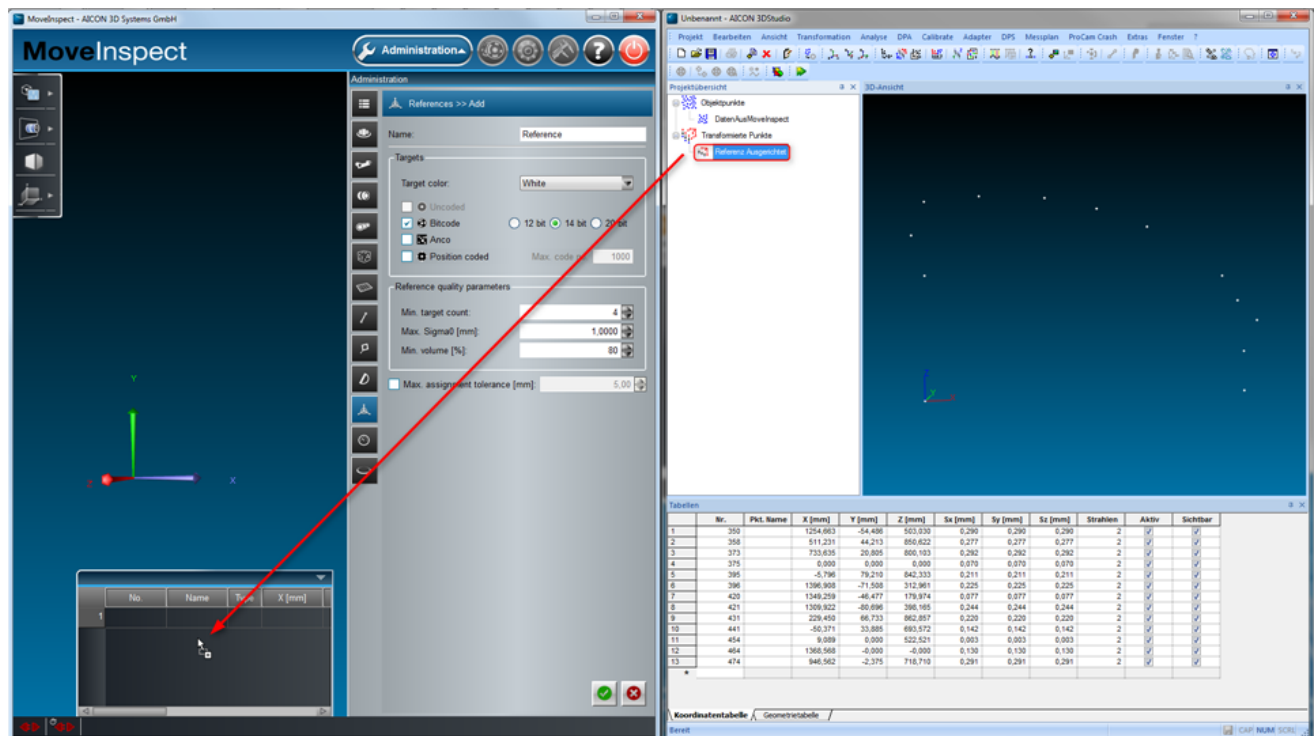


Figure 23: Data exchange from the AICON 3D Studio into MoveInspect Pilot by Drag&Drop






3.6 Status bar

The status bar is positioned at the bottom edge of the main window and serves to display the status messages.



Status of the online interface:

The online interface serves as the connection between MoveInspect Pilot and other types of evaluation software (e.g. AICON 3D Studio and PolyWorks®). The measurement results (probe measurements or 3D coordinates of the targets) are transferred to the other programme where they can be further processed. The status displays whether the online interface is active and whether an evaluation software is connected with MoveInspect Pilot.

Function	Description
	Online interface is inactive. Clicking the symbol activates the connecting function.
	Online interface is connected.
	Online interface is not connected.

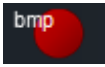
Status of the RealTime interface:

The RealTime interface allows for the real time transfer of measuring points. The status display shows whether and how many RealTime clients are connected to MoveInspect Pilot.

Function	Description
	The RealTime interface is connected. The number of the connected RealTime clients is displayed.
	The RealTime interface is not connected.



Save status images:



As soon as *Saving images* is activated, a recording symbol appears in the status display. It displays whether files are saved in the *.bmp, *.phc and/or *.numphc format. *Saving images* is activated and deactivated via the key combinations Alt+S (*.bmp), Alt+P (*.phc) and Alt+N (*.numphc).

Display of warnings:



In the event of a warning, a warning symbol is displayed in the status bar. The number shows the amount of existing system warnings. The existing warnings are displayed in the tooltip.

Display of information:



In the event of an information, an information symbol is displayed in the status bar. The number shows the amount of information. The existing information are displayed in the tooltip.

Battery status of the MI.Probe operating unit:

For the MI.Probe the battery status of the operating unit is displayed at the bottom right of the status bar. The exact battery charge status in percentage is displayed in the tooltip.

Function	Description
	The operating unit is not connected or the battery status is unknown.
	The battery status is okay at a battery level between 50 and 100%.
	The battery level between 10 and 50%.
	The battery level is below 10% and is therefore critical.

4 Menu item 'Administration'

This menu item allows to create different measurement configurations with the necessary measuring equipment as well as to manage general settings of the software. The menu item *Administration* includes the following submenu items:

- *Configurations*
- *Camera systems*
- *Cameras*
- *Camera models*
- *References*
- *Adapters*
- *Calibration devices*
- *Scale bars*
- *Probes*
- *Probe operating units*
- *External sensors*
- *Environment*

By clicking a submenu item the corresponding start window appears. The start windows for the administration of the configurations and the measuring equipment have the same structure (Figure 24). It is possible to create new entries, to edit or delete configurations and measuring equipment. Measuring equipment cannot be deleted as long as it is used by a configuration or other measuring equipment.

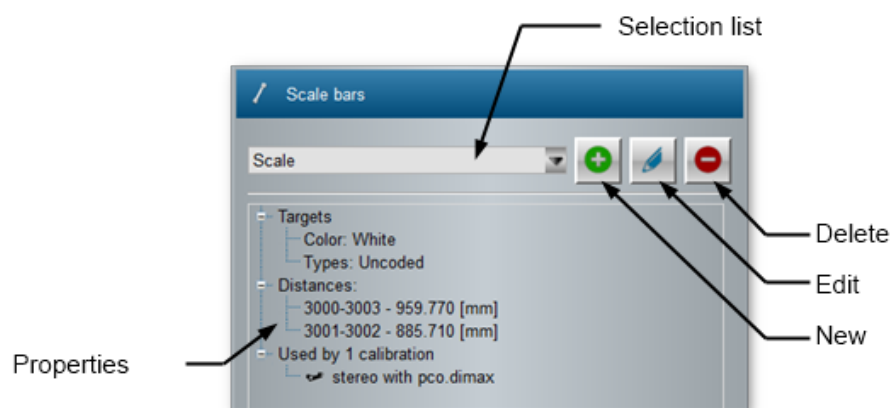


Figure 24: Start window of the submenu item *Scale bars*

4.1 Submenu item 'Configurations'

This submenu allows to create and manage different measurement configurations. A configuration describes all necessary measuring equipment for a measuring task (e.g. cameras, targets, adapters) as well as the measuring parameters.

For measuring tasks which require different measuring equipment or parameters different configurations should be created. The respectively active configuration is then defined in the drop-down list (Figure 25).

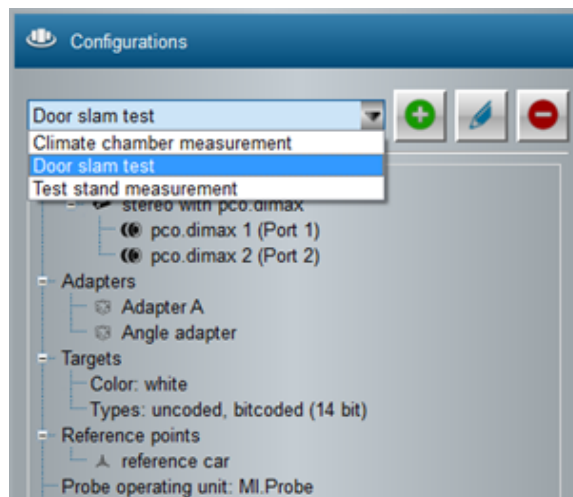


Figure 25: Selecting the active configuration

By clicking a button for creating a new or edit an existing configuration, a new window appears within the activity window (Figure 26). In this window, a user-defined name for the configuration can be entered. This name has to differ from the names of the already existing configurations.

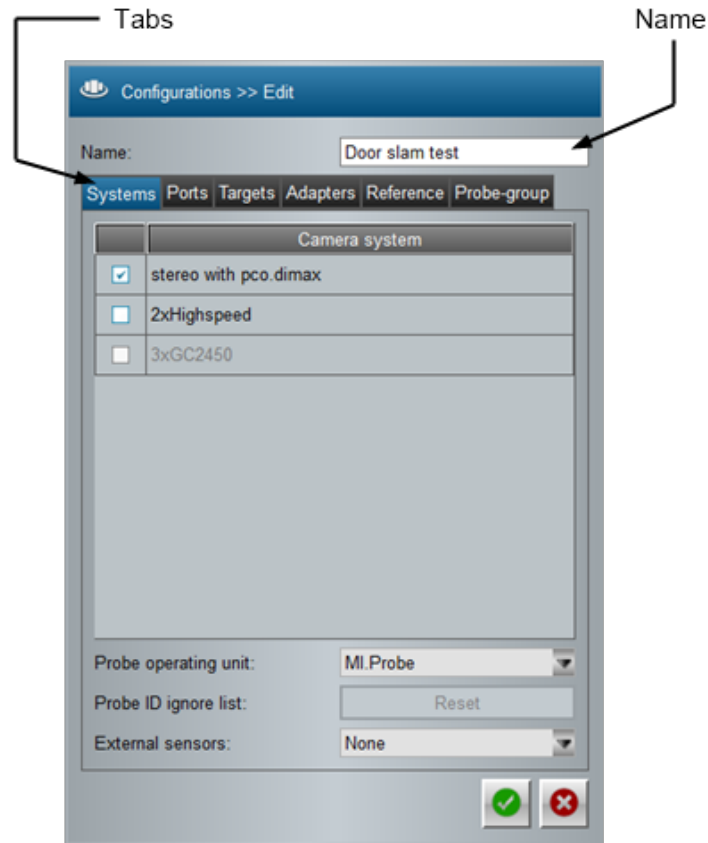


Figure 26: Creating and editing a configuration

A measurement configuration consists of at least one camera system and the description of the used targets. Optionally it is possible to add adapters, reference points, probe operating units and external sensors to a measurement configuration. For this purpose, the window offers the tabs Systems, Ports, Targets, Adapters, Reference and Probe-group. These tabs are described in the following sections.

After the tab editing is completed, the new configuration is added or the changes are applied by clicking



. By clicking



all entries are discarded.



4.1.1 Tab 'Systems'

Using the tab *Systems* , the specific camera system is selected for recording the measurement. All available camera systems are listed in a table, mark the desired camera system with a tick (Figure 27). How to previously create a camera system is described in section [Submenu item 'Camera systems'](#).

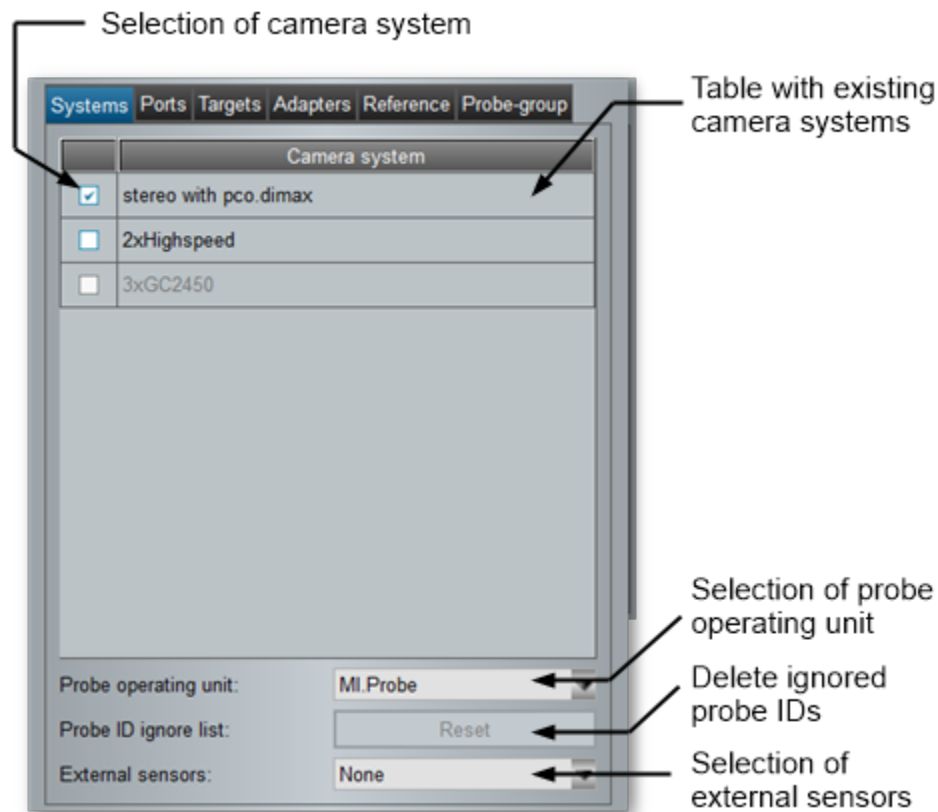


Figure 27: Selecting the camera system and the probe operating unit

If a probe shall be used for the measurement, the corresponding probe operating unit has to be selected as well (Figure 27). How to previously create a probe operating unit is described in section [Submenu item 'Probe operating units'](#).

In the case of active probes the probe ID is transmitted with the trigger signal and automatically recognised by the software. If a probe is not to be used in a configuration, the trigger signal of a probe can be ignored for the measurements. To do so, in the case of an unknown, not yet allocated probe address a dialog is displayed during the measurement in which the probe ID is allocated to the respective probe. This dialog additionally contains the option to ignore this probe ID. Clicking *Reset*



next to the *Probe ID ignore list* deletes the list and all probe IDs in this configuration are be taken into account again.

To use the external sensors, the respective sensor group needs to be selected in the selection box (Figure 27). These must have been previously created as described in section [Submenu item 'External sensors'](#).

4.1.2 Tab 'Ports'

After having selected the camera system, a list in the tab *Ports* specifies in which port of the Syncbox each camera is plugged in (Figure 28). The ports do not have to be specified if this configuration shall solely work with images from data carriers and not with images from connected cameras.



Figure 28: Indication of the used ports of the Syncbox

4.1.3 Tab 'Targets'

The tab *Targets* shows which targets are used (Figure 29).

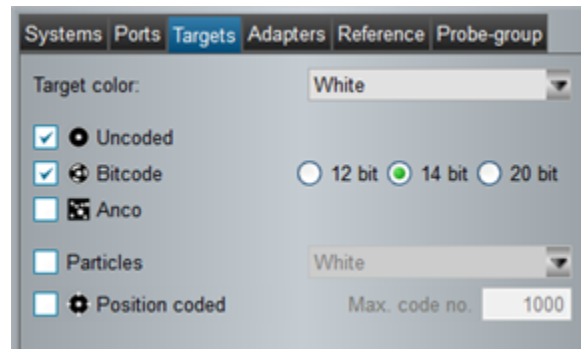


Figure 29: Specification of the used targets

It is possible to use uncoded and coded targets (Bitcode and Anco targets) in any combination (Figure 30). In case of coded targets, please make sure not to use targets with identical code numbers. In case of Bitcode targets, the respective number of bits has to be specified (14 bit in most cases).

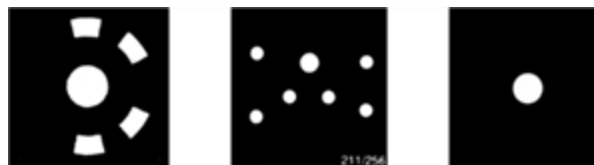


Figure 30: Different targets (Bitcode, Anco, Uncoded)

Furthermore, the colour of the target has to be specified; available are *White*, *Black* or *Black and White*. A measurement of black and white targets together is slower than a measurement of only black or only white targets.

In addition, it can also be selected whether natural particles shall be measured in the images. Particles can have any shape and are sized in such a way that they can be displayed with a sufficiently large contrast to the background. It has to be selected, if bright particles are to be measured in front of a dark background (*White*) or dark particles in front of bright background (*Black*).

Marking the option *Position coded* allows for the use of fixed installed uncoded measurement targets for the calibration of a stable camera system. Furthermore, position coded targets improve the allocation of these uncoded targets during the measurement. For the calibration as well as for the measurement the



positions and numbers of the position coded measurement targets must be loaded for each camera in the dialog box of the camera parameters (see Figure 31). After having successfully loaded the position coded targets the software treats them like coded targets. The targets are searched in a search radius around the loaded position. This parameter can be adapted in *Search radius*. It depends on sensor size, lens and measuring volume. Please contact the Hexagon Commercial Office (Hexagon CO) responsible for your country before changing this parameter.

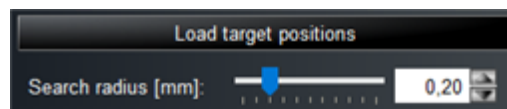


Figure 31: Loading the target positions
in the dialog box of the camera parameters

4.1.4 Tab 'Adapters'

The tab *Adapters* allows to select which adapters with which target points should be measured with this configuration. For this purpose, all available adapters are listed in a tree view. By clicking the name of an adapter, it is displayed in the 3D window. The checkbox before each adapter allows to select the desired adapter for the measurement (Figure 32). How to previously create an adapter is described in section [Submenu item 'Adapters'](#).

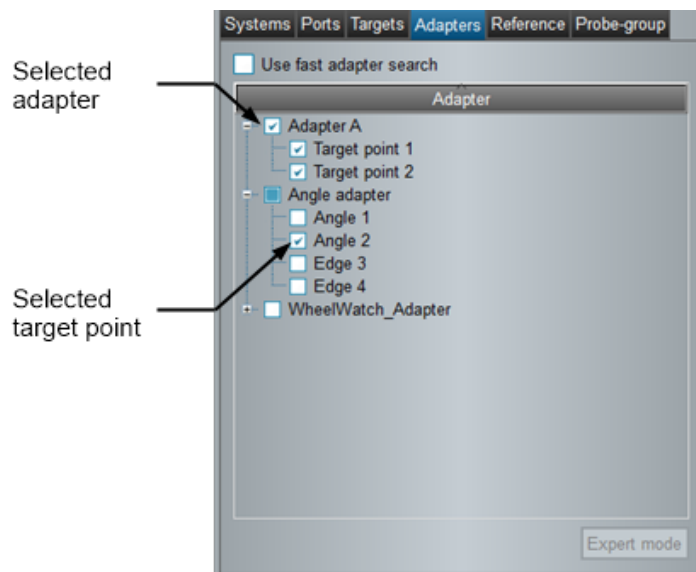


Figure 32: Selecting the adapters

After selecting an adapter, all target points of this adapter are selected by default. With the checkbox in front of each target point it is also possible to select a subset of target points. If all target points are unchecked, the adapter is deselected as well.

Within the configuration each target point can be given a new name. To do this, double click the displayed name to enter the desired name. With this name the corresponding measurement point is labelled later. Thus, the name can refer to the point to be measured (e.g. „hole top left“). In doing so, it is possible for an adapter to be used in different configurations in which the target point specifies different measurement points. The target point can then be labelled according to the measurement task. The name of the target point given during the adapter creation (see section [Create and edit an adapter](#)) is not overwritten by this name.

The checkbox *Use fast adapter search* allows to employ approximate values for a faster adapter measurement. The adapter positions of the previous epoch are used as approximate values for the next epoch. This option can only be used if the position of the adapter differs only minimally from one to the next epoch. Otherwise the adapter won't be found in the subsequent epochs.

In the case of a configuration with several systems, use the Expert mode to specify exactly which adapters are to be measured with which camera system.

4.1.5 Tab 'Reference'

The tab *Reference* allows to set the reference for the current configuration. In the selection list *Reference*, a valid reference for this configuration can be selected. For camera systems with variable geometry, it is mandatory to use a reference. Therefore, a reference has to be selected. A reference can only be deleted if it is not used by any configuration any longer. In this case, another or no reference has to be selected from the selection list.

With the checkbox *Allow activate/deactivate referencing* additionally specifies if activating or deactivating a reference is possible while measuring. By checking this option, the referencing can be switched on and off. If the option is not selected, the checkbox to activate / deactivate the reference while measuring is blocked.

By activating the checkbox *Preselection of references*, the references for the current configuration can be restricted. In this case, only preselected references are used with this configuration. If preselection is deactivated, all valid references of the database are used for measurement.

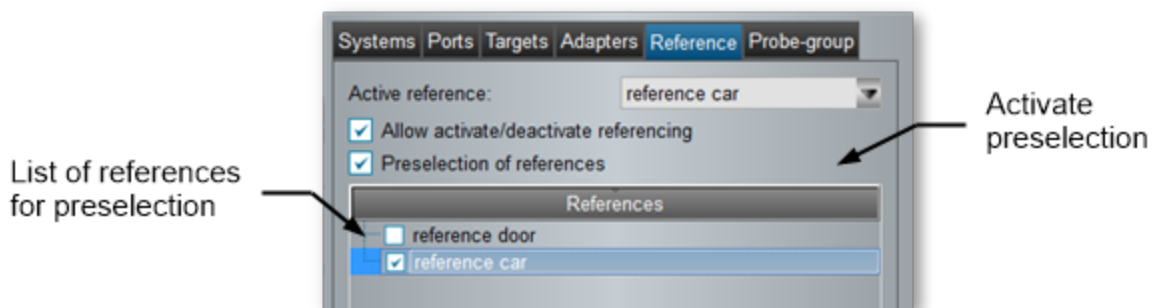


Figure 33: Preselection of references

By activating the checkbox *Preselection of available references in this configuration*, the tree view for selecting references is activated (Figure 33). Any incompatible references are marked in red colour and cannot be selected. For the preselection, at least one reference is required. The references must have been previously created in the [Submenu item 'References'](#).

4.1.6 Tab 'Probe-group'

Under the tab *Probe-group* the measurement can be activated using a probe-group. The probe-group allows for the automatic identification of MI.Probes mini based on their geometry during the measurement.



Figure 34: MI.Probe mini

By activating the checkbox *Measurement with probe-group* the tree view for the selection of the probes for the measurement appears (Figure 35). At least two probes are required for the measurement with a probe-group. Exactly one probe tip has to be selected for each probe. Only the selected probes with the respectively allocated probe tips are automatically recognised during the measurement. Any other probes and probe tips are not included. The MI.Probes mini must have been previously created in the [Submenu item 'Probes'](#) .

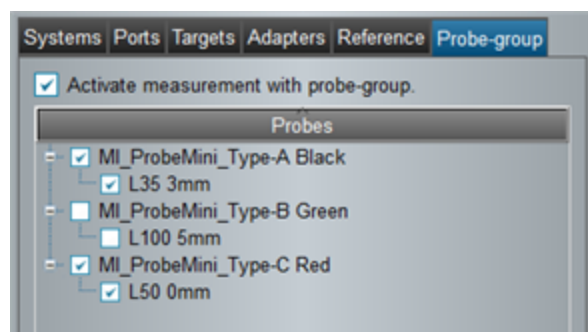


Figure 35: Selecting probes for the measurement with a probe-group

4.2 Submenu item 'Camera systems'

This submenu allows to create and manage different camera systems. A camera system describes a photogrammetric measurement system. It comprises one or several cameras and information on the geometric properties and the arrangement of these cameras. The geometric properties and the arrangement of the cameras of a camera system are determined by calibration (Section [Menu item 'Calibration'](#)).

A camera system can be a part of different configurations. As long as a camera system forms part of a configuration, it cannot be deleted.

4.2.1 Create a camera system

By clicking *Add*, a window appears to create a new camera camera system (Figure 36). In the field *Name*, insert a user-defined name for the camera system which, however, has to differ from the names of the already existing camera systems.

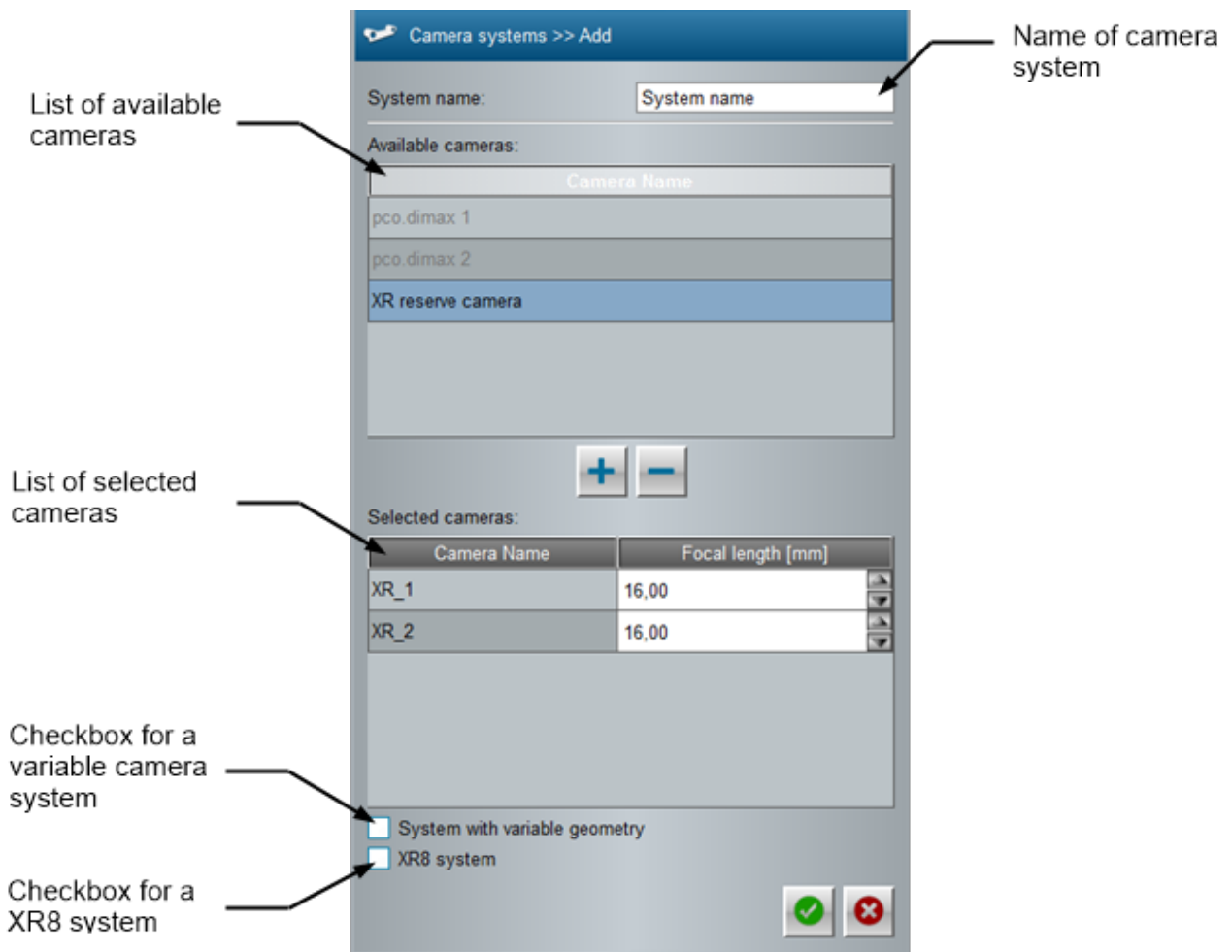




Figure 36: Creating a camera system

When creating a camera system, all existing cameras are listed in the table *Available cameras*. This table allows to select the cameras of the new camera system and add them to the table *Selected cameras* by double clicking the respective camera or by marking the respective camera and clicking . To delete a camera from the table *Selected cameras*, the camera is marked and removed by a double click or by clicking . In the table *Selected cameras*, the order of the cameras and the focal length of the individual cameras can be entered. By shifting a row, the order of the cameras in the new camera system is changed. The order is saved for the new system and cannot be changed afterward by editing a system.




A camera system may only comprise cameras which belong to the same family. Cameras that do not belong to the same camera family as the already selected cameras, are displayed grayed in the table *Available cameras*. How to create cameras is described in section [Submenu item 'Cameras'](#).

When a camera system consists of several cameras, specify in the checkbox whether the relative orientation of the cameras to one another is geometrically stable or variable during a measurement. A camera system is stable, for instance, when the cameras are mounted in a fixed position to one another on a bar. In contrast to that, the cameras in a variable camera system are mounted on tripods and are able to move relative to one another during the measurement.

For a variable camera system reference points are required during the measurement. With these reference points the relative orientation of the cameras to one another is determined anew in each epoch during the measurement. When creating the configuration containing the system with variable geometry, a reference has to be selected (see Section [Tab 'Reference'](#)).

By activating the checkbox *XR8 system* the specific geometry of the XR8 camera system is included. This option is only available for camera systems with two cameras and has to be activated when working with a XR8 camera system.

By clicking  the new camera system is added. Once a camera system has been created editing is limited. It is neither possible to add or delete cameras nor to change the indication for stability of the relative orientation.



4.2.2 Edit a camera system

By clicking *Edit*, a window appears to edit an existing camera system (Figure 37).

Camera	Focal length [mm]
MI 5M 8mm No. 1 [06457]	8,00
MI 5M 8mm No. 2 [06518]	8,00


☐ System with variable geometry

Max. sigma0 [mm]: 0,000345

Figure 37: Editing a camera system

The name of the camera system can be changed or a defect camera can be replaced by a new one. The button for camera replacement is only active when there is at least on camera of the same camera family, that does not already belong to this camera system. See section [Replace a camera](#).

Editing the camera system also allows to adjust the limit value for the calibration (Max Sigma0). To ensure a successful calibration, this value must not be exceeded. Adjusting this value should only be carried out after consultation with the Hexagon Commercial Office (Hexagon CO) responsible for your country.

By clicking , the changes are applied.



4.2.3 Replace a camera

To replace a camera, click *Replace* in the table to edit a camera system (see Figure 37). A window appears with the menu for replacing a camera (Figure 38).

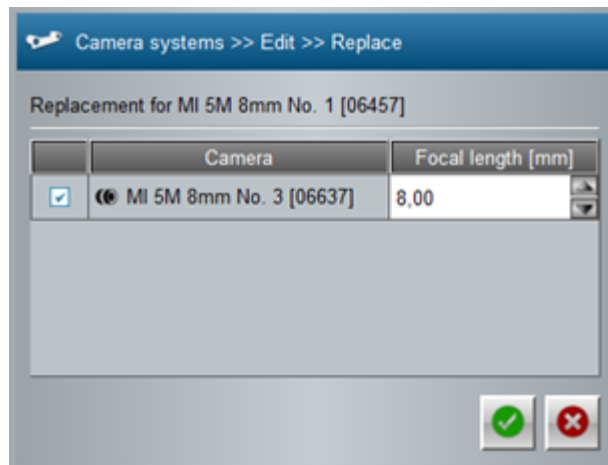



Figure 38: Replacing a camera

The table lists all existing cameras of the same camera family. How to create the cameras is described in the section [Submenu item 'Cameras'](#).

Select the camera by activating the checkbox. In addition, the focal length of the new camera can be set. By clicking , the specified camera is replaced by the new camera.

Caution! After replacing a camera the system has to be recalibrated.

4.3 Submenu item 'Cameras'

This submenu allows to create and manage different cameras. A camera may be part of different camera systems. As long as a camera still forms part of a camera system, it cannot be deleted.


When clicking a button to create or edit a camera, a new window appears (Figure 39). In the field *Name*, insert a user-defined name for the camera which, however, has to differ from the names of the already existing cameras.



Figure 39: Creating a camera

A camera is characterised by its camera model, a hardware identification and an IP address (in case of HF cameras). Select the camera model from the available models in the drop-down list. How to previously create a camera model is described in section [Submenu item 'Camera models'](#). Once a camera has been created, the camera model cannot be changed any more.

Depending on the family of the selected camera model it may be necessary to enter a special hardware identification of the camera (e.g. a Node-ID or a MAC address). With this hardware identification the software can identify the camera and establish a connection to it. The hardware identification of a camera can usually be read out by means of a camera manufacturer's software.

By clicking , the new camera is added or the changes are applied.

4.4 Submenu item 'Camera models'

This submenu allows to create and manage different camera models. A camera model may be assigned to different cameras. As long as a camera exists, its camera model cannot be deleted.

When clicking a button to create or edit a camera model, a new window appears (Figure 40). In the field *Model name*, insert a user-defined name which, however, has to differ from the names of the already existing camera models.




Figure 40: Creating a camera model

Each camera model belongs to a camera family which has to be selected in the corresponding drop-down list. The software supports the following camera families:


- TraceCamF
- TraceCamF 4M
- Prosilica GigE
- Point Grey



From these camera families, the software is able to directly capture images. For camera models without a direct image capture support by the software, select the camera family *User-defined*. Images of these cameras can be solely loaded from data carriers.

Furthermore, the image sensor of the camera model has to be characterised. For this, the number of pixels (rows and columns) as well as the size of the image plane (width and height of the total sensor or of one pixel) are to be specified. Moreover, the image sensor of the camera model has to be characterised. For this, the number of pixels (rows and columns) as well as the size of the image plane (width and height of the total sensor or of one pixel) are to be specified. In addition, the maximum possible image recording frequency of a camera model has to be stated. This specification can be obtained from the data sheet of the camera manufacturer.



By clicking , the new camera model is added. Once a camera system has been created editing is limited. The camera family and the properties of the image sensor cannot be changed any more.



4.5 Submenu item 'References'

This submenu allows to create and manage references. References are required to make the measurement in the coordinate system of these reference points. As long as a reference is active in a configuration or calibration or is included in the reference preselection of a configuration, it cannot be deleted.

4.5.1 Create and edit references

When clicking a button to create or edit a reference, a new window appears Figure 41. In the window *Name*, insert a user-defined name which, however, has to differ from the names of the already existing references.

Figure 41: Creating a reference

The reference points can be directly entered in the data window or loaded from a file (see section [Edit table](#)).



The *Reference quality parameters* allow to define the quality of the reference points for the transformation.

Parameter	Description
<i>Min. target count</i>	This parameter defines how many reference points have to be visible for the transformation, otherwise the display is highlighted in red as a warning and the measurement is discarded.
<i>Max. Sigma0 [mm]</i>	This parameter defines the limit for the accuracy value σ_0 for the transformation. If the set value is exceeded, the display is highlighted in red as a warning and the measurement is discarded.
<i>Min. volume [%]</i>	The stored reference consisting of measurement points spans a volume in space. During measurement it is checked whether the spanned volume defined by the measured reference points falls below the set value. In that case, the display is highlighted in red as a warning and the measurement is discarded.
<i>Max. assignment tolerance [mm]</i>	The assignment tolerance determines the maximum deviation of uncoded targets to the stored target data. This tolerance is only relevant for references with less than 4 coded targets.

Table 13: Parameters for reference quality

Furthermore, it has to be specified which targets are used by the reference. This procedure is the same as the description of the targets within a configuration (see section [Tab 'Adapters'](#)).

The checkbox *Uncoded* is automatically marked when entering the reference points into the data table. When creating a configuration, keep in mind that the targets of the used reference are supported. If, for example, a reference with Anco targets is used, the measurement of Anco targets has to be activated in the configuration.




By means of the number of the reference points and the selected targets, the kind of the target is displayed in the column *Type*. The reference points may consist of coded and/or uncoded targets.

For a successful referencing a minimum number of targets has always to be visible. Table 14 shows these minimum quantities for the corresponding camera systems.

Camera system	Minimum number
Stable multiple camera system	At least 4 coded or 4 uncoded targets
Variable multiple camera system	At least 4 coded targets
Single camera system	At least 4 coded targets

Table 14: Minimum quantities of visible targets for referencing

Each reference point can be given a name as a label for the corresponding measurement point.

Clicking  adds the new reference or updates an already existing reference. To use a reference, it must have been selected accordingly in the measurement process (see section [Dialog box 'Reference'](#)).

4.5.2 Set default parameters

To measure a reference, parameters to determine the reference and to evaluate the referencing quality are required. By creating a new reference, the default values for referencing are set. These default parameters are displayed and adjusted in the *Submenu item References* (see Figure 42).

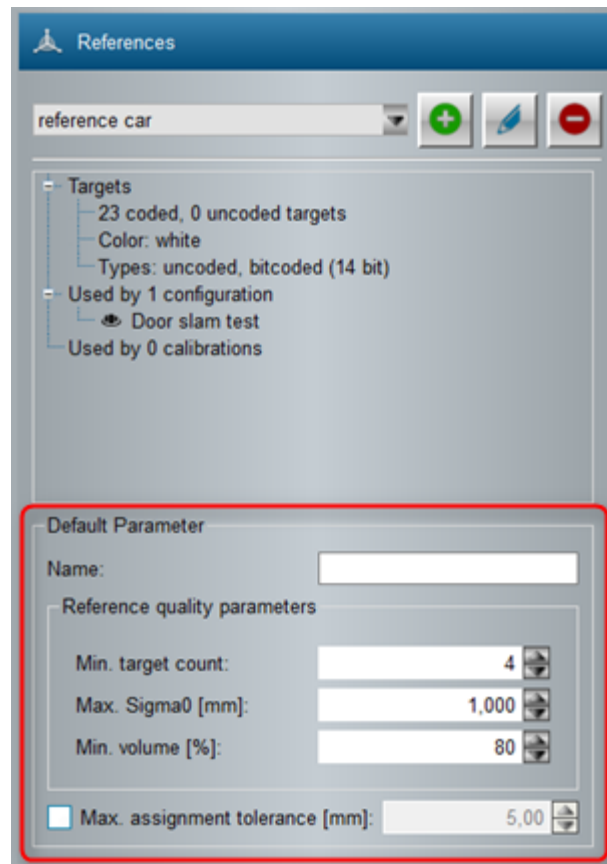


Figure 42: Default parameters for references

Table 15 lists the reference parameters.



Parameter	Description
<i>Name</i>	Name of the reference.
<i>Min. target count</i>	Defining how many reference points have to be visible for the transformation, otherwise the display is highlighted in red as a warning and the measurement is discarded.
<i>Max. Sigma0 [mm]</i>	Defining the limit for the accuracy value σ_0 for the transformation. If the set value is exceeded, the display is highlighted in red as a warning and the measurement is discarded.
<i>Min. volume [%]</i>	The stored reference consisting of measurement points spans a volume in space. It is checked during the measurement if the volume defined by the measured reference points falls below the set value. In that case, the display is highlighted in red as a warning and the measurement is discarded.
<i>Max. assignment tolerance [mm]</i>	Determining the maximum deviation of uncoded targets to the stored target data. This tolerance is only relevant for references with less than 4 coded targets.

Table 15: Parameters of the reference measurement



4.6 Submenu item 'Adapters'

This submenu allows to create and manage different adapters. An adapter can be used for measuring points which are not visible for the cameras or which cannot be directly distinguished by a target. An adapter consists of several targets and one or several target points with known 3D coordinates in a joint coordinate system (Figure 43). In a measurement, first the targets are measured as 3D points. Afterwards, they are replaced by the selected target points.

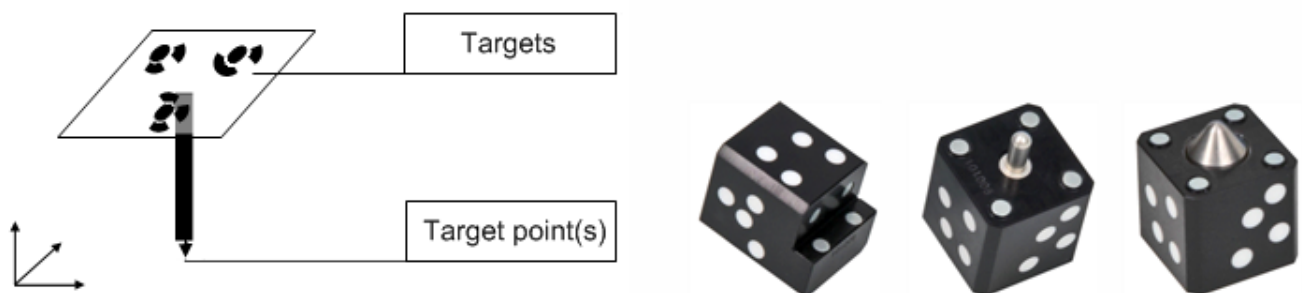


Figure 43: Adapters with targets and one target point

An adapter may be part of different configurations. As long as an adapter still forms part of a configuration, it cannot be deleted.



4.6.1 Create and edit an adapter

When clicking a button to create or edit an adapter, the window shown in Figure 44 as well as the data window (Figure 45) appear. The data window contains a table for the targets (*Targets*) and a table for the target points (*Points*). The existing targets and target points are also displayed in the 3D window.

Figure 44: Creating an adapter

In the activity window, the adapter can be given a freely selectable name which, however, has to differ from the names of the already existing adapters.

Furthermore, it has to be specified which targets are used by the adapter. This is done in the same way as the description of the targets within a configuration (see section [Tab 'Targets'](#)).

The checkbox *Uncoded* is activated automatically when entering the adapter points into the data table. When creating a configuration, it has to be minded that the targets of the used adapters are supported. If, for example, an adapter with Anco targets is used, the measurement of Anco targets has to be activated in the configuration.



Additionally, the number of visible targets as well as the quality criteria can be specified for the adapter measurement. The minimum amount of visible targets is specified as a percentage of all adapter targets. The adapter is assumed to have been measured once the minimum number of visible targets has been measured. Three further quality criteria can be specified for the adapter measurement (see Table 16).

Parameter	Description
<i>Minimum volume [%]</i>	The adapter, consisting of measurement points, spans a volume in space. During measurement it is checked whether the spanned volume defined by the measured reference points falls below the set value. In this case, the adapter measurement is marked invalid.
<i>Minimum rays [%]</i>	This parameter defines the number of rays to be measured for the transformation. The number of measured rays is compared to the highest possible number of rays (number of cameras x number of adapter marks). If the percental value falls below the set value, the adapter measurement is marked invalid.
<i>Maximal Sigma0 [mm]</i>	This parameter defines the allowed value for the accuracy value σ_0 for the transformation. The value refers to the deviations of the image coordinates in mm. If the set value is exceeded, the adapter measurement is marked invalid.

Table 16: Quality criteria of the adapter measurement

The table *Targets* allows to directly enter the targets with their coordinates or load them from a file (see section [Edit table](#)).



By means of the number of the targets and their previously entered description, the target type is displayed in the column *Type*. An adapter may consist of coded and uncoded targets as well as of uncoded targets only. For a successful adapter measurement a minimum number of targets has to be always visible. This minimum number depending on the camera system used in the configuration is given in Table 17.

Camera system	Minimum number
<i>Multi-camera system</i>	At least 4 coded or uncoded targets
<i>Single-camera system</i>	At least 4 coded targets

Table 17: Minimum number of visible targets for the measurement of an adapter

In the table *Points* (Figure 45) it is possible to enter the target points with their coordinates directly or load them from a file (see section [Edit table](#)).

Targets

Points

6DOF

	Name	X [mm]	Y [mm]	Z [mm]	Sx [mm]	Sy [mm]	Sz [mm]	Fixed
1	Target point 1	200.0000	175.0000	750.0000	0.0000	0.0000	0.0000	<input checked="" type="checkbox"/>
2	Target point 2	200.0000	175.0000	950.0000	0.0000	0.0000	0.0000	<input type="checkbox"/>
3								

Figure 45: Table with target points of an adapter


Each target point can be given a name as a labelling for the corresponding measurement point. The coordinates of the target points can be re-read with the aid of a probe in the menu *Measurement Submenu item 'Adapter points'*. If this function is not desired for a target point, the checkbox *Fixed* has to be activated.

The table *6DOF* allows to store the 6DoF values of an adapter (3 translations and 3 rotations plus a rotation order). The following Table 18 lists rotation sequences for the 6DoF target geometries which are available.



Rotation sequence	Description
XYZ	CAP rotation
<i>Rollei</i>	Rollei rotation
ZXY	Axle rotation
ZXY- <i>r</i>	Axle rotation for the right wheel in reference to the centre of the automobile
ZXY- <i>l</i>	Axle rotation for the left wheel in reference to the centre of the automobile

Table 18: Rotation sequences for 6DoF target geometries

By clicking  the new adapter is added or the changes are applied.

4.6.2 Import adapters

The submenu *Adapters* includes an additional button to import adapters which are already existing in the AICON 3D Studio (Figure 46).

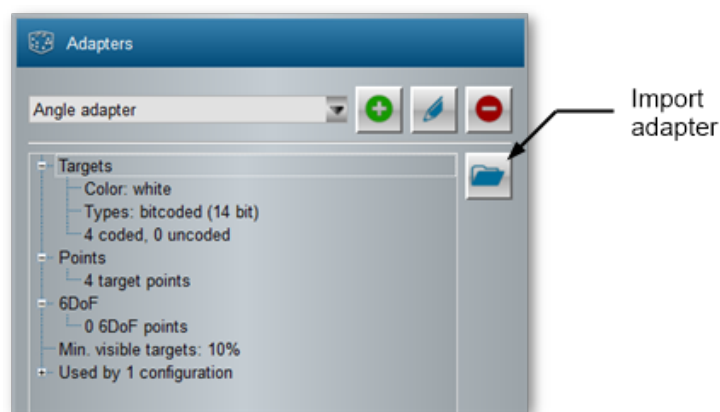


Figure 46: Start window for the submenu *Adapters*

Clicking this button opens a new window (Figure 47).

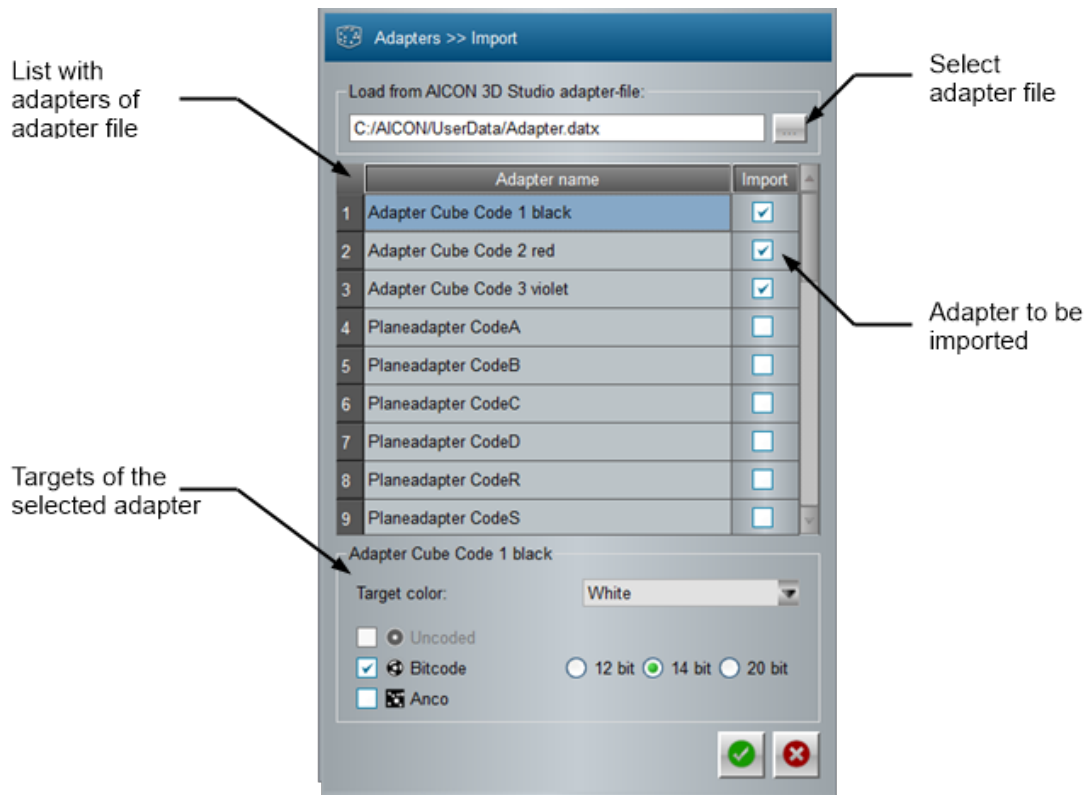


Figure 47: Importing adapters from the AICON 3D Studio

In this window, select the file in which the adapters of the AICON 3D Studio are stored (usually under `C:\AICON\UserData\Adapter.datx`). Afterwards, all adapters of the AICON 3D Studio are listed in a table. By clicking in a row of the table, that row is selected and the corresponding adapter is displayed in the data window and in the 3D window.

In the checkbox *Import* the adapters to be imported can be selected. The name of the adapter can be changed in the table. Specify for each adapter to be imported which targets are used (see section [Tab 'Targets'](#)). The checkbox *Uncoded* is marked automatically according to the selected type of targets and the existing point numbers of the adapter. The specifications refer to the adapter in the selected row of the table.

By clicking  the adapters are imported.



4.7 Submenu item 'Calibration devices'

This submenu allows to create and manage calibration devices (calibration panels and reference crosses). A calibration panel is used for the calibration of camera systems. It is provided with several targets the 3D coordinates of which are defined in high precision (Figure 48).

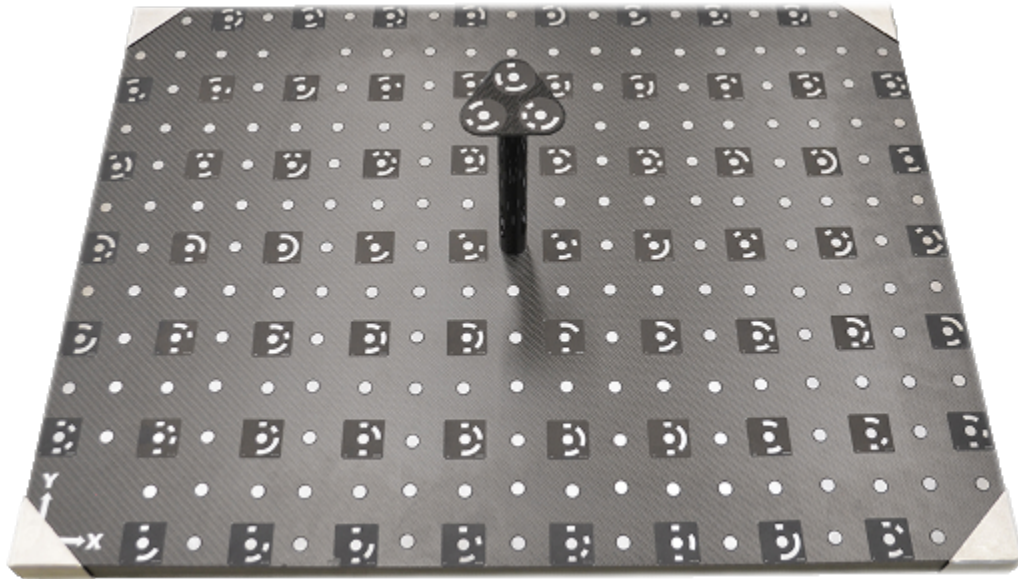


Figure 48: Calibration panels

Reference crosses are used for calibration with scale bars to define the initial orientation. A reference cross typically consists of CFRP composite material and provided with 5 coded targets, see also Figure 49.



Figure 49: Reference cross



When clicking a button to create or edit calibration devices, the window shown in Figure 50 appears.

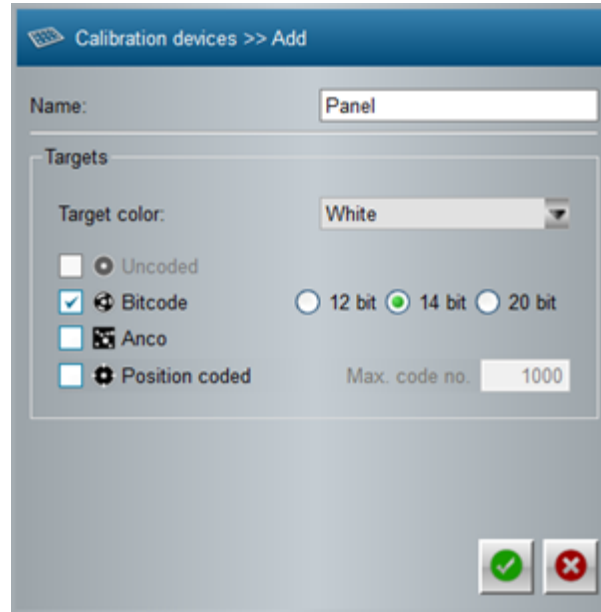


Figure 50: Creating a calibration device

In the field *Name*, insert a user-defined name for the calibration device which, however, has to differ from the names of the already existing calibration devices.

The existing targets of the calibration devices are displayed in the data window and in the 3D window (Figure 51). The targets with their coordinates can be directly entered in the table or loaded from a file (see section [Edit table](#)). By means of the number of the targets and their previous description, the type of target is indicated in the table column *Type*. A calibration panel has to be completely covered with coded targets and can be additionally provided with uncoded targets. A reference cross typically includes coded targets only. Each target can be given a name by which it is identified during the calibration.

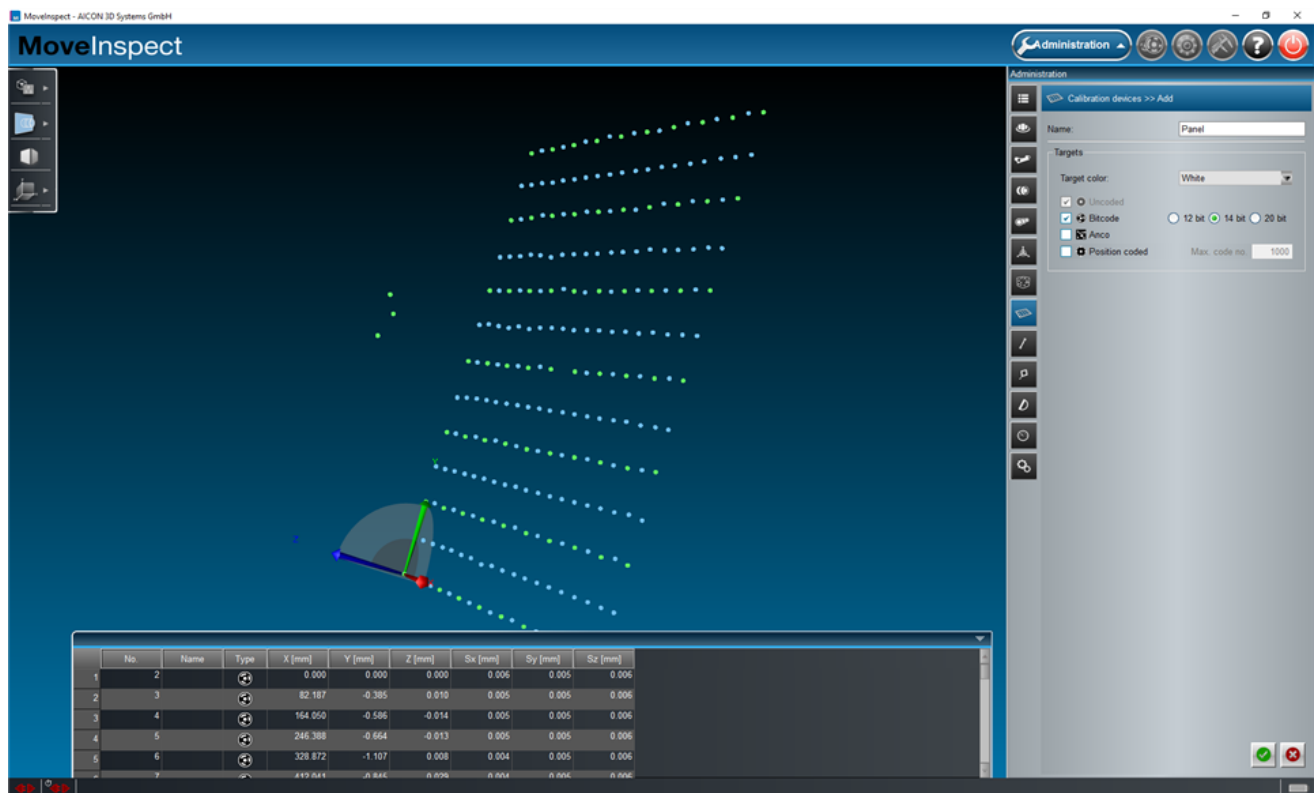


Figure 51: Calibration panel in the 3D window with coded (green) and uncoded (blue) targets

By clicking  the new calibration device is added or the changes are applied.



4.8 Submenu item 'Scale bars'

This submenu item allows to create and manage scale bars with coded and uncoded targets with any number of distances between the targets. Please take into consideration that the lengths of the defined scale bar distances have to differ by at least 50 mm when using several distances with uncoded targets within a scale bar.

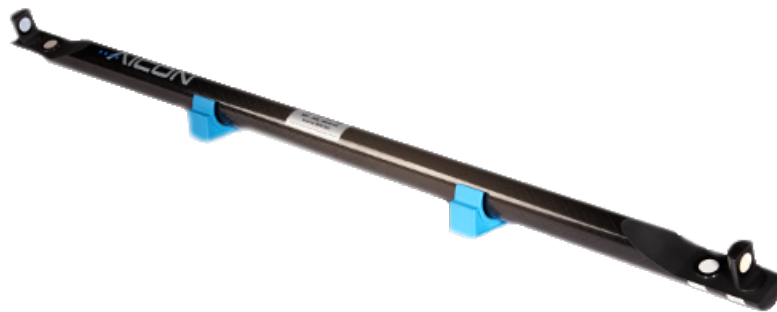


Figure 52: Scale bar

Besides calibration panels, scale bars (in connection with reference crosses) can be used for calibrating camera systems.



When clicking a button to create or edit a scale bar, the window shown in Figure 53 appears.

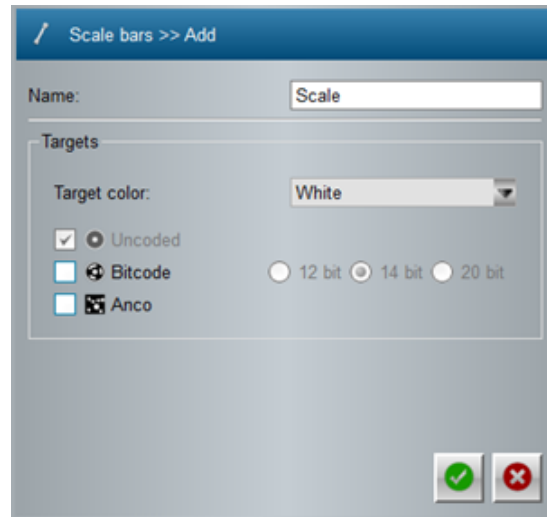


Figure 53: Creating a scale bar

In the field *Name*, insert a user-defined name for the scale bar which, however, has to differ from the names of the already existing scale bars.

The data window and the 3D window display the existing distances with the corresponding targets for the selected scale bar (Figure 54). The distances with their numeric values, the measurement uncertainty of the distances and the targets involved have to be directly entered into the table. By means of the target numbers and their previously entered description, the type of target is displayed in the column *Type*.

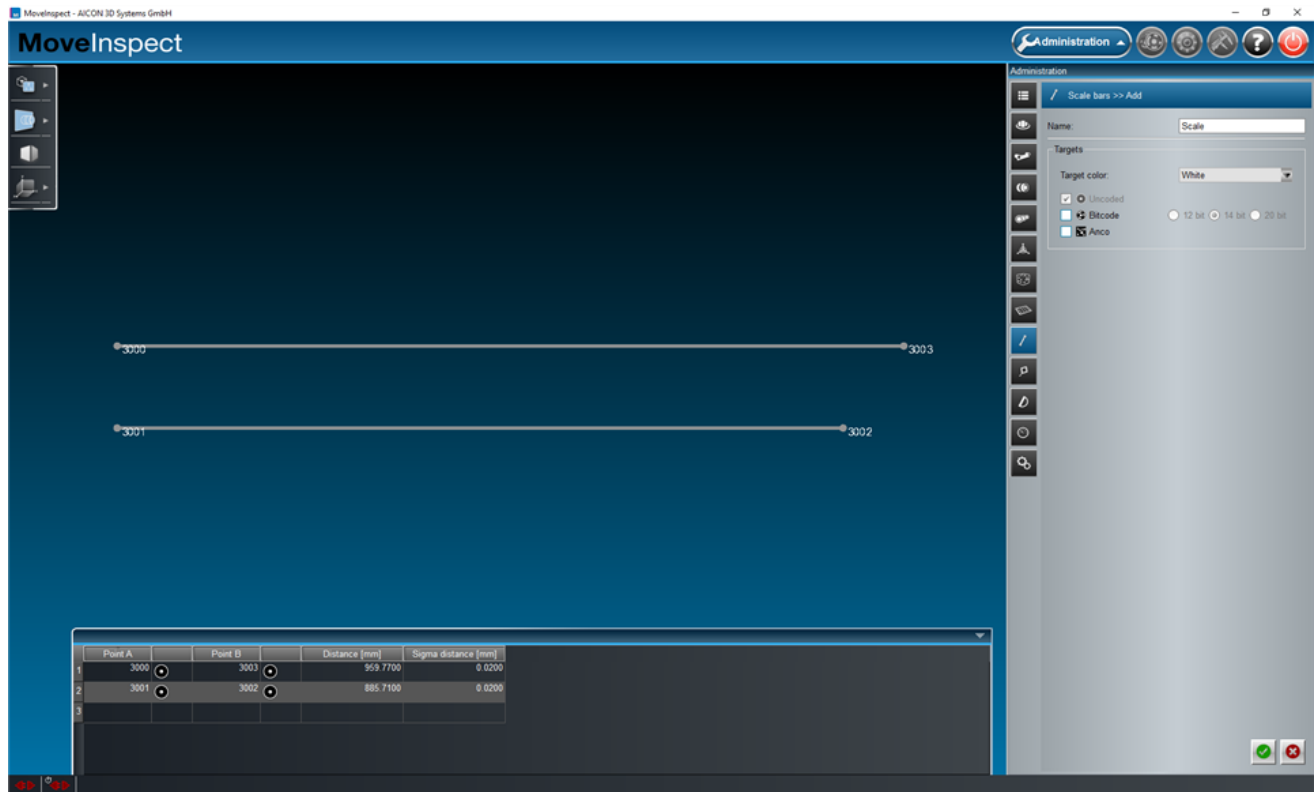



Figure 54: Scale bar with two distances in the 3D window

Clicking  adds the new scale bar or updates an already existing scale bar.

4.9 Submenu item 'Probes'

This submenu item allows to create and manage the MI.Probe, the DPS active probe or user-defined probes. A probe is used for the tactile measurement of points. A probe is provided with several targets as well as a probe tip with known 3D coordinates in a joint coordinate system. The coordinates of the created probe tip can be determined as well with a probe calibration at a later point in time. In a measurement, the targets of the 3D points are measured first. Afterwards, these are replaced by the selected probe tip.

For directly triggering measurements with a probe, it is necessary to create a probe operating unit (see Section [Submenu item 'Probe operating units'](#)).

Please note:

MI.Probes and active probes are automatically recognised by their address and the respective probe is selected in the software. If MoveInspect Pilot receives data from an unknown probe address, it can be assigned to a probe. To assign the probe address, a list of all probes appears including the previous addresses of the respective probes, as far as they are available. If the user selects a probe, the address is saved as its new hardware ID.

4.9.1 Create and edit a probe

When clicking a button to create or edit probes, the window shown in Figure 55 as well as the data window appear. The data window includes a table for *Targets* and a table for *Probe tips*. The targets and the probe tips are also displayed in the 3D window (Figure 56).

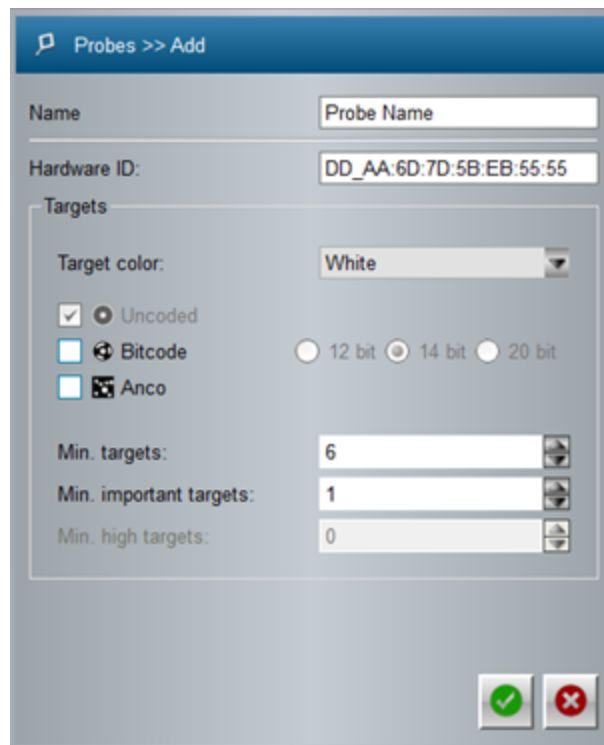


Figure 55: Creating a probe

A probe is created and edited in the same way as an adapter (see section [Submenu item 'Adapters'](#)). When specifying the probe tip in the table *Probe Tips*, additionally the direction vector of the probe tip (columns *DirX*, *DirY*, *DirZ*) as well as the diameter of the tip and the shank have to be specified (columns \emptyset and *Shank- \emptyset*) (Figure 56).

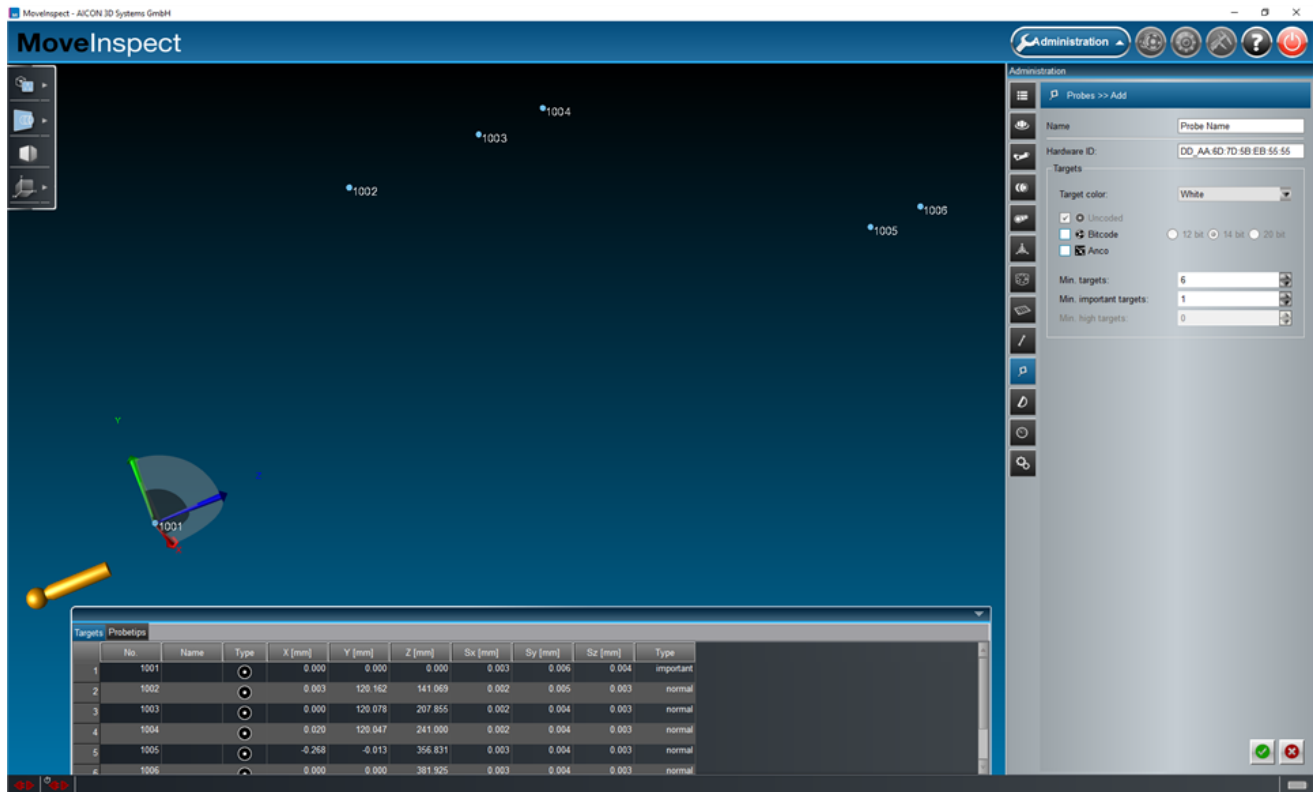



Figure 56: Targets and probe tip of an adapter in the data window and in the 3D window

The probe also requires to specify its hardware identification (hardware ID), as far as it is known. For the MI.Probe, the hardware identification can be read on the housing of the MI.probe. The hardware ID serves for the automatic identification of the probe by the probe operating unit (see section [Submenu item 'Probe operating units'](#)).

The dialog box *Targets* allows to make settings for the targets. The colour of the target is selected in the list *Target colour*. The checkmarks of the applicable coding (*Bitcode* or *Anco*) are to be allocated in accordance with the applied measuring targets. The box *Uncoded* is marked automatically when entering uncoded point numbers into the table. The further settings apply to the quantity of the targets to be measured: In the table *Min. targets*, enter the minimum number of targets which shall be measured with the probe. The same principle applies to the table *Min. important targets* and *Min. high targets*. The table of targets allows to define which target is specified as important or as high. In the column *Type*, a target can be defined as *normal*, *important* or *high*. The selection is made by double-clicking in the column *Type* on the corresponding target.

By clicking , the new probe is added or the changes are applied.

4.9.2 Import and export probes

The submenu item *Probes* contains additional buttons to import and export probes (Figure 57).

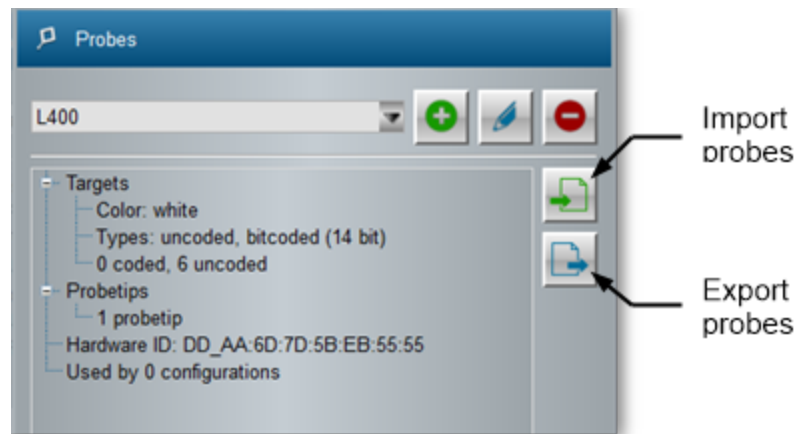


Figure 57: Start window of the submenu item *Probe*

Import:

To import probes, a file selection dialog appears. In this dialog, several *.probe files can be selected for import. If the hardware ID of an imported probe is already existing in the MoveInspect Pilot database, the imported probe replaces the existing probe. Confirm the corresponding message for overwriting the existing probe or cancel the import (Figure 58).

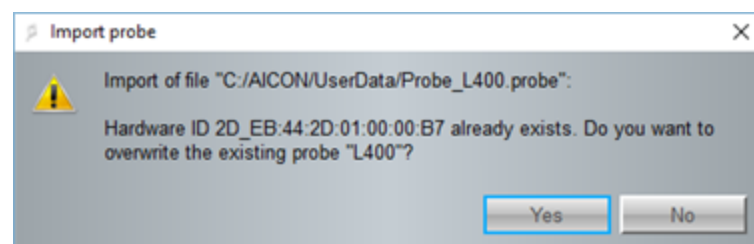


Figure 58: Message for overwriting an existing probe

In case of an already existing probe with the same name in the database, a new name can be inserted (Figure 59).

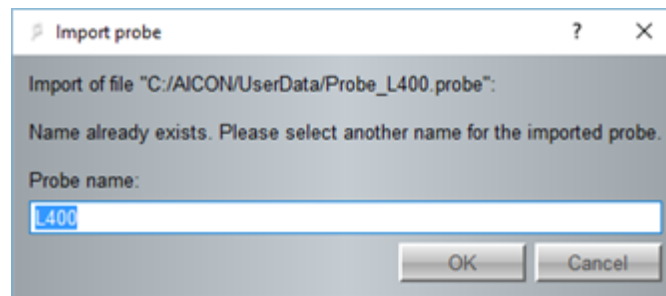


Figure 59: Message to adapt the probe name of the imported probe

Export:

Click *Export* to export the currently selected probe. A dialog for saving files appears. In this dialog, select the path and name for the *.probe file to be exported.

4.9.3 MI.Probe

The hand-held measurement probe MI.Probe (Figure 60) can be combined with all MoveInspect systems.



Figure 60: The MI.Probe

When creating a MI.Probe it is important to make sure that the point near the probe tip is marked as an important point (Figure 59). To do so, the point must be assigned with the type *important* in the table and in the dialog window the *Min. amount of important targets* should be set to 1. This ensures that the

MI.Probe is only be measured if the important point near the probe tip is also measured. Including the measurement target close to the probe tip increases the measurement accuracy.

4.9.4 DPS probe (active probe)

A DPS probe is created and edited in the same way as the MI.Probe. The only difference consists in defining the probe's high targets. The DPS probe has two high targets which have to be defined. They can be identified in the 3D window as such and are defined as high target by double-clicking in the table column *Type* (Figure 61). In the dialog window *Targets* the minimum number of high targets to be measured has to be set to 1. Since a maximum of one high target is visible with the DPS active probe, this value must not be set to 2.

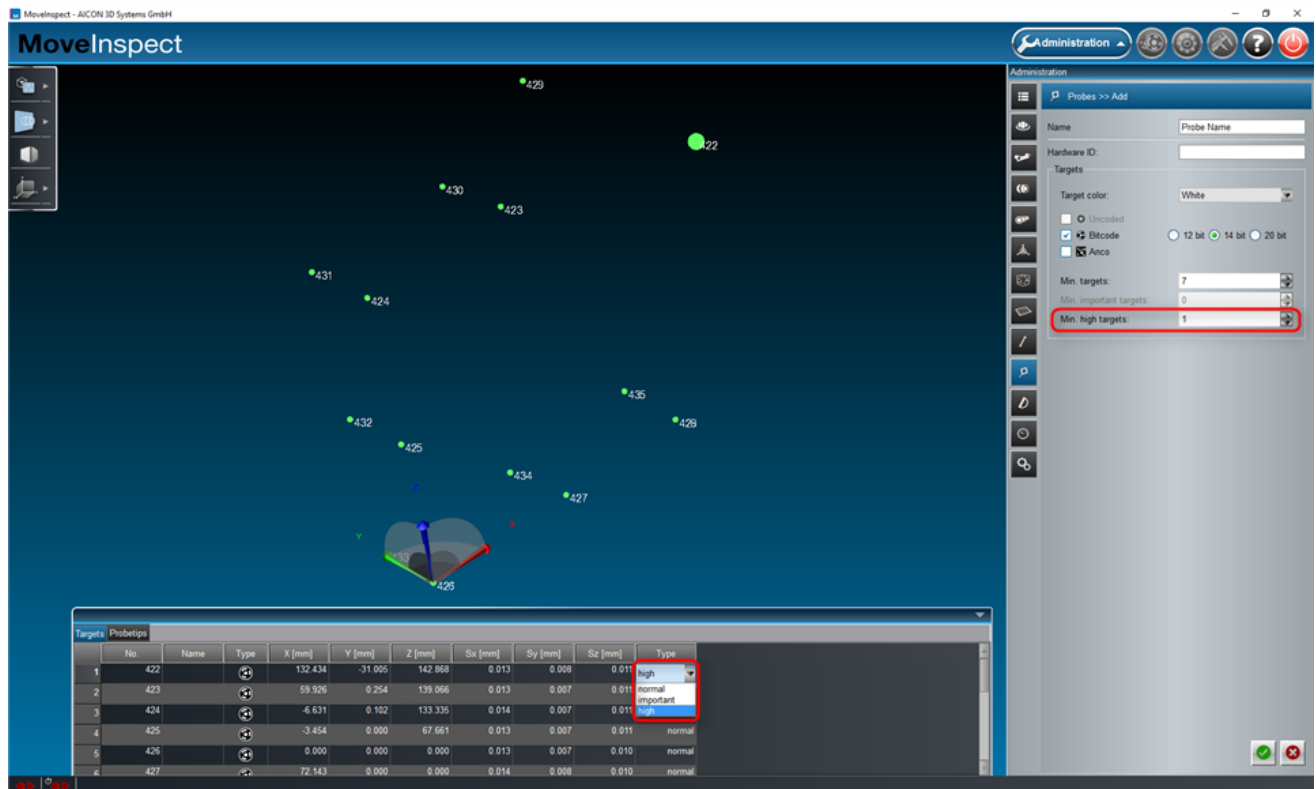


Figure 61: DPS probe with two high targets



4.10 Submenu item 'Probe operating units'

This submenu allows to create and manage probe operating units. A probe operating unit is used for triggering probe measurements. In case of the MI.Probe a single operating unit can be used for different probes (Figure 62).

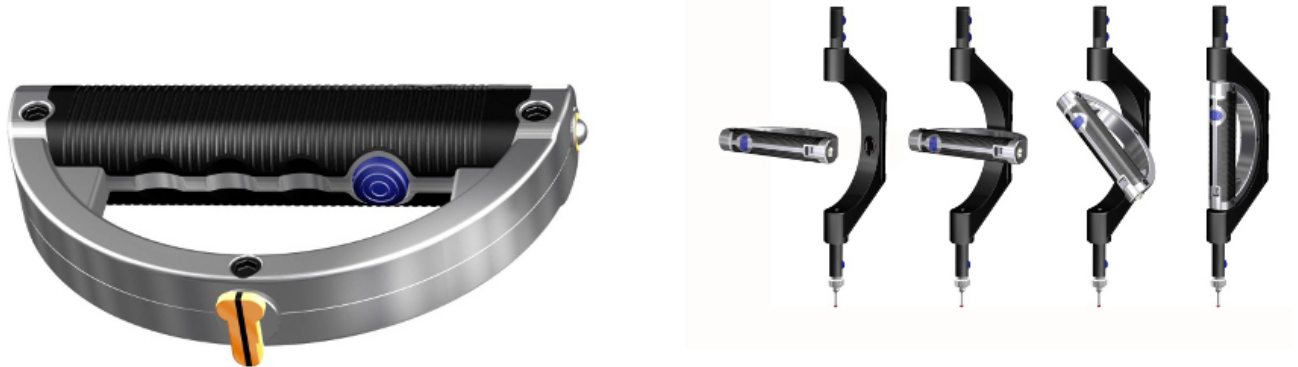


Figure 62: Operating unit of the probe MI.Probe

When clicking a button to create or edit a probe operating unit, a new window appears (Figure 63). In the field *Operating unit name*, insert a user-defined name for the operating unit which, however, has to differ from the names of the already existing operating units.

For a MI.Probe, select the entry *Bluetooth* under *Model* and enter the corresponding COM-Port. The COM-Port can be obtained from the Windows Bluetooth settings. The *MI.Probe setup* (see section [Tab 'Hardware'](#)) pairs the MI.Probe with the PC and sets automatically the COM-Port.

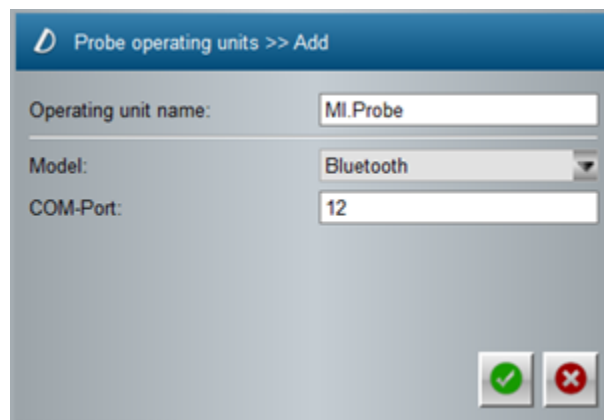



Figure 63: Creating a probe operating unit (MI.Probe)



By clicking , the new probe operating unit is added or the changes are applied. To use a probe operating unit, select it in the configuration (see section [Tab 'Systems'](#)).

For a DPS probe, select the entry *EnOcean* or *EnOcean USB300* as *model* (Figure 64). Connect the EnOcean receiver with the computer. The corresponding COM-Port can be obtained from the Windows unit manager in the submenu item *Ports*.

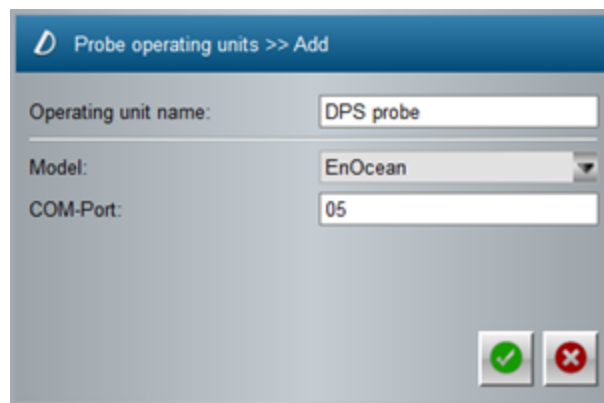


Figure 64: Creating a probe operating unit (DPS probe)

As an additional probe operating unit a presenter or a keyboard with multimedia keys can be used. To do so, select the model *Media-Player*. The keys listed in Table 19 and Table 20 are assigned with the probe operating unit Media-Player during the measurement process and serve to control the measurement.



Media key	Action
<i>Play/Pause</i>	Start a single measurement
<i>Mute, Home</i>	Start/stop a continuous measurement
<i>Previous title</i>	Delete the last measurement
<i>Next title (short)</i>	Complete the geometry measurement
<i>Next title (long)</i>	Scanning mode

Table 19: Keyboard layout of the probe operating unit Media-Player

Presenter key	Key on Keyboard	Action
<i>Slide forward</i>	<i>Page down</i>	Prompt a single measurement
<i>Slide backward</i>	<i>F5, Escape</i>	Start/stop a continuous measurement
<i>Start slide show</i>	<i>Page up</i>	Delete the last measurement
<i>Black screen (short)</i>	<i>Point (short)</i>	Complete the geometry measurement
<i>Black screen (long)</i>	<i>Point (long)</i>	Scanning mode

Table 20: Keyboard layout of the Logitech Wireless Presenter R400

4.11 Submenu item 'External sensors'

This submenu item allows to create and manage external sensors. MoveInspect Pilot is able to read the measurement values of IES tilt sensors as well as National Instruments data acquisition modules (NI-DAQ).

By clicking a button to create or process external sensors, the window shown in Figure 65 appears.

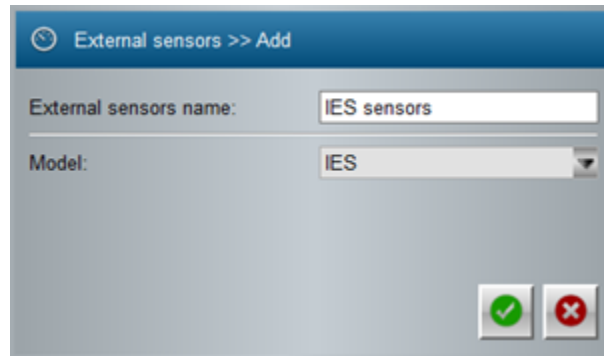



Figure 65: Setup of external sensors

In the field *External sensors name*, insert a name for the external sensors. The name must be different from the names of the already existing external sensors. For NI-DAQ sensors the name of the external sensor must correspond to the task name which has been created with the NI software “Measurement & Automation Explorer” (MAX). When using IES sensors, the name can be selected freely.

By clicking , the new sensors are added or changes are applied.

After successfully creating the external sensors, assign them to the calibration (see section [Tab 'Systems'](#)). With each measurement the current measurement values of the external sensors are then scanned and displayed in a measurement value table for the external sensors ([Table 'External sensors'](#)). As the type of measurement values is unknown to MoveInspect Pilot, the measurement values are displayed without any unit.

Note:

For a measurement with several sensors of one model type, only one external sensor has to be created in the administration window and to be assigned for calibration. With the model IES all measurement values of the connected IES tilt sensors are scanned. For the NI-DAQ sensors it is specified in the NI-MAX Task, which sensors deliver measurement values.



4.11.1 IES sensors

To use the IES sensors with MoveInspect Pilot, it is necessary to activate the data communication in the IES sensor software *TiltView*. Therefore, open the file `TiltView.ini` in the programme directory of the IES sensor software set the entry *Server* in the section *Dupos* to ON:

```
...  
[DuPos]  
SERVER=ON  
...
```

This only has to be changed once.

After adding the IES sensors to the MoveInspect Pilot configuration (see [Tab 'Systems'](#)), the current values of all available IES sensors are scanned with each trigger and displayed in the table *External sensors* in the unit radian. If no sensor values are displayed in MoveInspect Pilot, restart the *TiltView* software to reconnect to MoveInspect Pilot. *TiltView* is only able to establish a connection, but it doesn't recognise any disconnection.

4.11.2 NI-DAQ sensors

To use NI-DAQ sensors the name of the external sensor in MoveInspect Pilot has to be identical to the task name defined in the NI software “Measurement & Automation Explorer” (MAX). In MAX it is necessary to create a task and select the following settings:

Configuration:

- Acquisition mode: *continuous*
- Values: *1*

Advanced Timing Options (see Figure 66):

- Sample Clock Type: *External*
- Clock Source: sync-out der MoveInspect Sync-Box (e.g. `/cDAQ1/PFI0`).

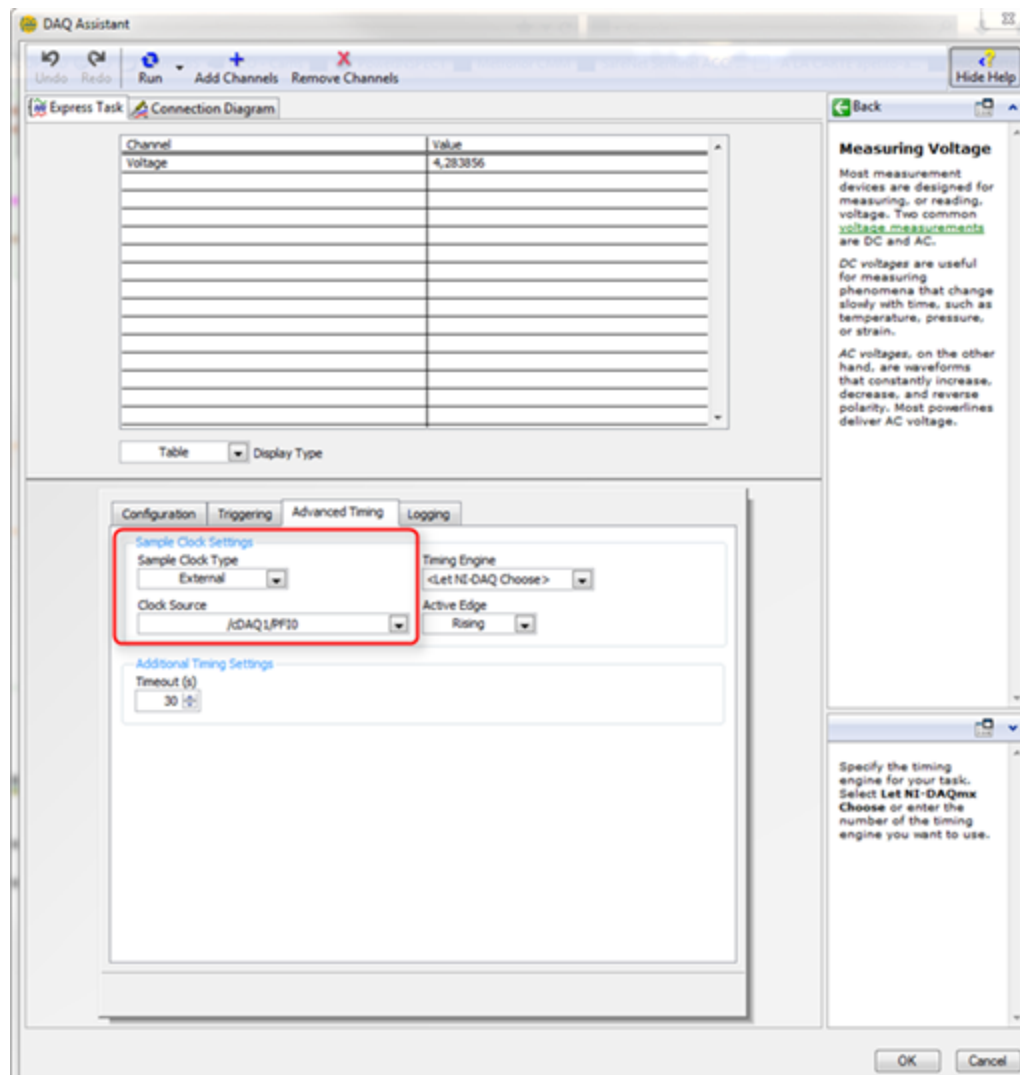


Figure 66: Settings in the DAQ assistant

To use NI-DAQ, set the Sync-Box trigger settings to TTL.

4.12 Submenu item 'Environment'

This submenu allows to make general settings of the system environment. The submenu item *Environment* includes the tabs *Database*, *Administrator*, *Settings* and *Hardware*.



4.12.1 Tab 'Database'

The tab *Database* (Figure 67) allows to determine which MoveInspect Pilot database is used and where to save these data.

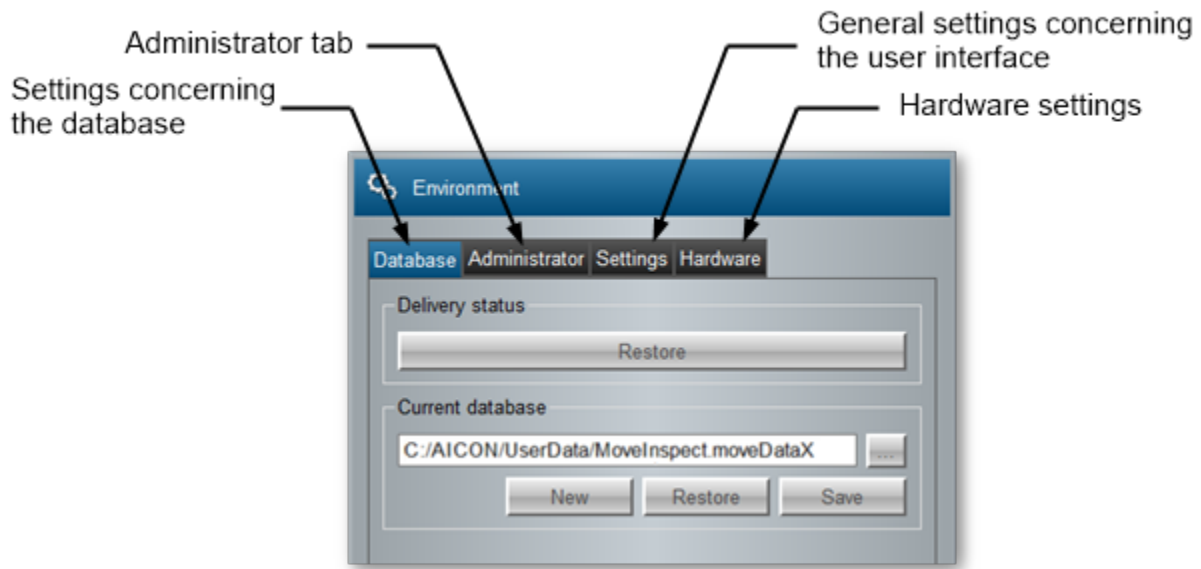


Figure 67: Settings of the system environment, tab *Database*

The MoveInspect Pilot database is a file in which all important programme settings are stored, especially the settings made under the menu item *Administration*. Usually, the database is stored under `C:\AICON\UserData\MoveInspect.moveDataX`.

It is possible to create several databases and switch between them by stating the respective storage location. Furthermore, it is possible to save the MoveInspect Pilot database, for example to an external storage medium or restore it from this medium. By doing this, the content of the current database is overwritten by the restored database.

As soon as the software is started, it automatically stores a backup of the database. Up to 10 backup-files are saved in the folder `MI-Backup`. If a backup has to be saved with 10 files already contained in the folder, the oldest backup-file is deleted. The name of the backup contains the original name of the database, the current date and time, e.g. `C:\AICON\UserData\MI-Backup\MoveInspect_2015-05-18_0817.moveDataX`.



If a backup of the delivery status of the MoveInspect Pilot database is available, you can return to this status by clicking *Restore delivery status*.

Caution! Restoring the delivery status will overwrite existing data!

The current MoveInspect Pilot database can be saved in advance at another storage location with *Save*.

Up to version 7.10, the valid data base name was `MoveInspect.moveData`. The data base `MoveInspect.moveDataX` used from version 7.10 on is not downward compatible and cannot be opened in older versions of MoveInspect Pilot. If the data is converted when changing from an older version to version 7.10, a message is displayed. In addition, the `MoveInspect.moveData` is saved in the backup folder.



4.12.2 Tab 'Administrator'

The tab *Administrator* (Figure 68) allows to activate and deactivate the password protection. By activating the password protection it is possible to disable parts of the software for processing.

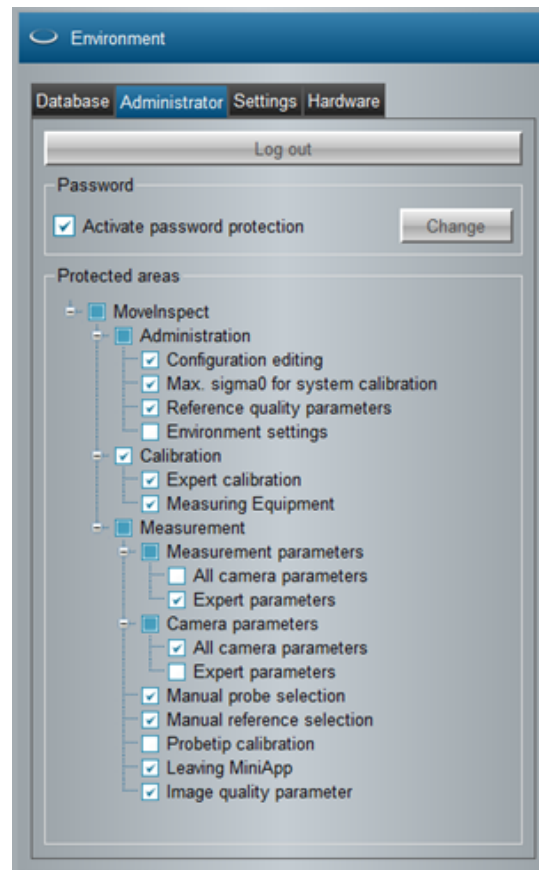


Figure 68: Settings of system environment, tab *Administrator*

If the password protection is activated in the checkbox, the user is asked to enter a password and confirm it again. For as long as the user is logged in, he can select the areas to be protected from editing. Activating the checkbox for a certain area makes this area password-protected. If the checkbox for a certain area is not activated, all users can edit this area. A detailed description of each area that can be protected can be found in the respective tool tip.

In addition, administrator rights allow to change the user level. Table 21 shows the available user levels.



User level	Description
<i>MoveInspect Standard</i>	Complete range of functions of MoveInspect Pilot.
<i>MoveInspect XR8</i>	Specific user interface with all functions to use the software with a MoveInspect XR8 system.

Table 21: User level of MoveInspect Pilot

4.12.3 Tab 'Settings'

The tab *Settings* (Figure 69) allows to make general settings concerning the software appearance and the performance of the software.

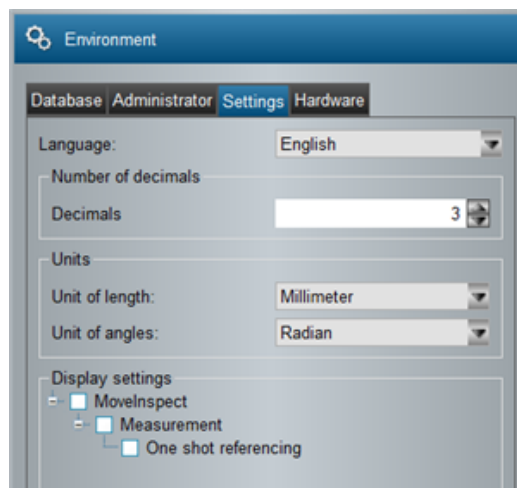


Figure 69: Settings of the system environment, tab *Settings*



The following settings are possible:

Function	Description
<i>Language</i>	Select the desired language. The selected language will be activated with the next programme start.
<i>Number of decimals</i>	Set the number of decimal places to be displayed in the user interface.
<i>Units</i>	Define the units for lengths and angles. All lengths and angle values are displayed according to the selected settings in the software.
<i>Display settings</i>	Set the elements to be displayed in the user interface. The indicated elements can be turned off, if they are not required for the measuring tasks with this system, to get a more clearly arranged user interface.

Table 22: General settings of MoveInspect Pilot

4.12.4 Tab 'Hardware'

The tab *Hardware* (Figure 70) allows for general settings of the MoveInspect hardware.

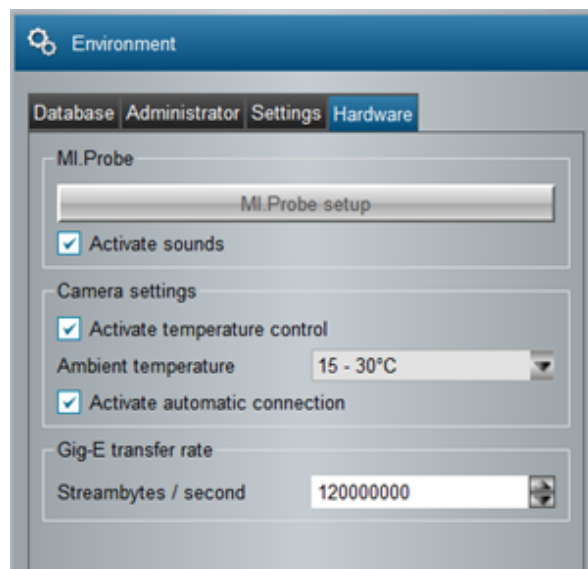


Figure 70: Settings of the system environment, tab *Hardware*

The following settings are possible:



Function	Description
<i>MI.Probe</i>	<p>Settings for the MI.Probe</p> <p><i>MI.Probe setup</i> installs and pairs the MI.Probe.</p> <p><i>Activate sounds</i> turns on and off the MI.Probe's sound.</p> <p>Short low tone: Successful probe measurement</p> <p>Short high tone: Successful point measurement (triggered with MI.Probe without selected probe)</p> <p>Long tone: Failed measurement</p>
<i>Camera settings</i>	<p><i>Activate automatic connection</i> turns on and off the automatic connection of the camera system at starting the programme and at changing the menu.</p> <p><i>Activate temperature control</i> allows to turn on and off the temperature control of the XR8 system. Turning off the temperature control stops the control of the temperature stability in the warm-up phase of the system as well as during measurements. The system stability with regards to a constant measuring accuracy is not guaranteed. The temperature control should only be turned off if a measurement with temperature control is not possible due to external factors.</p> <p>The temperature range that shall be used for measuring can be set in the drop-down list Ambient temperature. A stable function and a high accuracy of the system is only possible if this range is set according to the ambient temperature. After a change of the temperature range, the system has to be recalibrated.</p>
<i>Gig-E transfer rate</i>	<p>A maximum data transfer rate is determined for all cameras connected via the network interface. This rate is specified with the <i>Gig-E transfer rate</i>. The maximum data transfer rate of a Gig-E network adapter must not exceed 120.000.000 bytes/s. The higher the setting for the broadband, the higher the maximum recording frequency, but also the higher the possibility of losing images due to transmission problems.</p>

Table 23: Settings of the MoveInspect hardware

5 Menu item 'Calibration'

This menu allows for the calibration of the camera systems. In the calibration, the geometric properties of the camera system are determined. The properties include values for the interior orientation of each single camera (e.g. the exact focal length of a camera). These are called camera calibration. In case of multi-camera systems, the properties also include the relative orientations of the cameras (positions and orientations of the cameras to one another). These are called system calibration.

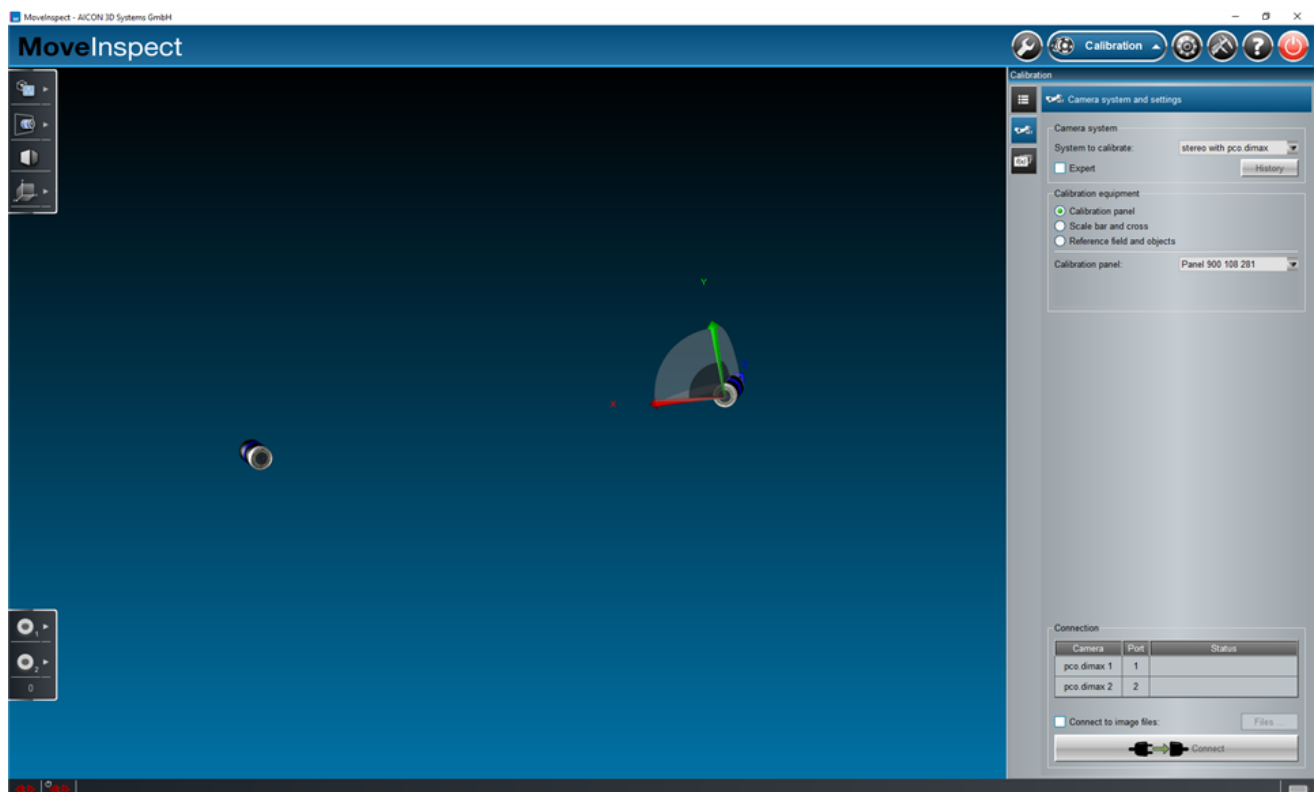


Figure 71: Menu item *Calibration*

The geometric properties of a camera system may vary due to ambient influences (e.g. vibrations, high differences in temperature). In such a case, the measuring accuracy decreases so that the camera system has to be calibrated anew.

The calibration is valid for one camera system. If a camera system is used in several configurations, a new calibration of the camera system is applied in all these configurations.



The activity window in the menu item *Calibration* (Figure 71) comprises the submenu items:

- *Camera systems and settings*
- *Recording and calculation*

Define in the submenu *Camera system and settings* how the calibration shall be performed. Then the software is connected with the cameras and the calibration is started in the submenu *Recording and calculation*. As soon as the calibration equipment has been defined, the connection to the cameras is established by changing again to the menu *Calibration*. The calibration starts automatically.

In addition to the 3D tool bar, the camera tool bar is displayed. The camera tool bar allows to set in which way the images are recorded by the cameras and processed ([Camera tool bar](#)). In the case of a scale bar camera, after the connection with the cameras the measurement parameter tool bar for the configuration of the parameters for the point allocation is additionally displayed.



5.1 Submenu item 'Camera system and settings'

In this submenu, the window shown in Figure 72 appears. It consists of the dialog boxes *Camera system*, *Calibration equipment*, *Connection* and optional the *Expert settings*.

Camera system and settings

Start calibration

Camera system

System to calibrate: stereo with pco.dimax

☒ Expert History

Calibration equipment

☒ Calibration panel
☐ Scale bar and cross
☐ Reference field and objects

Calibration panel: Panel 900 108 281

Expert settings

☐ Relative orientation only

☒ Focal length ☒ A1 ☒ A2 ☒ A3
☒ Principle point ☒ B1 ☒ B2 ☒ C1 ☒ C2

Connection

Camera	ID	Port	Status
pco.dimax 1		1	
pco.dimax 2		2	

☐ Connect to image files: Files ...

Connect

Figure 72: Submenu item *Camera system and settings*

Clicking *Start calibration* connects the cameras or the image files, the software changes to the submenu item *Recording and calculation* and starts a recording in the continuous mode. This process is carried out automatically at starting the menu, if a valid calibration equipment has been selected.

5.1.1 Dialog box 'Camera system'

The dialog box *Camera system* shows the camera system of the current configuration to be calibrated in a drop-down menu. In the case of configurations with several camera systems these are displayed in the selection list and can be selected for calibration. Each camera system must be calibrated separately.



Figure 73: Dialog box *Camera system*

The cameras of this camera system and their ports are listed in a table ([Dialog box 'Connection'](#)) and can be changed under the menu item *Administration*, submenu item *Configuration*.

By activating the expert mode the dialog box *Expert settings* is displayed (see [Dialog box 'Expert parameters'](#)). In addition to adjusting the expert settings, the expert mode also allows for the loading of an internal orientation for each camera in the camera connection table (see [Dialog box 'Connection'](#)).

Additionally, it is also possible to view a calibration history. By clicking *History* an overview shows the last calibrations (Figure 74). By clicking the respective calibration, the statistics can be displayed and saved as protocols in HTML format.

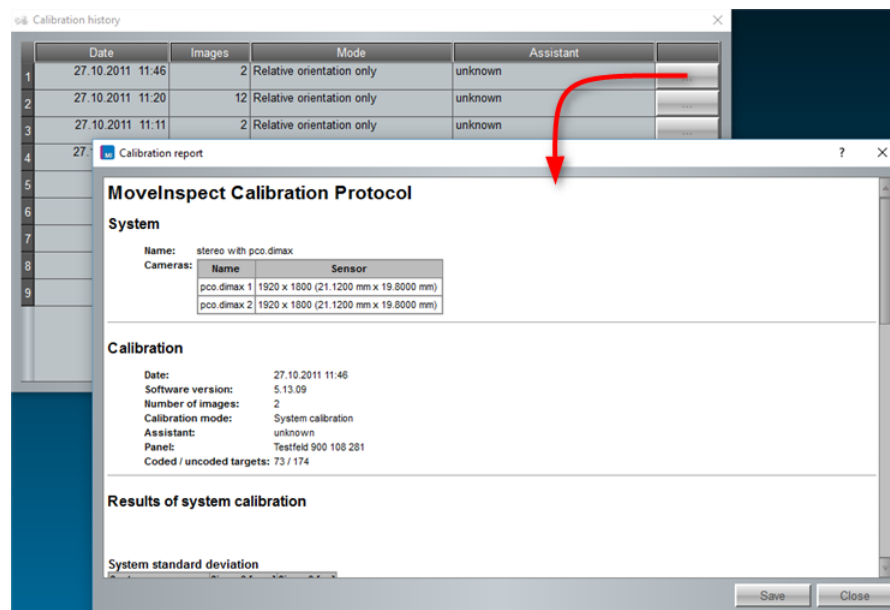


Figure 74: Calibration history with open protocol of the last calibration

5.1.2 Dialog box 'Calibration equipment'

The dialog box *Calibration equipment* allows to select whether the calibration shall be performed by means of calibration panels, with scale bar and reference cross or with a reference field and additional objects.

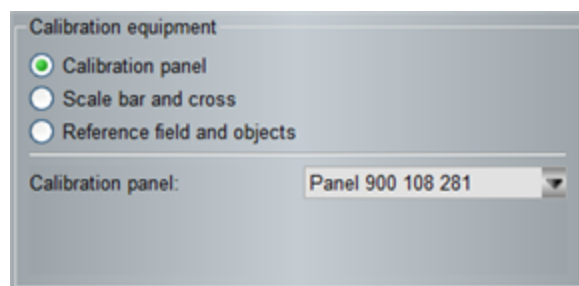


Figure 75: Dialog box *Calibration equipment*

After having selected the calibration equipment, the respective drop-down lists display all existing calibration panels, scale bars, reference crosses and references. From this list, select the calibration equipment with which the calibration shall be performed (for creating calibration devices, see section [Submenu item 'Calibration devices'](#), section [Submenu item 'Scale bars'](#) and section [Submenu item 'References'](#)).

5.1.3 Dialog box 'Expert parameters'

The dialog box *Expert settings* allows to select the geometrical properties to be specified for the internal orientation of each camera or, in the case of multi-camera systems, for the relative orientation only. In the case of a calibration using a calibration table, by default all parameters should be specified. In the context of a scale bar calibration, by default the focal length as well as the principle point have to be specified in addition to the relative orientation. Any additional parameters in connection with a scale bar calibration should only specified if no factory calibration has been carried out for the system.



Figure 76: Dialog box *Expert settings*

When calibrating a multi-camera system it is possible to redetermine the relative orientations of the cameras only. The internal orientations of the cameras are taken from the current calibration. This approach makes sense when only the positions and the orientations of the cameras relative to each other have changed (e.g. when having changed the tripod positions). This approach, usually requires less calibration captures compared to a complete calibration. To only calibrate the relative orientations of the cameras, activate the respective checkbox.

5.1.4 Dialog box 'Connection'

After all settings have been defined, the software can be connected to the cameras or image files (see section [Dialog box 'Connection'](#) in the section [Menu item 'Measurement'](#)) by clicking *Connect*. If an operating unit has been selected in the configuration, it is connected as well. With this, the operating unit can be used to trigger measurements. The connection status for the operating unit is not displayed in the calibration menu.

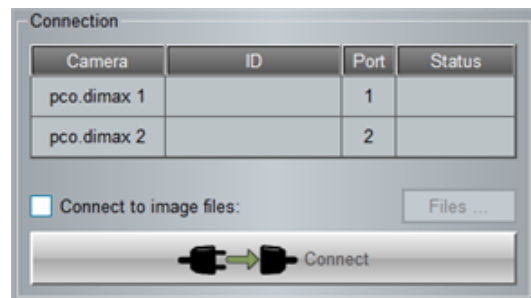


Figure 77: Dialog box *Connection*

The camera connection status is displayed in the column *Status* (see Table 24).

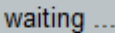


Status	Description
 waiting ...	Camera connection is being established
 OK	Camera has been connected successfully
 Error	Camera connection has failed or has been interrupted

Table 24: Connection status of the cameras

After a successful connection the software automatically switches to the submenu *Recording and calculation*.

In the expert mode, the column ID is additionally displayed in the connection table. With a right-click inside the column, a context menu appears. Using this context menu, the internal orientation for each camera can be individually loaded from a *.ior file or the relative orientation from a *.eor file. To load a *.eor file, a dongle with the according rights is required. For loading a file, the context menu must be opened in the respective row. The import dialog's title shows the current camera name and the camera ID, for which the corresponding file with the internal orientation has to be selected. After having loaded successfully the internal orientation, the relative orientation of the system has to be redetermined. For cameras with a 180° sensor rotation, only the relative orientation can be loaded from a *.eor file. The file with the relative orientation must contain the cameras in the same sequence

as they are listed in the camera system in MoveInspect Pilot. The cameras are allocated according to this sequence in the *.eor file.

It is possible to export the internal and external orientations of the cameras. To export the internal orientations, select the folder where the *.ior files shall be stored. For each camera, a file with the corresponding internal orientation is written. The name of the exported *.ior files consists of the camera name and the camera ID. To export the external orientation, select the folder and name for the *.eor file. This file contains the external orientation of the camera system.



5.2 Submenu item 'Recording and calculation'

The window in the submenu item *Recording and calculation* displays varying information, depending on whether the calibration has already been started.

If there is no calibration in progress, the window shown in Figure 78 is displayed to adjust the camera parameters and the calibration assistant. Changing the camera parameters is only necessary if the measuring conditions have changed.

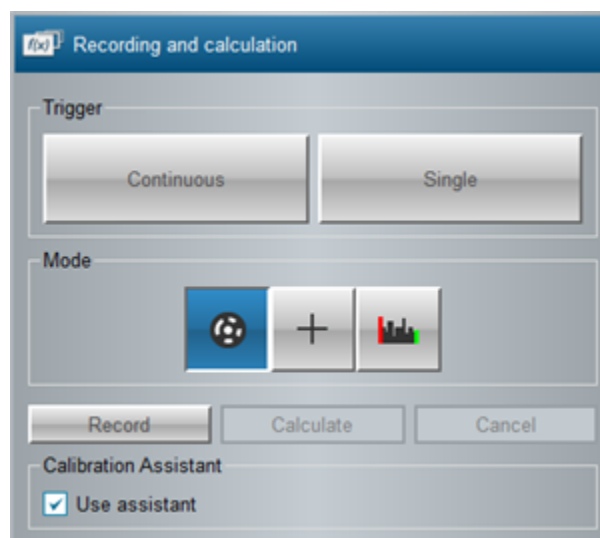


Figure 78: Submenu item *Recording and calculation*

Set the camera parameters with the functions *Trigger* (see section [Dialog box 'Trigger'](#)) and *Mode* (see section [Dialog box 'Mode'](#)) as well as with the camera tool bar (see section [Camera tool bar](#)). The camera parameters shall be defined in such a way that the measuring targets of the calibration panel are recognised and the position of the calibration panel in the 3D window is displayed correctly. Using the mode *Orientation adjustment*, first the cameras shall be aligned according to the required position of the measurement object. Subsequently, control the exposure with the mode *Image brightness* and, if necessary, adjust them by changing the camera parameters. After setting up the cameras the calibration can be started. For the measurement, the camera parameters have to be set up separately.

Each camera system has its own camera parameters for calibration. Therefore, changes in the camera parameters do not influence the camera parameters in the configurations.

By default the calibration is carried out with the calibration assistant, guiding the user in easy steps through the camera and system calibration processes. If the calibration cannot be carried out with the assistant because of the system configuration, the assistant can be switched off by deactivating the checkbox *Use assistant*. This, however, is only possible in connection with a scale bar calibration.

After that the actual calibration procedure is started by clicking *Record*. Clicking the trigger button *Continuous* starts the image recording. Once the calibration is running, the system and camera parameters should not be changed. If changes are necessary, cancel the calibration.

During an ongoing calibration with assistant, this submenu and the 3D window inform about the calibration progress (see calibration strategies [Calibration with calibration panels](#), [Calibration with scale bars](#) and [Calibration with reference fields](#)).

5.2.1 Dialog box 'Trigger'

In the dialog box *Trigger* it is possible to capture images from the cameras or from the data carrier, depending on the previously selected connection type.



Figure 79: Dialog box *Trigger*

By clicking *Continuous*, the images are captured in continuous epochs. By clicking the button again, the image capture is stopped. By clicking *Single*, the image capture for exactly one epoch is triggered. The number of the triggered epochs is displayed in the epoch counter of the [Camera tool bar](#).



5.2.2 Dialog box 'Mode'

The dialog box *Mode* allows to adjust in which mode the camera images are to be displayed.



Figure 80: Dialog box *Mode* HR and XR cameras

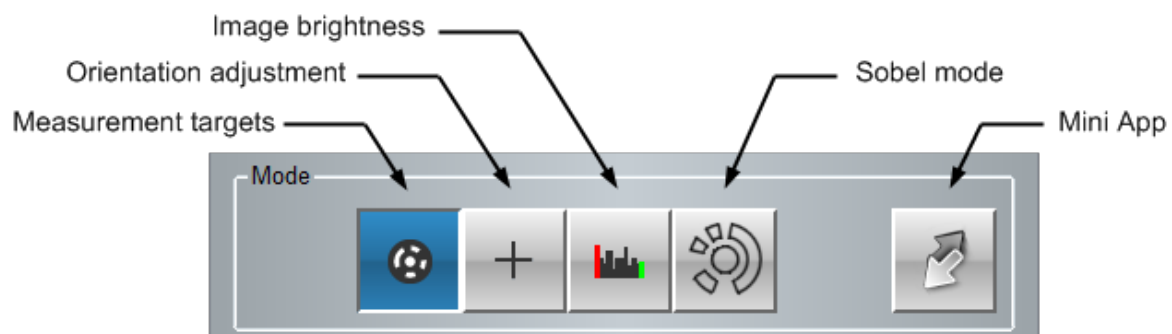



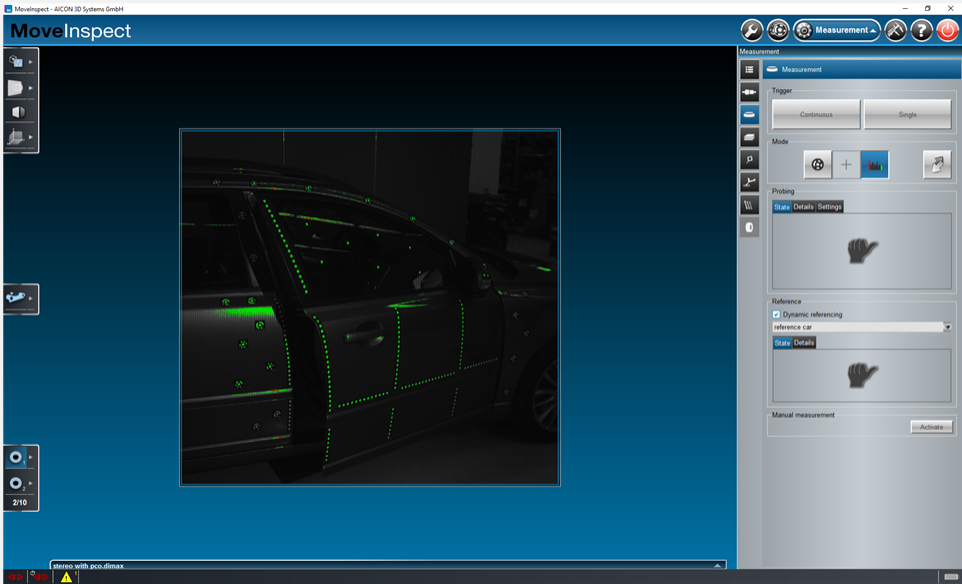



Figure 81: Dialog box *Mode* HF cameras

Depending on the camera type, various setting modes are available (see Table 25).

Mode	Description
	With the option <i>measurement targets</i> being activated, it is searched for targets in all images during each image capture and the current position of the measurement points is calculated. The targets found and the measurement points are displayed in the 3D window. This option is useful for checking the camera parameters.
	The option <i>Orientation adjustment</i> allows to check the cameras' orientation towards the measuring object. Here the camera images are brightened, if this is supported by the



Mode	Description
	cameras. In the centre of each camera image a crosshairs is displayed.
	<p>When <i>Image brightness</i> is activated, the images are coloured according to the image brightness (see Figure 82 and Table 26). This option is helpful for the setting of the exposure time and flash of the cameras. The settings are good when the majority of the displayed targets has an optimum brightness.</p> <div data-bbox="410 759 1377 1341" data-label="Image">  </div> <p>Figure 82: Display of the image brightness</p>
	<p>In the <i>Threshold mode</i> the threshold images are displayed (see Figure 83). This mode serves to calibrate and verify the target measurement and is only available for the MoveInspect HF. The live image of the camera is superimposed with the measured point and its contour is displayed.</p>



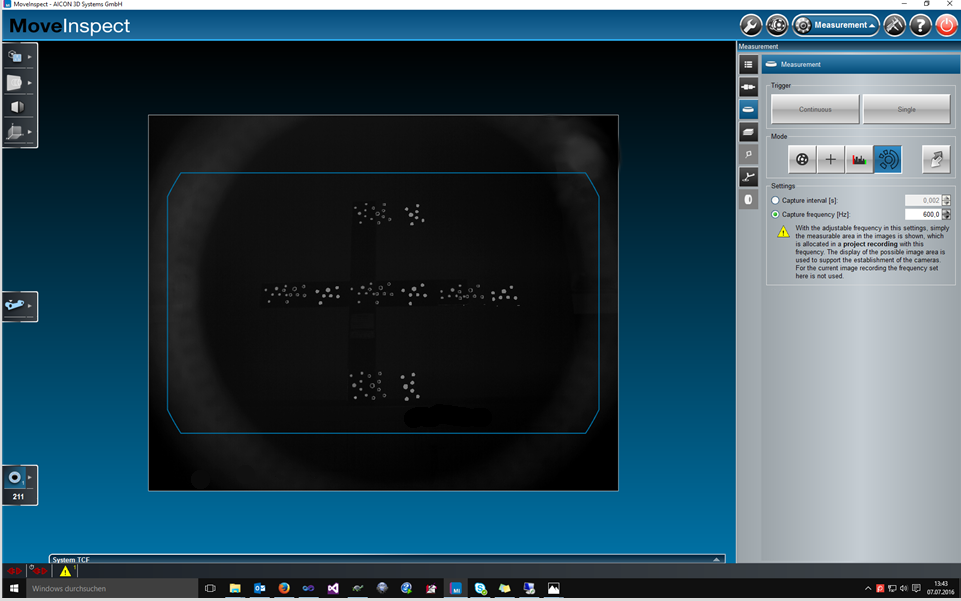

Mode	Description
	<div></div> <p>Figure 83: Target measurement in the threshold mode</p>
	Display of the <i>Mini-App</i> . The software is displayed in a minimised version which only shows the most important status information (see section Minimized application (Mini App)).

Table 25: Setting modes

Colouring	Brightness
Red	Too bright
Green	Optimum brightness
No colour	Too dark

Table 26: Colouring of image areas and their brightness

In the case of HF cameras, in the modes *Orientation adjustment*, *Image brightness* and *Sobel mode* the dialog box *Settings* is also displayed (see Figure 83). The frequency settings in this menu item only serve to display the measurable image area in 3D (blue line), in which by using this frequency it is

possible to carry out a measurement during a project recording. No images are recorded with this frequency in the submenu item *Measurement*.

5.3 Calibration with calibration panels

When using calibration panels for the calibration, the user is supported by a calibration assistant. The calibration assistant is displayed in the 3D window (Figure 84).

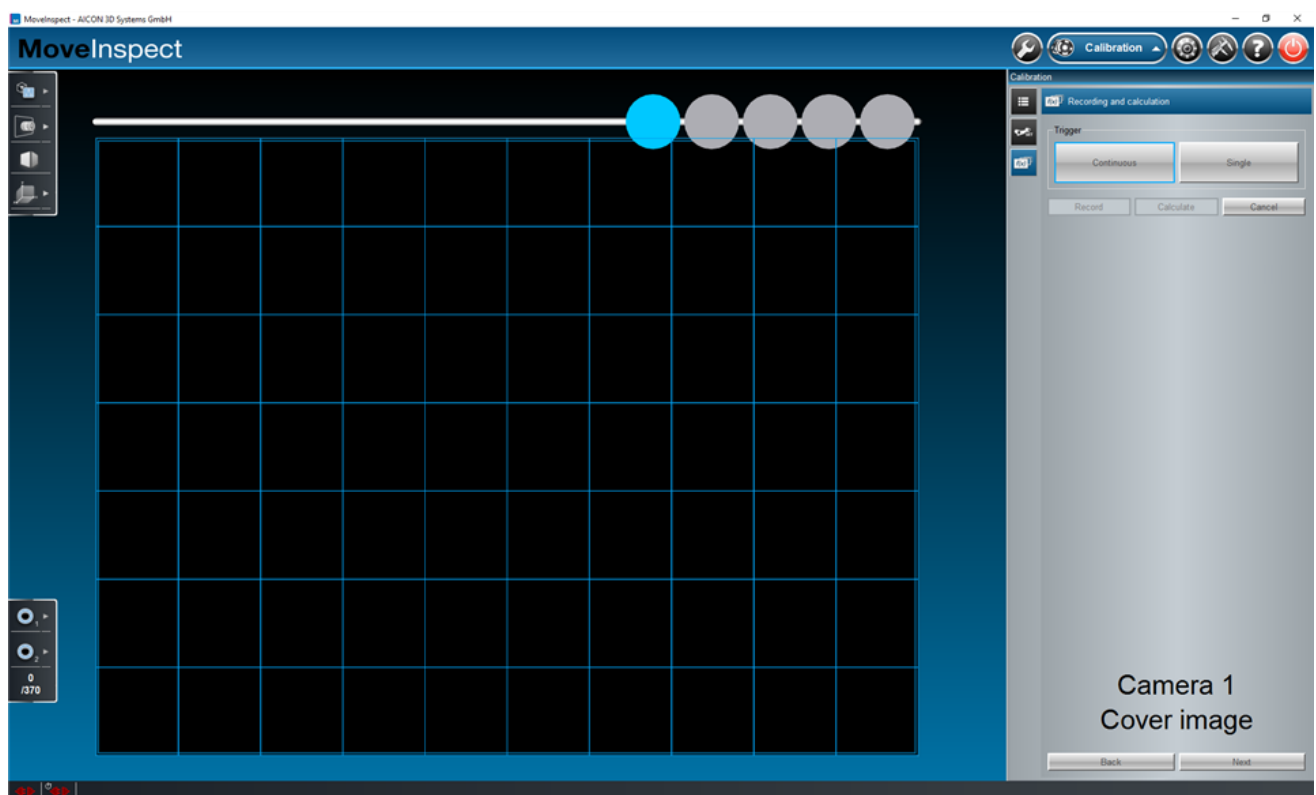


Figure 84: Calibration assistant

The calibration assistant offers assistance when recording the calibration images. The calibration images have to comply with defined criteria. At first, the complete image coverage for each camera is recorded. Subsequently, images are captured with defined inclinations and rotations of the calibration panel for each camera. The respective step is displayed in the activity window as well as in the progress indicator.

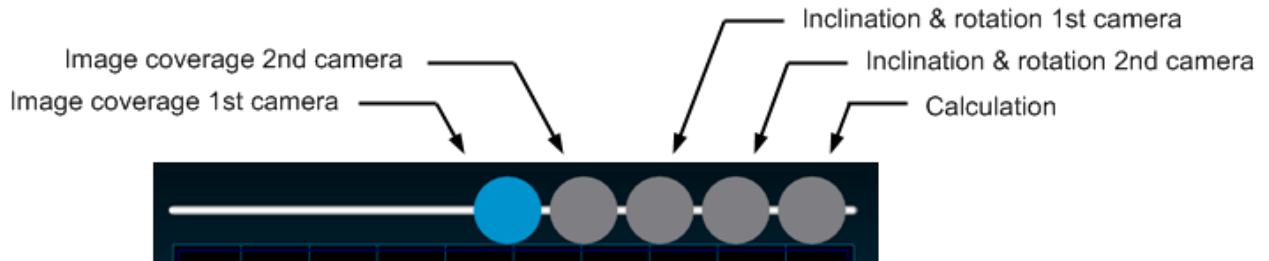


Figure 85: Progress indicator in the calibration assistant for a two-camera system

At first, take the recordings of the calibration panel for the image coverage. To do so, the measurement targets of the calibration panel have to be represented for each camera in the entire image plane. For this purpose, the calibration assistant displays the image plane of a camera with a sector division. Sectors in which targets have already been captured are coloured in blue (Figure 86). Move the calibration panel during the recording in such a way that all sectors are coloured.

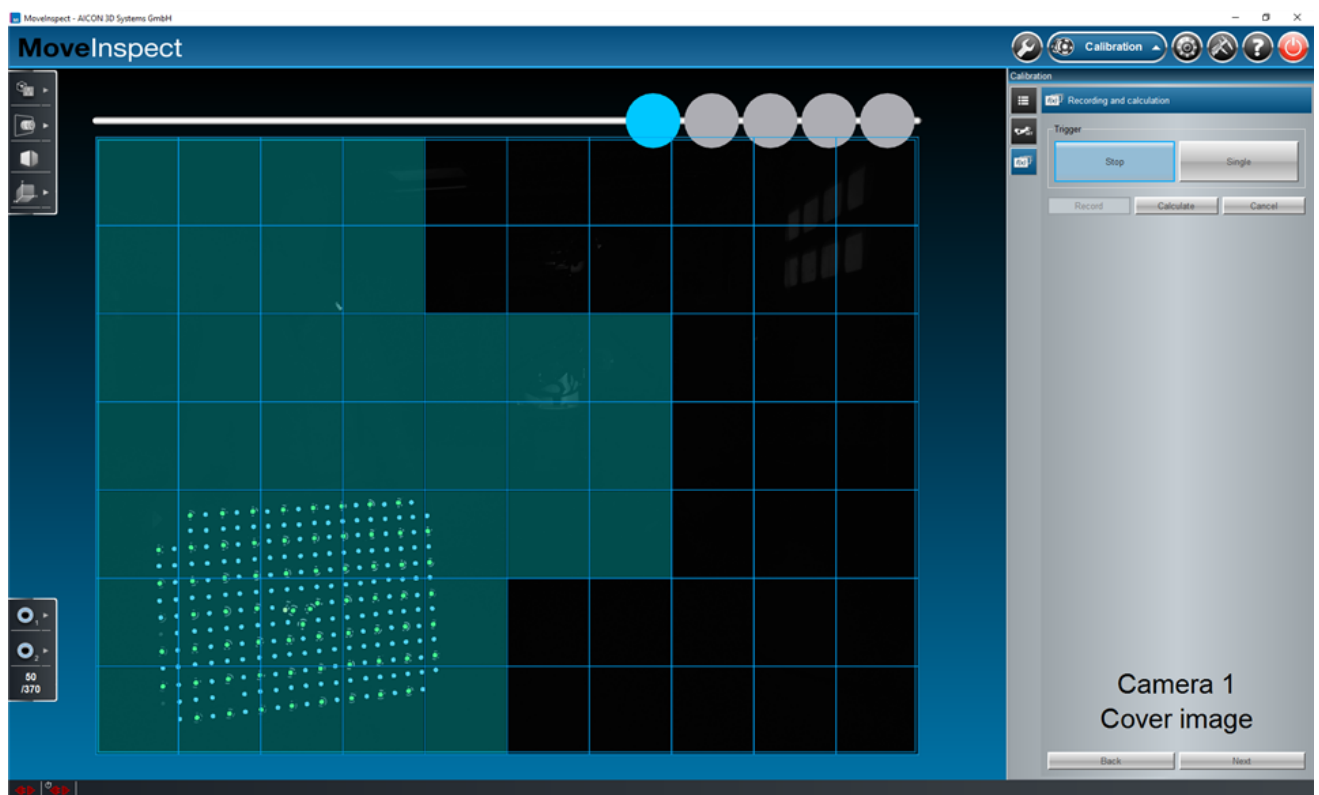


Figure 86: Display of the image coverage in the calibration assistant



Once the image coverage is complete for a camera, the progress indicator is updated. The calibration assistant switches to the next camera. The previously recorded calibration images are also registered for this camera. Thus, some sectors may already be coloured.

After a complete image coverage is reached, the calibration assistant changes to the recording of inclined and rotated calibration images (Figure 87). For each camera, take four inclined images of the calibration panel. To do so, the calibration panel must be tilted upwards, downwards, to the right and to the left. Additionally, take four images of the rotated calibration panel. To do so, the calibration panel must be rotated by 0° (perpendicular), by 90°, by 180° and by 270°. For a rotated recording, the calibration panel must not be inclined. For an inclined recording, the calibration panel should be perpendicular (not rotated).

The calibration assistant displays a sector for each of the eight images (Figure 87). After the respective image was recorded, the sector is coloured in blue. The sector of the current recording is coloured in dark blue. The previously recorded calibration images for the image coverage were also registered with respect to inclination and rotation so that some sectors may already be coloured.

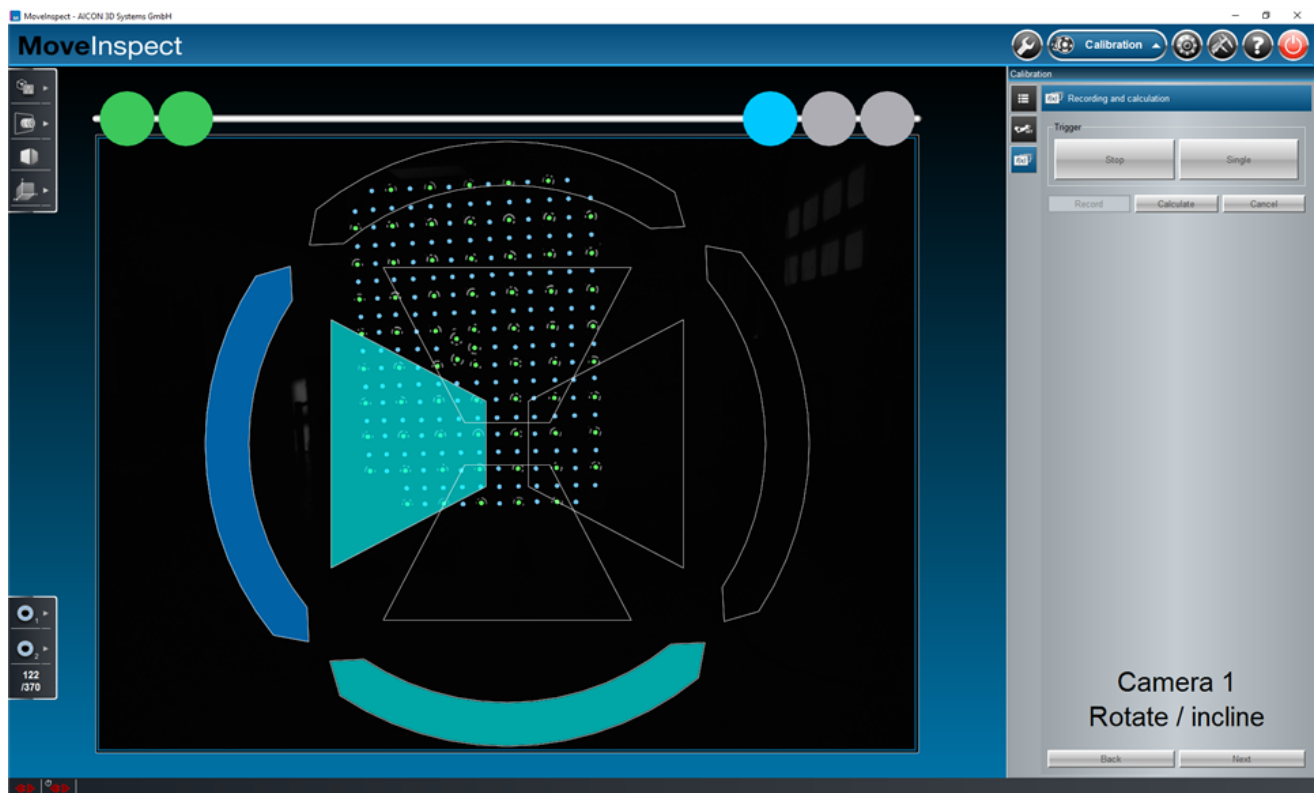
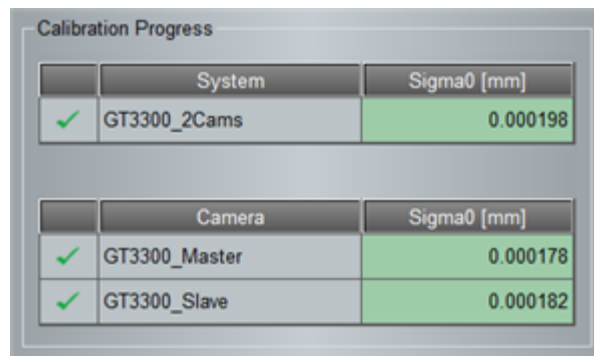


Figure 87: Display of inclinations and rotations in the calibration assistant

After all inclined and rotated calibration images are taken for a camera, the progress indicator is updated. The calibration assistant switches to the next camera. In the case that measurements in all sectors are already available for the next camera, this camera is skipped.

After all calibration images have been recorded, the calibration assistant automatically starts the calculation of the geometric properties of the camera system. The progress of the calculation and the static parameters (achieved accuracy of the calibration) are displayed in a table (Figure 88).



	System	Sigma0 [mm]
✓	GT3300_2Cams	0.000198

	Camera	Sigma0 [mm]
✓	GT3300_Master	0.000178
✓	GT3300_Slave	0.000182

Figure 88: Successful calculation of system and camera calibration

After successful calculation, the new calibration is saved automatically; click **Yes** to change to the menu *Measurement* (Figure 89).

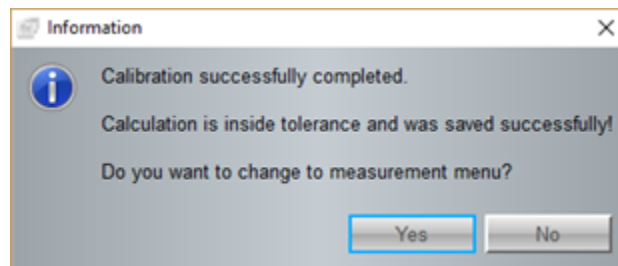


Figure 89: Calibration completed

After saving the calibration results the newly calculated positions and alignments of the cameras are displayed in the 3D window.

Please note:

It is also possible to switch manually to the next step or to return to a previous step of the calibration assistant by clicking *Next* and *Back*. The calculation can also be activated manually by clicking *Calculate*.

5.4 Calibration with scale bars

A calibration with scale bars is automatically performed when a scale bar and reference cross have been selected as calibration equipment (see section [Dialog box 'Calibration equipment'](#)).

After having established the connection with the cameras, the activity window of [Submenu item 'Recording and calculation'](#) allows to activate or deactivate the scale bar calibration assistant by using the checkbox *Use Assistant*. This is only possible as long as the calibration has not been started yet.



Figure 90: Checkbox to (de)activate the assistant for the calibration with scale bars

The procedure for the calibration with scale bars is started by clicking *Recording*. The image recoding then is started by clicking *Continuous*. The current as well as the subsequent step of the calibration are displayed in the activity window. In addition, the 3D window informs about the calibration progress.

At first, the initial orientation is specified (see section [Determination of the initial orientation](#)). The subsequent calibration procedure depends on whether the calibration has been started with or without the assistant (see [Scale bar calibration without assistant](#) and [Scale bar calibration with assistant](#)).

5.4.1 Determination of the initial orientation

At the beginning of the scale bar calibration the assistant for the initial orientation is displayed both in the case of an activated as well as a deactivated scale bar assistant. The activity window displays a reference cross indicating the current process step.

Move the reference cross over the image plane of each camera. When measuring the reference cross, keep in mind the correct distance to the camera system. The reference cross is only measured when the distance bar has a green or yellow marking (Figure 91). The distance bar shows the current distance of the reference cross (green/yellow/red) to the measurement system as well as the nominal distance (white).

The colouring of the tiles shows the progress of the initial orientation (Figure 91). After all tiles for camera 1 are blue, the assistant switches to camera 2. Due to the previous recording some tiles may

already be blue. The remaining tiles of the other cameras have to be measured with the reference cross.

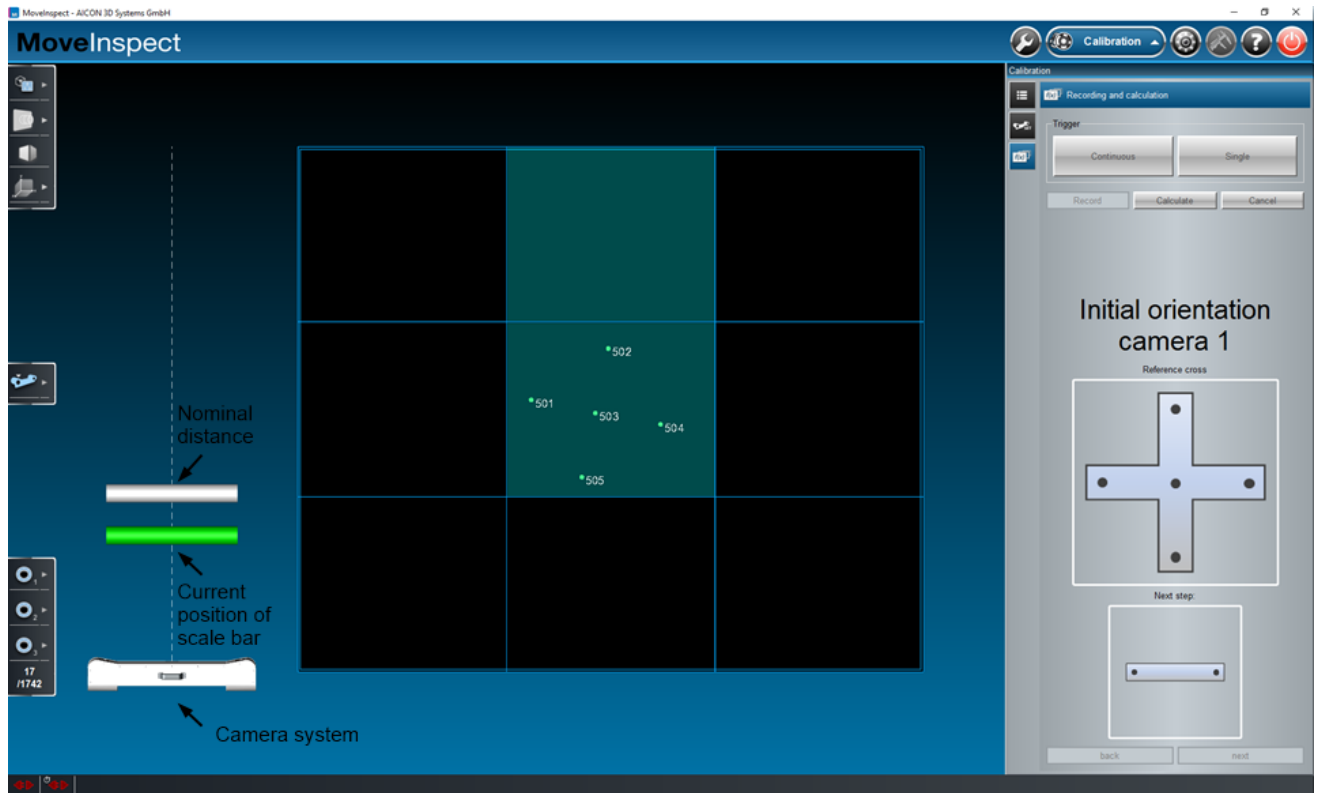


Figure 91: Coloured tiles in the image plane and the distance bar

After the reference cross is successfully measured in all cameras, the initial orientation is calculated. The assistant automatically switches to the next calibration step.

5.4.2 Scale bar calibration without assistant

The scale bar calibration without assistant should only be carried out if the calibration with assistant is not possible due to the system configuration.

Similar to performing a scale bar calibration with the assistant, when performing a scale bar calibration without the assistant firstly the initial orientation of the cameras has to be determined (see [Determination of the initial orientation](#)).

Afterwards, move slowly the selected scale bar through the entire measuring volume. Make sure, that the scale bar is measured in parallel position to the camera system as well as in depth direction. The scale bar's orientation should vary between horizontal, vertical and diagonal directions. The measurements can be visually controlled by displaying the scale bar distances in the 3D view. The scale bar has been measured successfully when the 3D points in the 3D view are displayed on a connecting line (see Figure 92).

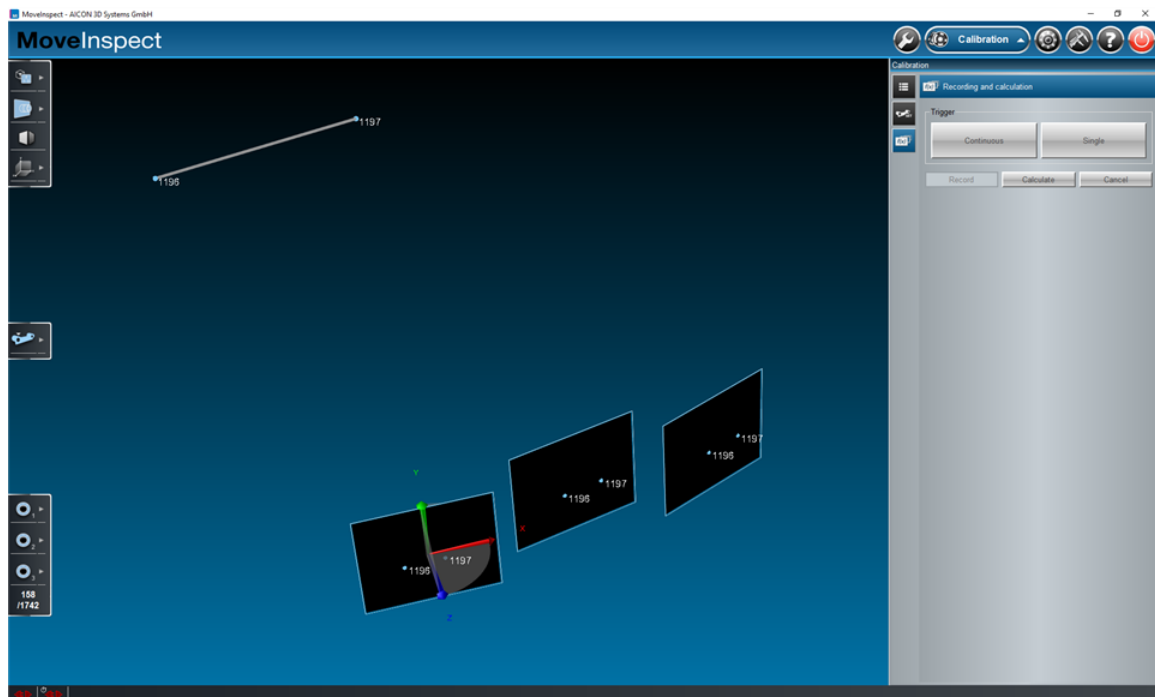
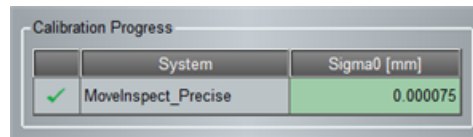


Figure 92: Calibration with scale bars, display of the measured scale bar

When the image recording is finished, start the calculation process by clicking *Calculate*. A table shows the calculation progress and the static parameters of the calibration (Figure 93).



A screenshot of a 'Calibration Progress' dialog box. It contains a table with two columns: 'System' and 'Sigma0 [mm]'. The 'System' column has a green checkmark icon and the text 'MoveInspect_Precise'. The 'Sigma0 [mm]' column has the value '0.000075'.

	System	Sigma0 [mm]
✓	MoveInspect_Precise	0.000075

Figure 93: Calibration with scale bars, statistic parameters

After completing successfully the calibration, the new calibration is saved automatically; it is possible to change directly to the menu *Measurement* (Figure 94). The calculated positions and orientations of the cameras are displayed in the 3D window.

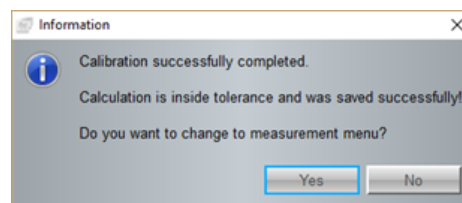


Figure 94: Calibration completed

5.4.3 Scale bar calibration with assistant

When performing a scale bar calibration with the help of the assistant, firstly the initial orientation of the cameras has to be determined by using a reference cross (see section [Determination of the initial orientation](#)). If a sufficiently accurate initial orientation is already known (i.e., the scale bar can be measured), the scale bar calibration assistant can also be started without reference cross.

The second step of the assistant is to define the subsequent measuring volume of the calibration. To do so, the minimum and maximum distance to the measuring system is determined.

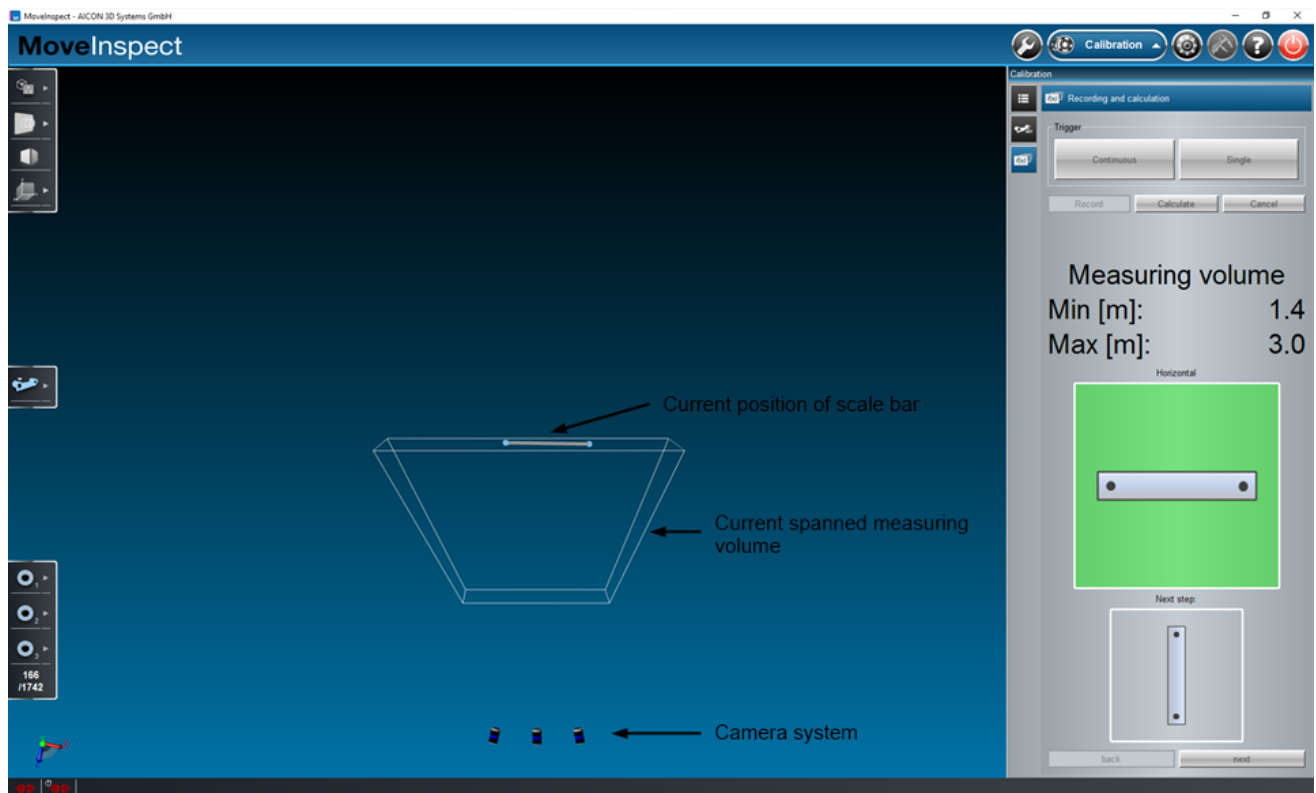


Figure 95: Determination of the measuring volume in horizontal position of the scale bar

The 3D window shows the measuring system (Figure 95). As soon as the scale bar is held into the camera view, the 3D view displays as well the scale bar and the currently spanned measuring volume. In addition, the activity window displays the current distance.

First, the beginning of the measuring volume is determined. To do so, move the scale bar in horizontal orientation as close to the cameras as desired. This point represents the beginning of the measuring volume. If the scale bar is measured subsequently, the position is automatically updated. The distance closest to the system is saved. Then, the end of the measuring volume is defined. To do so, measure the scale bar in horizontal orientation in the desired distance to the measuring system. This point represents the end of the measuring volume.

Based on the above determinations, the measuring volume is divided into three planes, **plane 1** (front), **plane 2** (middle) and **plane 3** (rear). A small measuring volume is split only in two planes, **plane 1** (front), and **plane 2** (rear). This classification is carried out automatically and cannot be influenced by the user. The scale bar then has to be measured in these planes at predefined positions in horizontal,

vertical, diagonal direction as well as in depth direction. The direction of the scale bar is indicated by the assistant in the pictogram on the right-hand side of the activity window.

After having defined the distance range, click *next* to get to the next step of the assistant. This can also be done automatically by turning the scale bar in the vertical position, as displayed in the activity window under *Next step* or, alternatively, by clicking *Next* (Figure 96).

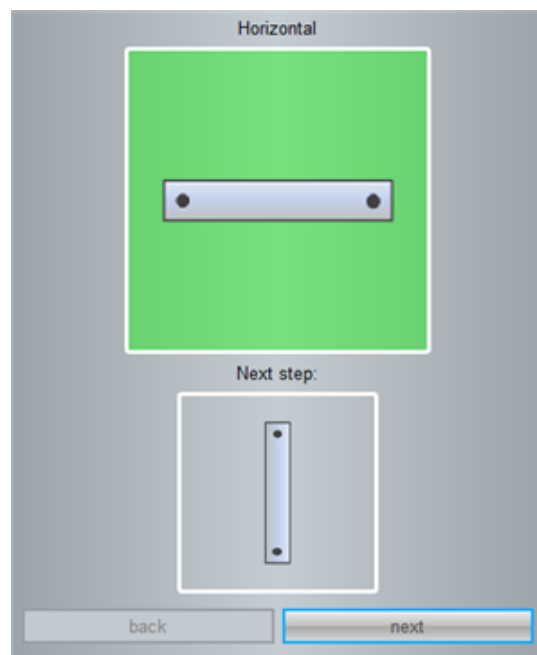


Figure 96: Display of the current and subsequent step including of the direction of the scale bar

In the subsequent step, the 3D window displays a distance range and a rectangle divided into squares. This rectangle represents the sectional plane of the cameras in the distance range closest to the system (plane 1). Measurements of the scale bar in horizontal, vertical, diagonally descending, diagonally ascending alignment as well as depth measurements are required. In all five steps, i.e. for each plane, the highlighted squares of the rectangle are to be coloured in blue. To do this, the displayed scale bar has to be moved slowly to the predefined positions. If the scale bar calibration is carried out with the standard parameters and no internal parameters are specified (see [Dialog box 'Expert parameters'](#)) less positions are required. Positions indicated in gray do not have to be covered.

The distance display next to the displayed plane shows the current distance of the scale bar. This one has to be consistent with the distance of the plane to the measuring system. The current plane is

accentuated in the distance range. If case of consistency, the current position of the scale bar is displayed in green on the distance range. If the distance and position are consistent with the software requirements, the segments of the plane are coloured in yellow (Figure 97).

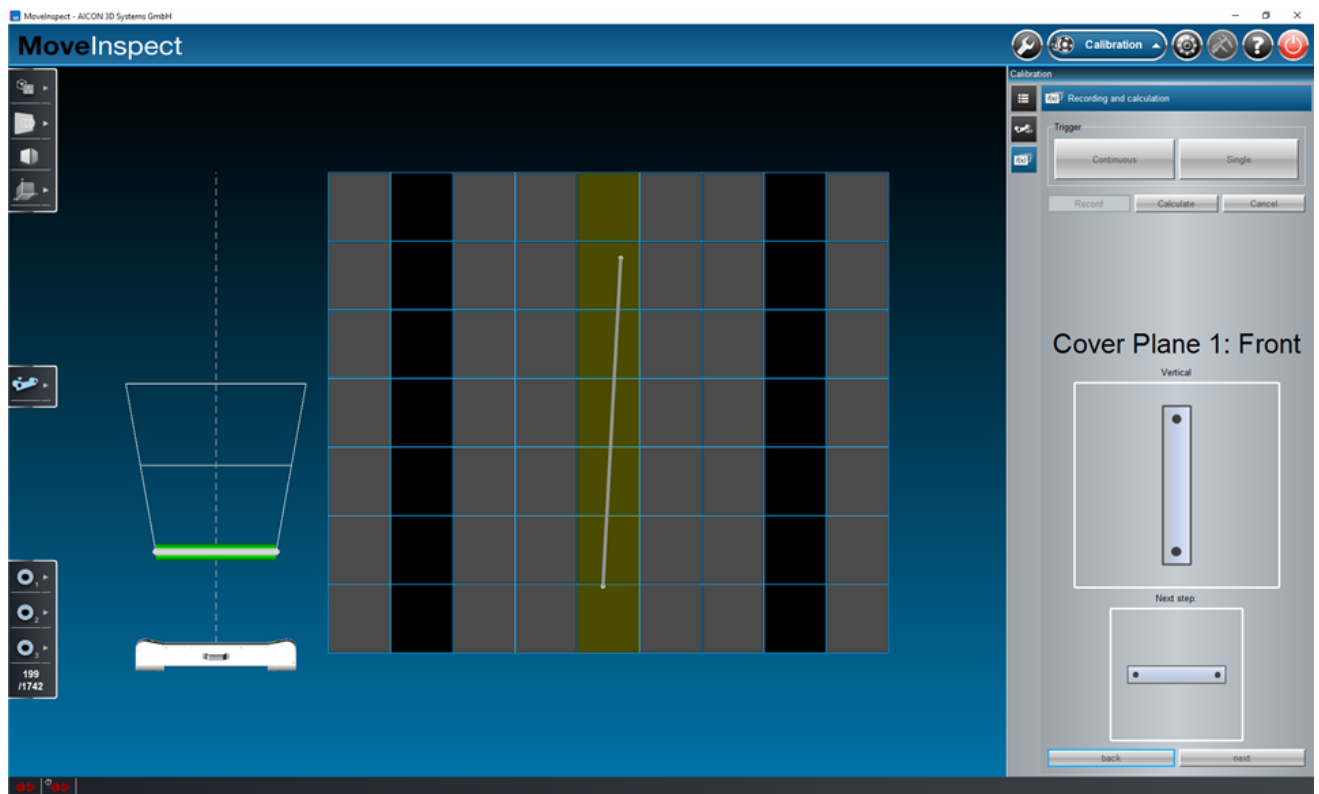


Figure 97: The scale bar has to be moved slowly in vertical position through the first plane for all squares to be coloured in blue

The scale bar now has to be held without moving until the tiles taken have are coloured in blue. This indicates that the scale bar measurement has been successful in this position (Figure 98).

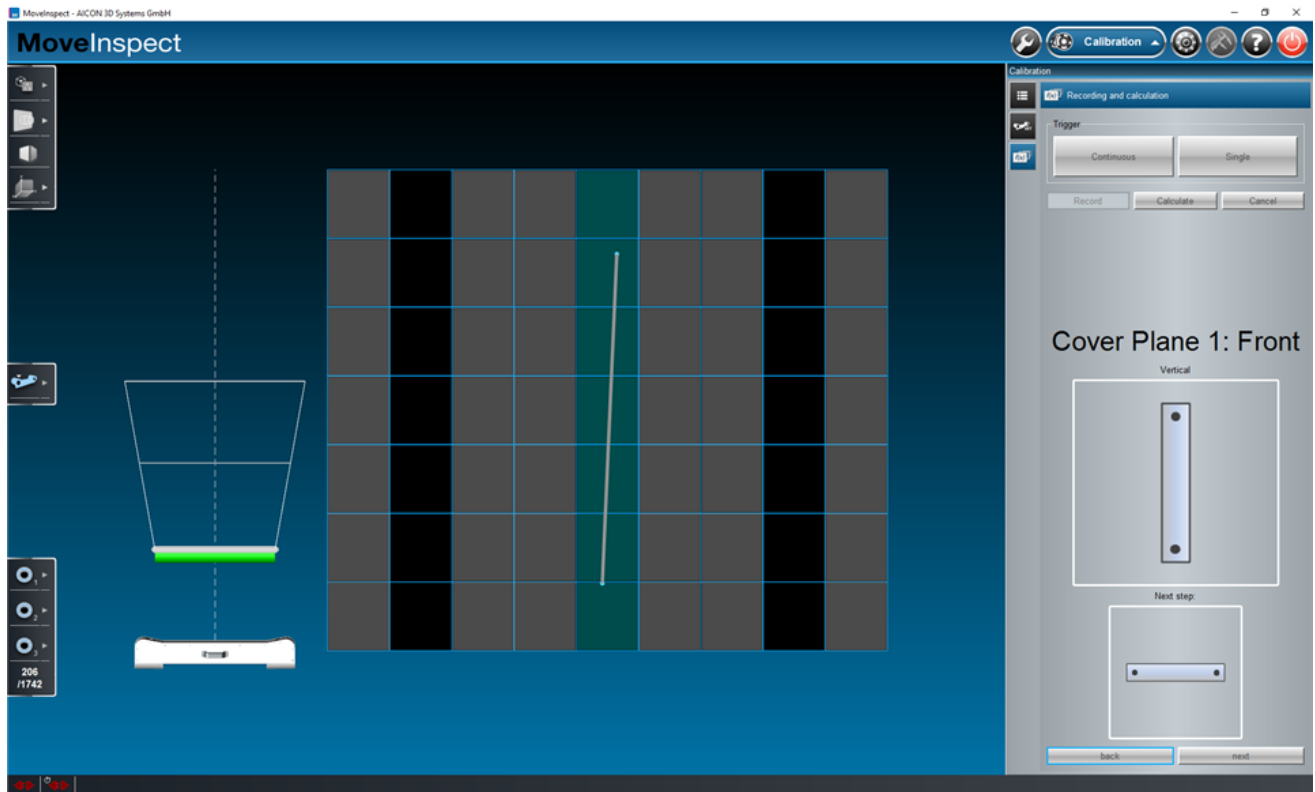


Figure 98: Blue-coloured squares denote a successful measurement of the scale bar

If the first plane is completely covered in vertical position of the scale bar, the next step of the assistant is automatically selected. If one of the planes cannot be completely covered because of hidden objects or obstacles in the measuring volume, it is also possible to manually switch to the next step of the assistant. This can be done by clicking *Next* or by switching to the next scale bar orientation displayed under *Next step*.

Subsequently the recordings in horizontal, diagonally descending and diagonally ascending direction follow (Figure 99 to Figure 101). The position, in which the scale bar has to be held, is displayed in the activity window. Areas which do not require covering or areas in the image corners which cannot be captured by the scale bar are marked by gray tiles.

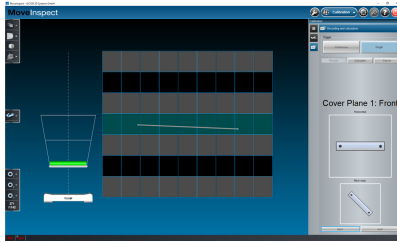


Figure 99: Horizontal scale bar measurement in plane 1

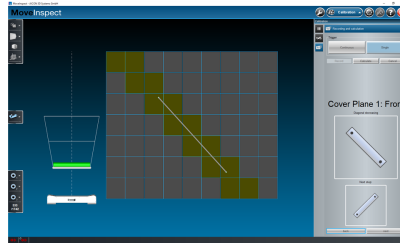


Figure 100: Diagonally descending scale bar measurement in plane 1

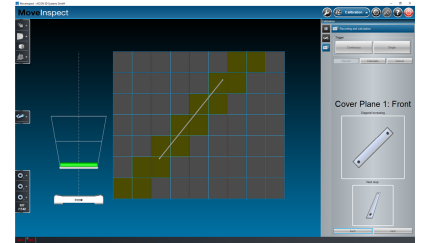


Figure 101: Diagonally ascending scale bar measurement in plane 1

After the plane in diagonally ascending position has been covered completely, the assistant automatically jumps to the next step of the depth measurement. For this, the scale bar with the vertical targets is oriented towards the cameras so that the second scale bar distance can be measured, see Figure 102. By default, the scale bar for the depth measurements has to be tilted against the vertical alignment by at least 60° . In the last plane, an inclination of at least 45° is enough.

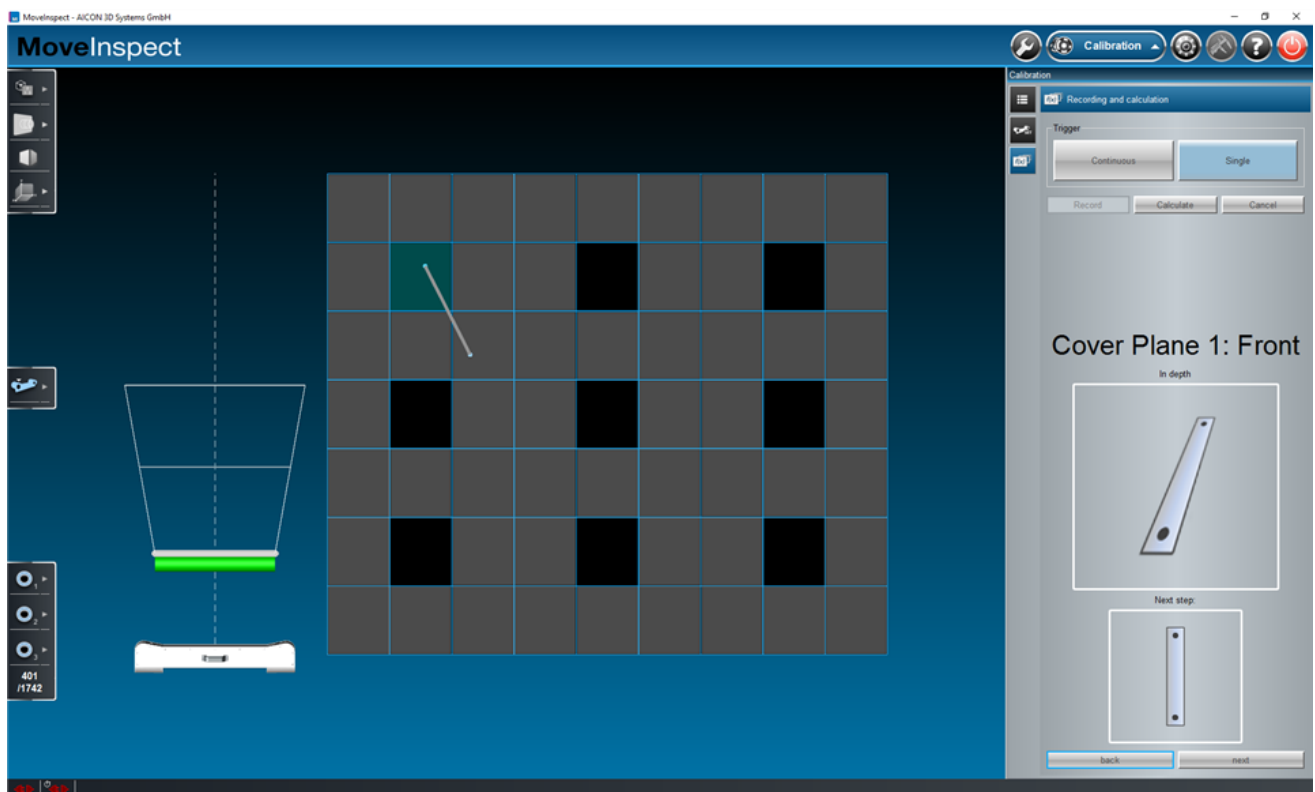


Figure 102: Measurement of the second scale bar distance with depth extension in plane 1

After plane 1 has been completely covered in all three scale bar positions, the above-mentioned five single steps of the assistant have to be performed for the further planes.

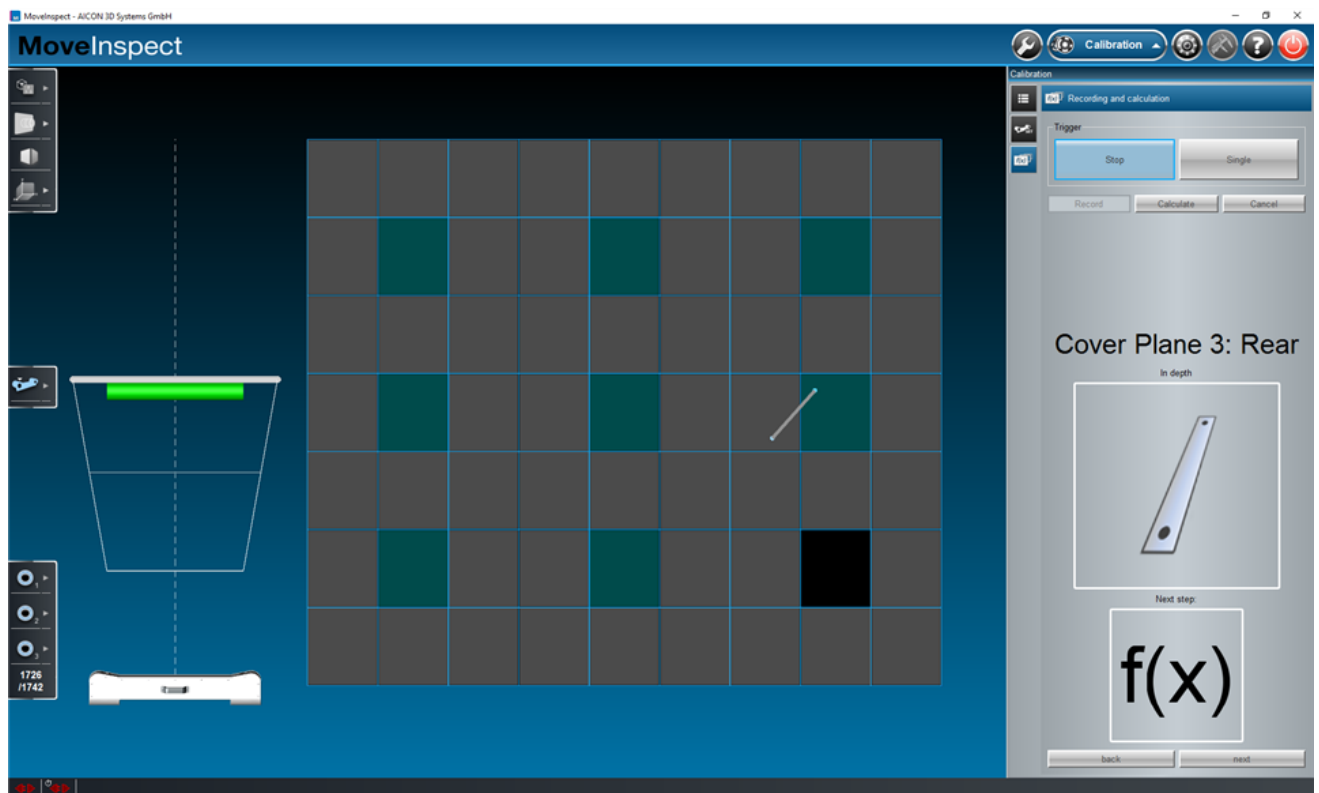


Figure 103: Measurement in plane 3 as the last step before commencement of the calculation

When all planes have been recorded completely, the calculation of the calibration starts automatically. If not all planes have been covered completely, a statistics is displayed, listing the incomplete steps marked in colour, see Figure 104. These should be added, if possible. For this, *Amend* has to be activated and the assistant automatically jumps to the steps to be complemented.

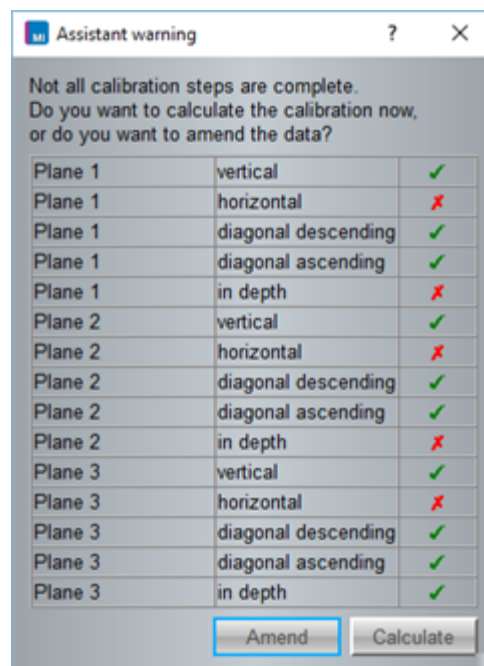


Figure 104: Display of the incomplete steps during the use of the assistant

If it is not possible to add the missing planes, the calculation can also be started manually by clicking *Calculate*. During the calculation the calibration progress and the achieved level of accuracy of the calibration are displayed in the activity window (Figure 105).

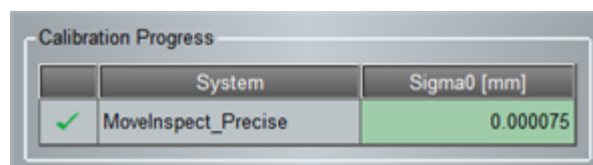


Figure 105: Display of the calibration progress in the activity window

After completing successfully the calibration, the new calibration is saved automatically; it is possible to change directly to the menu *Measurement* (Figure 106).

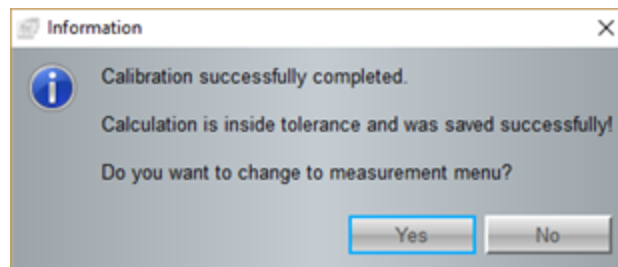


Figure 106: Scale bar calibration assistant terminated with success

Please note when using the calibration assistant:

If the required distance is not consistent with the nominal distance, the scale bar symbol in the distance display on the bar is coloured in red (Figure 107).

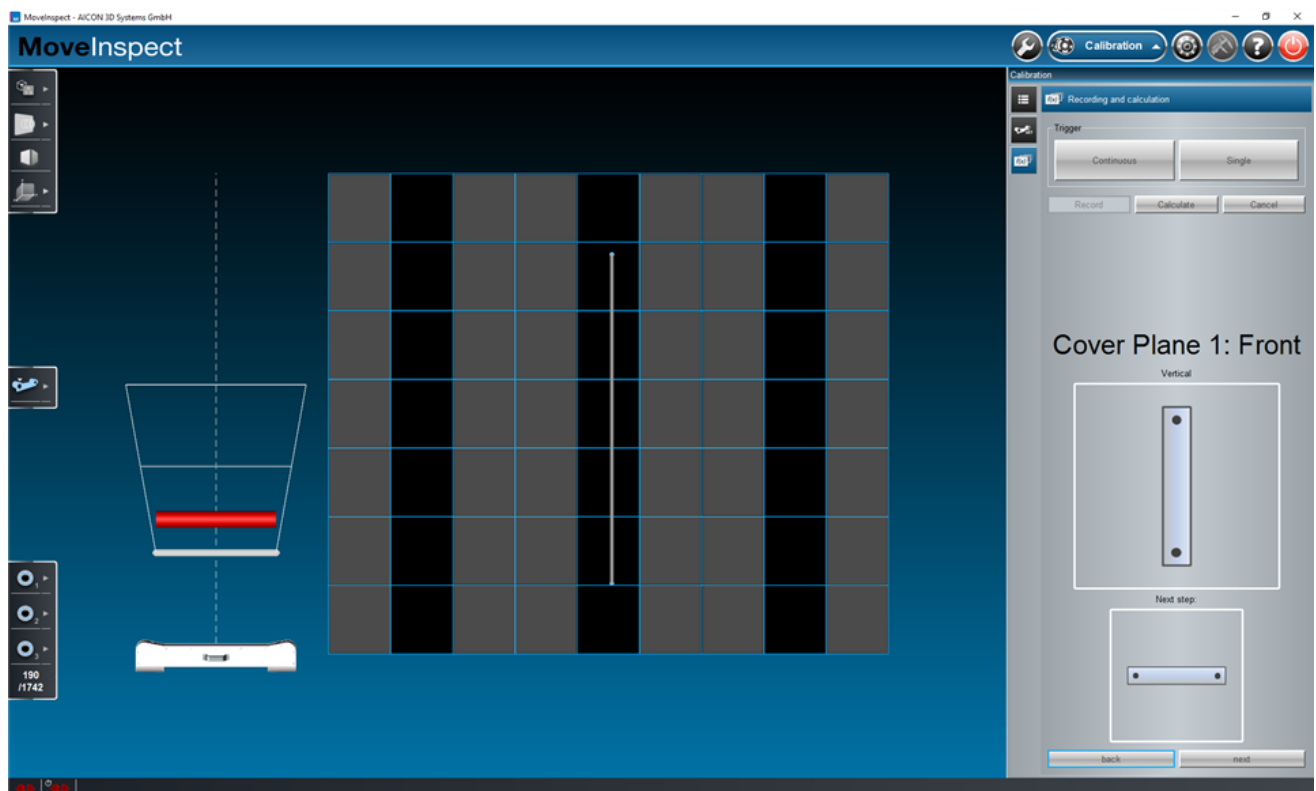


Figure 107: Measurement of the scale bar in incorrect distance

If the orientation of the scale bar is not consistent with the required orientation, the scale bar is displayed in red and the scale bar is not measured. Figure 108 shows such an example with the horizontal orientation of the scale bar is required, but the scale bar held in diagonal orientation.

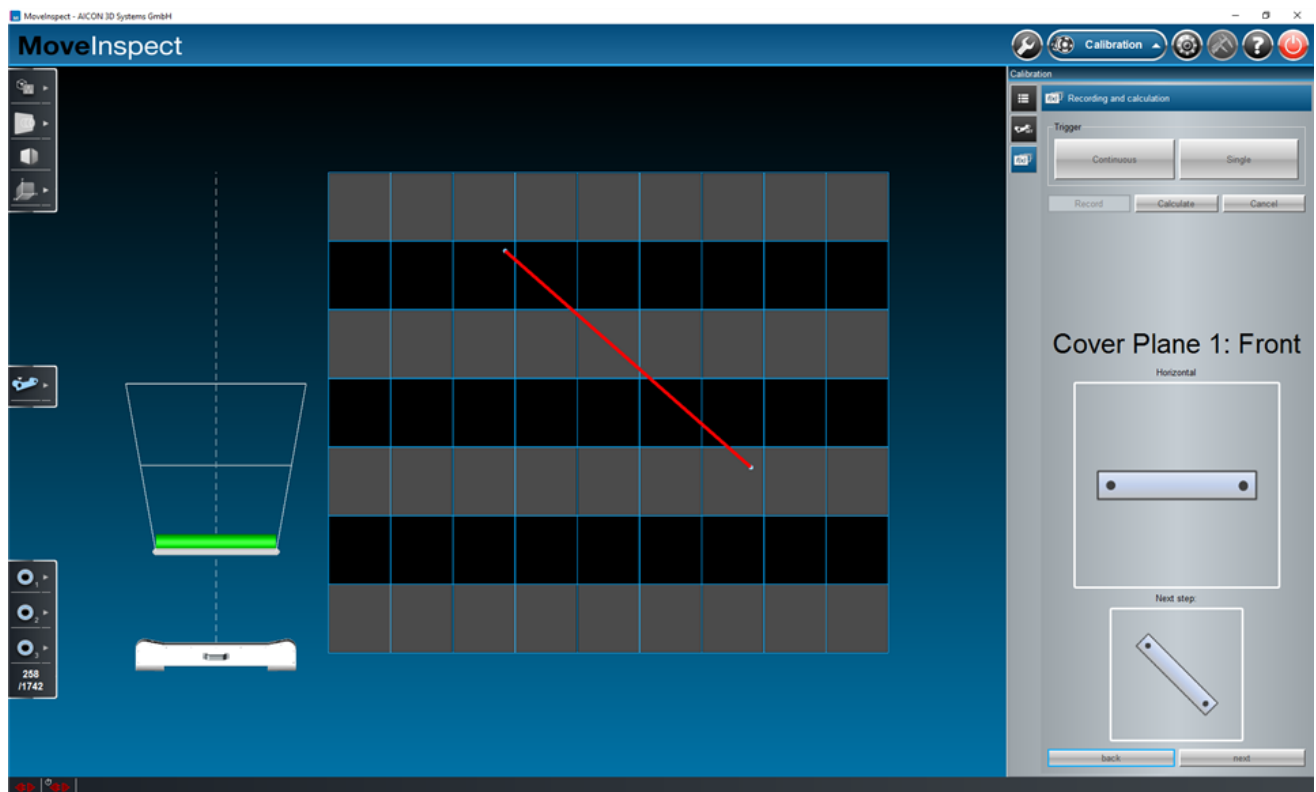


Figure 108: Measurement of the scale bar in incorrect orientation

5.5 Calibration with reference fields

The calibration method *Reference field and objects* uses a reference and optionally a scale bar and/or additional new points for the calibration. There is no detailed specification required for the additional new points, they can move within the measuring volume.

This calibration method does not use an assistant. If a scale bar is used, it is recommended to move it slowly through the complete measuring volume, similar to the [Scale bar calibration without assistant](#). While moving, make sure to measure the scale bar parallel to the camera system as well as in depth direction. The scale bar's orientation should vary between horizontal, vertical and diagonal.

After finishing the image recording, start the calculation process by clicking *Calculation*. A table shows the calculation progress and the achieved calibration accuracy (Figure 109).

Calibration Progress		
	System	Sigma0 [mm]
✓	8HR-Arena	0.000283

Figure 109: Calibration with reference fields, statistic parameters

After successful calculation, the new calibration is saved automatically; click *Yes* to change to the menu *Measurement* (Figure 110). The calculated positions and orientations of the cameras are displayed in the 3D window.

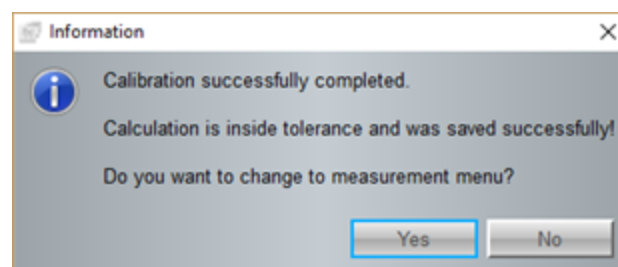


Figure 110: Calibration completed

6 Menu item 'Measurement'

In this menu item it is possible with the current configuration to carry out and record measurements and save them as projects. The measurement results can also be transferred to other programmes (e.g. PolyWorks®).

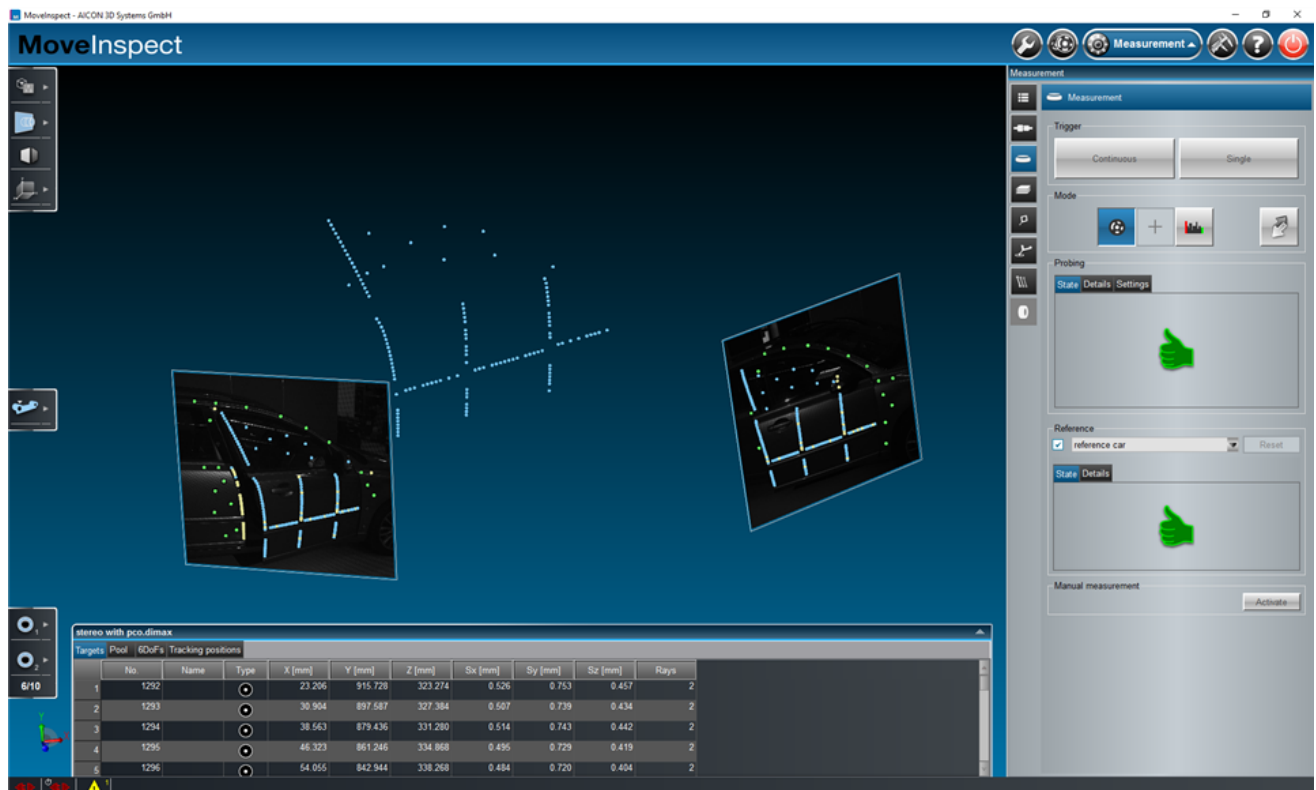


Figure 111: Menu item *Measurement*

The activity window of the menu item *Measurement* includes the following submenu items:

- *Connection*
- *Measurement*
- *Project recording*
- *Adapter points*
- *Probe tip calibration*
- *Accuracy check*
- *Wheel calibration*



First open the submenu item *Connection* to establish a link to the cameras. This is carried out automatically by starting the menu *Measurement*. The submenu item *Measurement* serves to prepare measurements and transfer the generated measurement results to other programmes (e.g. PolyWorks®). In the submenu item *Project recording* measurements can be recorded as sessions and filed as projects. In the submenu item *Adapter points* it is possible to calibrate adapter points. In the submenu item *Probe tip calibration* the probe tips can be checked and re-calibrated. In the submenu item *Accuracy check* the entire system can be checked with the aid of scale bar measurements. In the case of 6DoF measurements of wheel movements, the submenu item *Wheel calibration* offers the possibility to refer the results to an axle fixed point.

In addition to the activity window and the 3D tool bar, the data window, the camera tool bar and the measurement parameter tool bar are displayed.

6.1 Submenu item 'Connection'

When activating the submenu item *Connection*, the window shown in Figure 112 appears. It comprises the dialog boxes *Configuration* and *Connection*.

In the dialog box *Connection* it is possible to connect or disconnect the software to cameras or image files. After a successful connection the software automatically switches to the submenu item *Measurement*. When switching from *Measurement* to another menu item (e.g. *Administration* or *Calibration*) the connection is automatically closed.

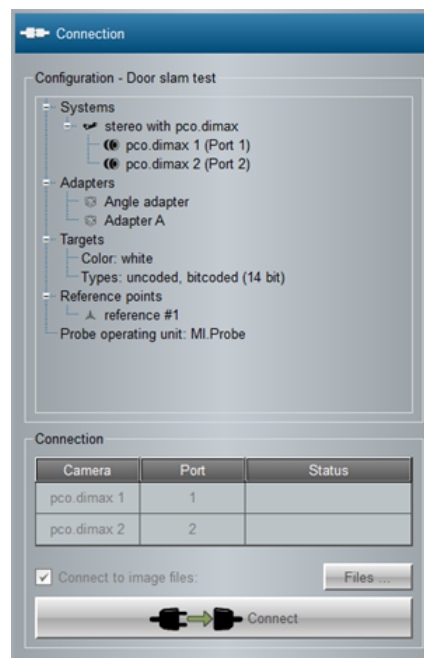


Figure 112: Submenu item *Connection*



6.1.1 Dialog box 'Configuration'

The dialog box *Configuration* shows the name of the configuration in the dialog box label as well as the properties of the active configuration. This configuration is used in the measurement.

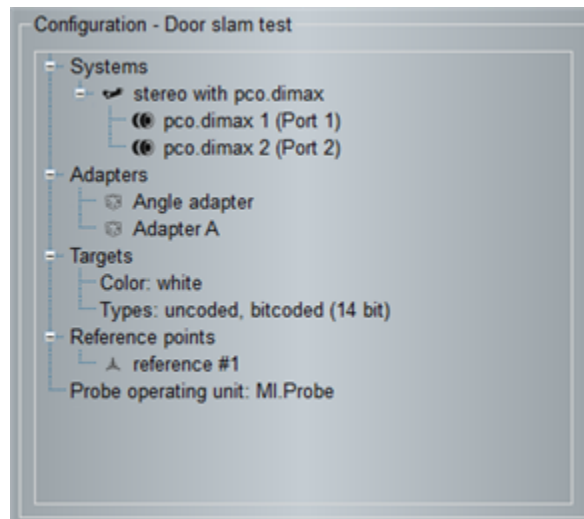


Figure 113: Dialog box *Configuration*

If required, the active configuration can be changed under administration [Submenu item 'Configurations'](#).

6.1.2 Dialog box 'Connection'

The dialog box *Connection* is only displayed when the automatic connection fails at opening the menu *Measurement* or if the connection to the cameras is interrupted. In the dialog box *Connection* a connection can be made to cameras or image files by clicking *Connect*.

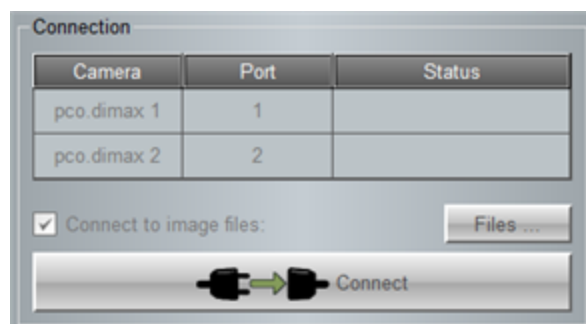


Figure 114: Dialog box *Connection*



In case of cameras of supported camera families (see section [Submenu item 'Camera models'](#)), the software is able to directly connect to the cameras.

In case of other camera families, the image capture can occur from the data carrier only. For this purpose, the checkbox *Connect to image files* has to be activated. The corresponding image files are selected in the window which appears after having clicked *Files...* (Figure 115).

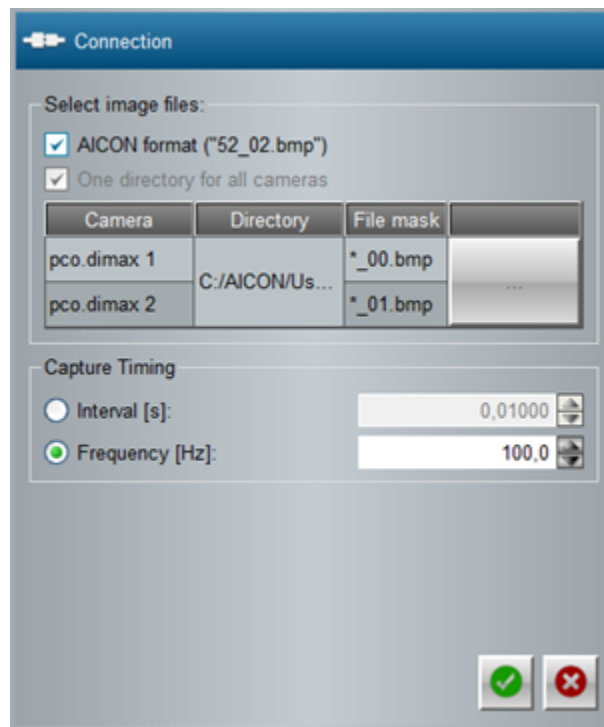


Figure 115: Selecting image files

All cameras are listed in a table. For each camera the path to its image files has to be specified there.

The software supports the following image file formats:

- BMP Image (*.bmp)
- JPEG Image (*.jpg, *.jpeg)
- TIFF Image (*.tif, *.tiff)
- PHC File (*.phc) (format description see [PHC format \(image coordinates\)](#))



The software proceeds on the assumption that all image files of a camera are in the same directory and that the file names only differ from one another by an epoch number. The epoch number has to be replaced by a star (*) in the column *File mask* (see Table 27).

Name of image files	File mask
<ul style="list-style-type: none">• Camera1_00.bmp• Camera1_01.bmp• Camera1_02.bmp• Camera1_03.bmp• ...	<ul style="list-style-type: none">• Camera1_*.bmp

Table 27: Example of creating the file mask

For a camera, the directory of its image files can either be directly entered in the table or by clicking *Directory* and subsequently selecting an image file. The name of the selected image file is applied as file mask and can be edited in the table then.

The following functions facilitate the path indications for the image files. When the checkbox *AICON format* is activated the software proceeds on the assumption that all images of all cameras are in the same directory and that the file names are composed according to the scheme CAMERA NUMBER_EPOCHE NUMBER. For this, the camera numbers have to start with 0 and correspond to the order of the cameras in the table. After that, only the corresponding directory (not the image file) has to be selected by clicking the *Directory*. The file masks are automatically created.

By activating the checkbox *One directory for all cameras* and with the checkbox *AICON format* being deactivated, the software is informed that all image files of all cameras are located in the same directory. Then, the directory has to be selected once and the file masks have to be edited manually.

In the dialog box *Capture timing* it is possible to specify the capture interval of the epochs stored in the image files as well as the original frequency.



By clicking , the window is closed and the selected image files are set. The selection is saved for further connections with this configuration.

6.2 Submenu item 'Measurement'

This submenu item allows to prepare, execute and transfer measurements to other programmes (e.g. AICON 3D Studio or PolyWorks®). The window shown in Figure 116) appears. It includes the dialog boxes *Trigger*, *Mode*, *Probing*, *Reference* and *Manual Measurement*.

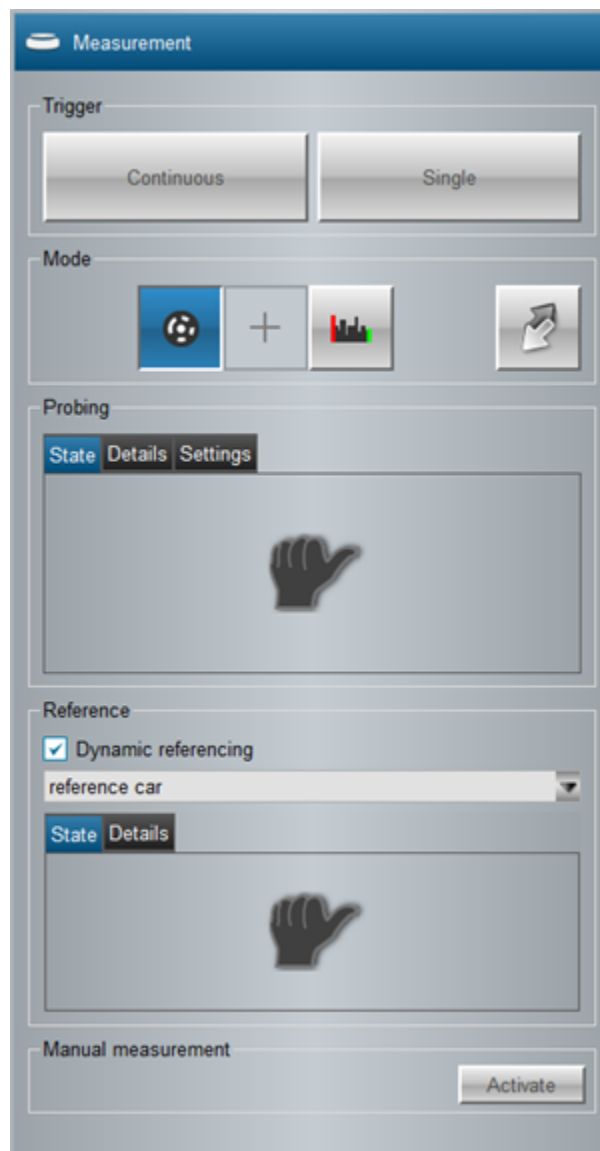


Figure 116: Submenu item *Measurement*



6.2.1 Dialog box 'Trigger'

In the dialog box *Trigger* it is possible to capture images from the cameras or from the data carrier, depending on the previously selected connection type.



Figure 117: Dialog box *Trigger*

By clicking *Continuous*, the images are captured in continuous epochs. By clicking the button again, the image capture is stopped. By clicking *Single*, the image capture for exactly one epoch is triggered. The number of the triggered epochs is displayed in the epoch counter of the [Camera tool bar](#).

6.2.2 Dialog box 'Mode'

The dialog box *Mode* allows to adjust in which mode the camera images are to be displayed.



Figure 118: Dialog box *Mode HR and XR cameras*

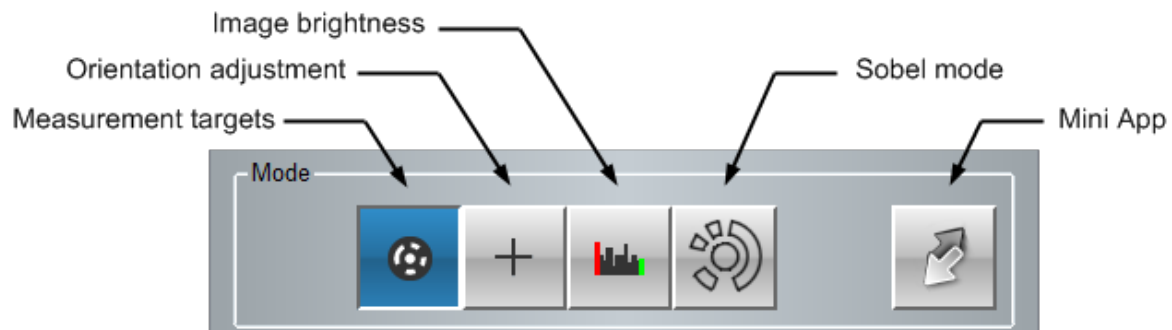
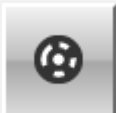


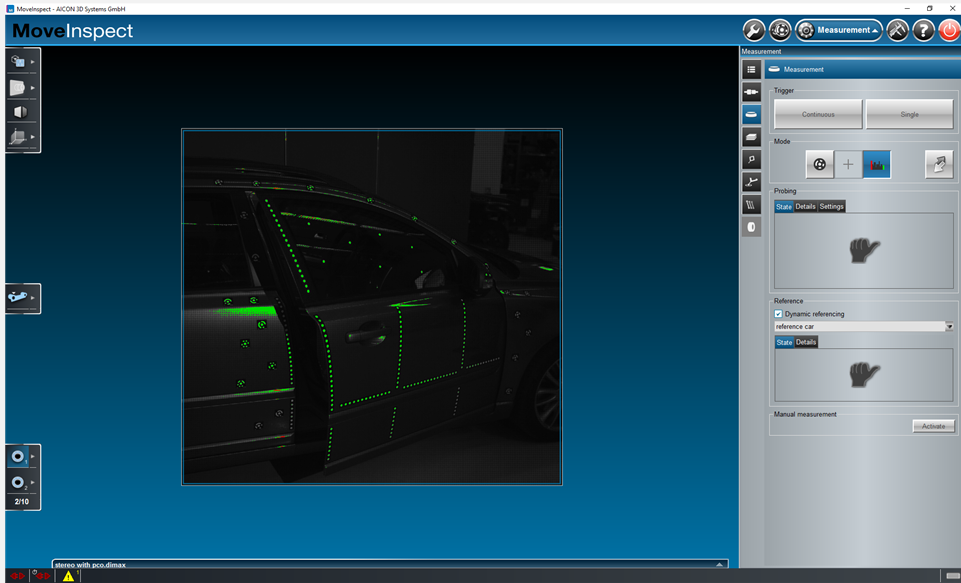



Figure 119: Dialog box *Mode HF cameras*

Depending on the camera type, various setting modes are available (see Table 28).

Mode	Description
	With the option <i>measurement targets</i> being activated, it is searched for targets in all images during each image capture and the current position of the measurement points is calculated. The targets found and the measurement points are displayed in the 3D window. This option is useful for checking the camera parameters.
	The option <i>Orientation adjustment</i> allows to check the cameras' orientation towards the measuring object. Here the camera images are brightened, if this is supported by the cameras. In the centre of each camera image a crosshairs is displayed.
	When <i>Image brightness</i> is activated, the images are coloured according to the image brightness (see Figure 120 and Table 29). This option is helpful for the setting of the exposure time and flash of the cameras. The settings are good when the majority of the displayed targets has an optimum brightness.



Mode	Description
	 <p>Figure 120: Display of the image brightness</p>
	<p>In the <i>Threshold mode</i> the threshold images are displayed (see Figure 121). This mode serves to calibrate and verify the target measurement and is only available for the MoveInspect HF. The live image of the camera is superimposed with the measured point and its contour is displayed.</p>



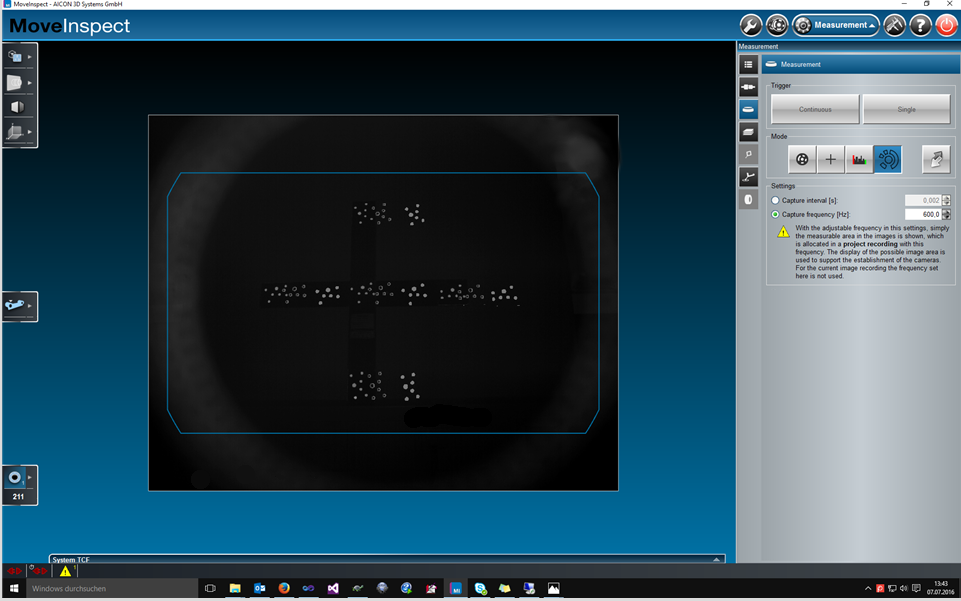

Mode	Description
	<div></div> <p>Figure 121: Target measurement in the threshold mode</p>
	Display of the <i>Mini-App</i> . The software is displayed in a minimised version which only shows the most important status information (see section Minimized application (Mini App)).

Table 28: Setting modes

Colouring	Brightness
Red	Too bright
Green	Optimum brightness
No colour	Too dark

Table 29: Colouring of image areas and their brightness

In the case of HF cameras, in the modes *Orientation adjustment*, *Image brightness* and *Sobel mode* the dialog box *Settings* is also displayed (see Figure 121). The frequency settings in this menu item only serve to display the measurable image area in 3D (blue line), in which by using this frequency it is

possible to carry out a measurement during a project recording. No images are recorded with this frequency in the submenu item *Measurement*.

6.2.3 Dialog box 'Probing'

In the dialog box *Probing* it is possible to configure measurements which were performed with the probe and the measurement status as well as details of the probe measurements are displayed.

Under the tab *State* the current state of the measurement of the MI.Probe is displayed. A successful measurement is signalled by a green thumb (Figure 122). If the measurement was not successful, a red thumb appears.

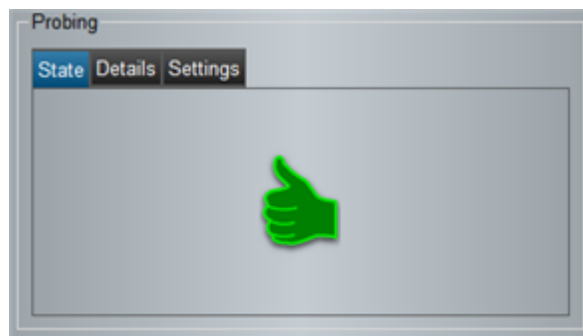


Figure 122: Dialog box *Probing*, *State* (here: Successful measurement)

Under the tab *Details* the measured targets are displayed. Here, a distinction is made between *Targets*, *High targets* and *Important targets* (Figure 123). Under *Targets*, the quantity of all measured targets on the MI.Probe is displayed. Under *High targets* and *Important targets*, the number of targets is displayed which were previously defined as such in the administration (section [Submenu item 'Probes'](#)). If fewer targets are measured than specified in the administration, the respective line is highlighted in red. Then, the measurement is not successful. In case of no important or high targets being defined in the administration, these are not listed in the *Probing* dialog box under the tab *Details*.

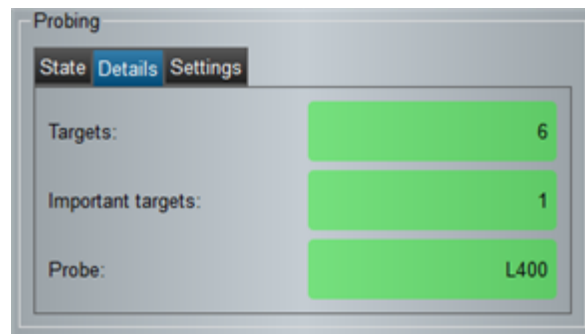


Figure 123: Dialog box *Probing*, display of details (here: successful measurement)

The tab *Settings* shows further parameters which can be set by the user. The operating unit status bar shows whether the software could successfully connect to the probe operating unit (Figure 124). When the connection was successful, a green tick is displayed, otherwise the *Operating unit query* can be activated to connect the probe with the software. The probe operating unit is previously selected in the configuration (see section [Tab 'Systems'](#)).

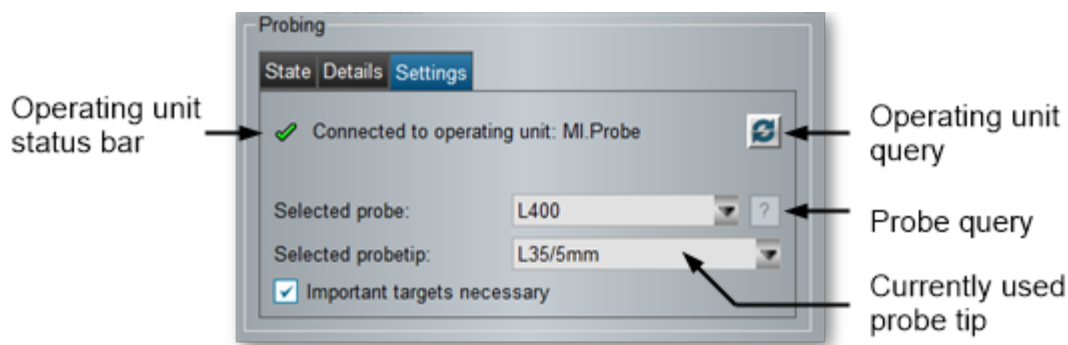


Figure 124: Dialog box *Probing*, *Settings*

The drop-down list *Selected probe* shows which of the existing probes shall be used for the measurement. When measuring with the MI.Probe, a change in the probe is automatically recognised and the drop-down list is updated correspondingly. Active probes are authenticated automatically on triggering, prompting the probe ID to be transmitted via the trigger signal. In the same way, it is possible to update the selection by clicking *query*. It is also possible to manually select the probe from the list. When measuring with a probe-group (see section [Tab 'Probe-group'](#)), the selection list serves to display the last recognised probe. Additionally, the measurement can be configured for the respectively selected probe (e.g. activating/deactivating the checkbox *Important targets necessary*). The probes of a probe group (MI.Probe minis) are recognised on the basis of their geometry.

The drop-down list *Selected probe tip* shows which probe tip is used for the current measurement. When changing the probe tip, always the currently used probe tip has to be selected.

The quality of the probe measurement can be influenced by the respective setting of *Important targets necessary*, the *minimum number of important targets* and the *minimum number of high targets*. These measurement parameters are to be specified for the probe in administration under [Submenu item 'Probes'](#). With the parameter *Important targets necessary*, it is possible to specify under the tab measurement whether the same measurement target which has been marked as important in the administration must be among the measured measurement targets. In the case of the MI.Probe, this is the target near the probe tip. If the criteria defined by the parameters are not fulfilled, the probe measurement is invalid and is displayed in red in the coordinate table accordingly (see Figure 125). The coordinates of invalid measurement points are not transferred to the evaluation software connected with MoveInspect Pilot.



	No.	Name	Type	X [mm]	Y [mm]	Z [mm]	Sx [mm]	Sy [mm]	Sz [mm]	Rays
1	1006	Probe (triggered)		192.03	-32.40	-1231.74	0.05	0.02	0.10	---
2										

Figure 125: Invalid probe measurement

6.2.4 Dialog box 'Reference'

The dialog box *Reference* allows to activate the dynamic referencing to define the coordinate system for the measurement.

If the checkbox *dynamic referencing* is activated, the coordinate system is redefined for each following recording, as far as the reference is measured successfully. The reference coordinate system which has been defined in section [Submenu item 'References'](#) is used as the coordinate system for the measurement points.

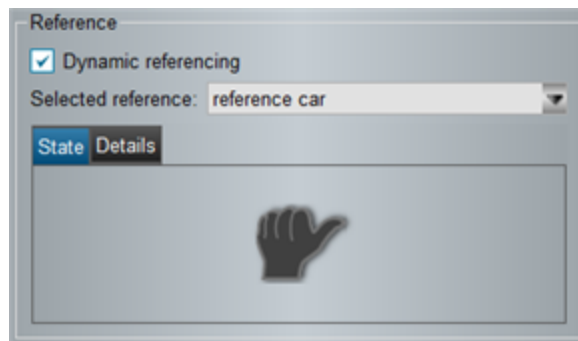


Figure 126: Dialog field *Reference* with active dynamic referencing

When the checkbox *Preselection of references* is activated (see section [Tab 'Reference'](#) in the *Administration*), the drop-down list for dynamic referencing only shows the references for this configuration. If the checkbox is deactivated, all available references are displayed. References, which are incompatible the current configuration, are marked in red and cannot be selected.

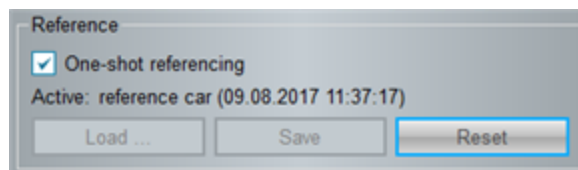


Figure 127: Dialog field *Reference* with active and saved one-shot reference

By deactivating the dynamic referencing, the coordinate system is set back to its original position. After calibration, the coordinate system typically is positioned in the projection centre of camera 1, in case of MoveInspect XR8 systems the coordinate system positioned in the system centre.

The tab *State* shows the current state of the measurement. When all parameters, which were defined in section [Tab 'Reference'](#), are valid, a green thumb appears. Once a parameter was not met, a red thumb appears.

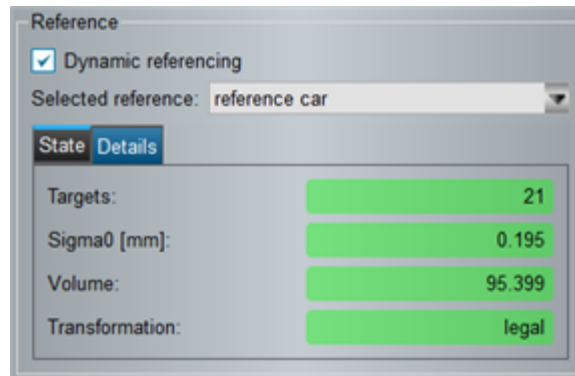


Figure 128: Dialog box *Reference*, *Details*

The tab *Details* lists the parameters which are explained in the following (see Figure 128 and Table 30). In the tool tips, a brief description as well as the minimum and maximum value of the specified parameter is displayed. The tool tips appear when the mouse cursor is moved across the values.

Parameter	Description
<i>Min. target count</i>	This parameter defines how many reference points have to be visible for the transformation, otherwise the display is highlighted in red as a warning and the measurement is discarded.
<i>Max. Sigma0 [mm]</i>	This parameter defines the limit value for σ_0 for the transformation. If the set value is exceeded, the display is highlighted in red as a warning and the measurement is discarded.
<i>Min. volume [%]</i>	The stored reference consisting of measurement points spans a volume in space. It is checked during the measurement if the volume defined by the measured reference points falls below the set value. In that case, the display is highlighted in red as a warning and the measurement is discarded.
<i>Transformation</i>	Displays the status of the transformation into the reference coordinate system.

Table 30: Parameters of the reference measurement

For changing the parameter values see section [Tab 'Reference'](#) in the submenu configuration of the *administration*.

6.2.5 Dialog box 'Manual measurement'

The dialog box *Manual measurement* allows to measure any points with the mouse (Figure 129). This function generates starting points for the tracking or surfacing.



Figure 129: Dialog box *Manual measurement*

For the manual measurement, trigger either an image acquisition under *measurement* or select an epoch under *projects*. The manual measurement can only be activated in a 2D view with camera images and can also only be carried out in a 2D view. An overview displays all the camera images as well as a single image view in which only the current image of the selected camera is displayed. To open the camera image view see section [Display of 3D view / camera images](#). By clicking *Activate* the manual measurement is activated. While the manual measurement is active, no further image acquisition can be prompted under measurement.

When pressing the *Alt* key, the mouse cursor changes to a crosshairs (Figure 130). With this crosshairs, the user has to click the point to be measured in the image as precisely as possible. This point has to be measured in another camera in the same way. For finding the point in the other images more easily, a line is displayed on which the point to be measured has to be located (Figure 131).

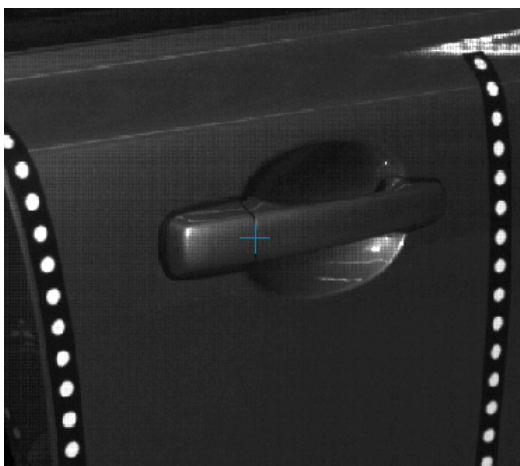


Figure 130: Manual measurement in image 1

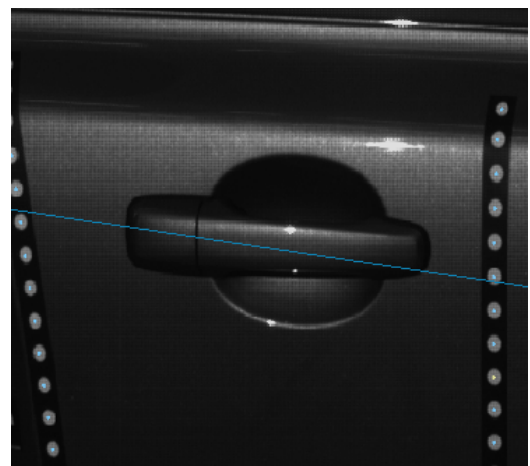


Figure 131: Manual measurement in image 2

After measuring the point in the second image, its 3D coordinates are determined and displayed in table *Pool*. If no further points are to be measured, the manual measurement is finished by clicking *Deactivate*.

6.3 Camera tool bar

The camera tool bar (Figure 132) enables the setting of the camera parameters. The camera parameters control the way in which the images are captured and processed by the cameras. Each configuration has its own camera parameters.

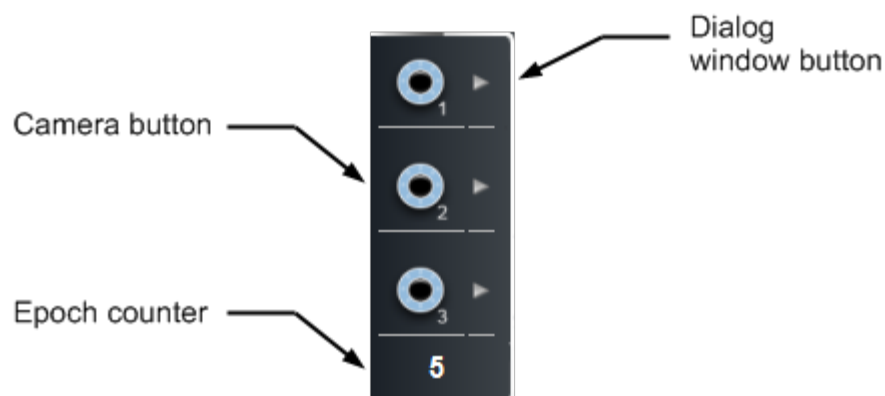


Figure 132: Camera tool bar

The tool bar provides a button for each camera. By clicking a button, the single image view of this camera appears (see section [Display of 3D view / camera images](#)).

The camera parameters can be set for the selected camera or for all cameras. The camera parameters for the selected camera can be set in the dialog window of the camera button. If there the checkbox *Set for all cameras* is marked with a tick, the changes made in the camera parameters are applied for all cameras. The camera parameters include the exposure time, the measuring area, the particle parameters and the expert parameters. The particle parameters are only displayed if particles have been selected in the target settings of the configuration.

The particle parameters and expert parameters are displayed in separate windows. The expert settings can be reset to the preset default values (factory setting).

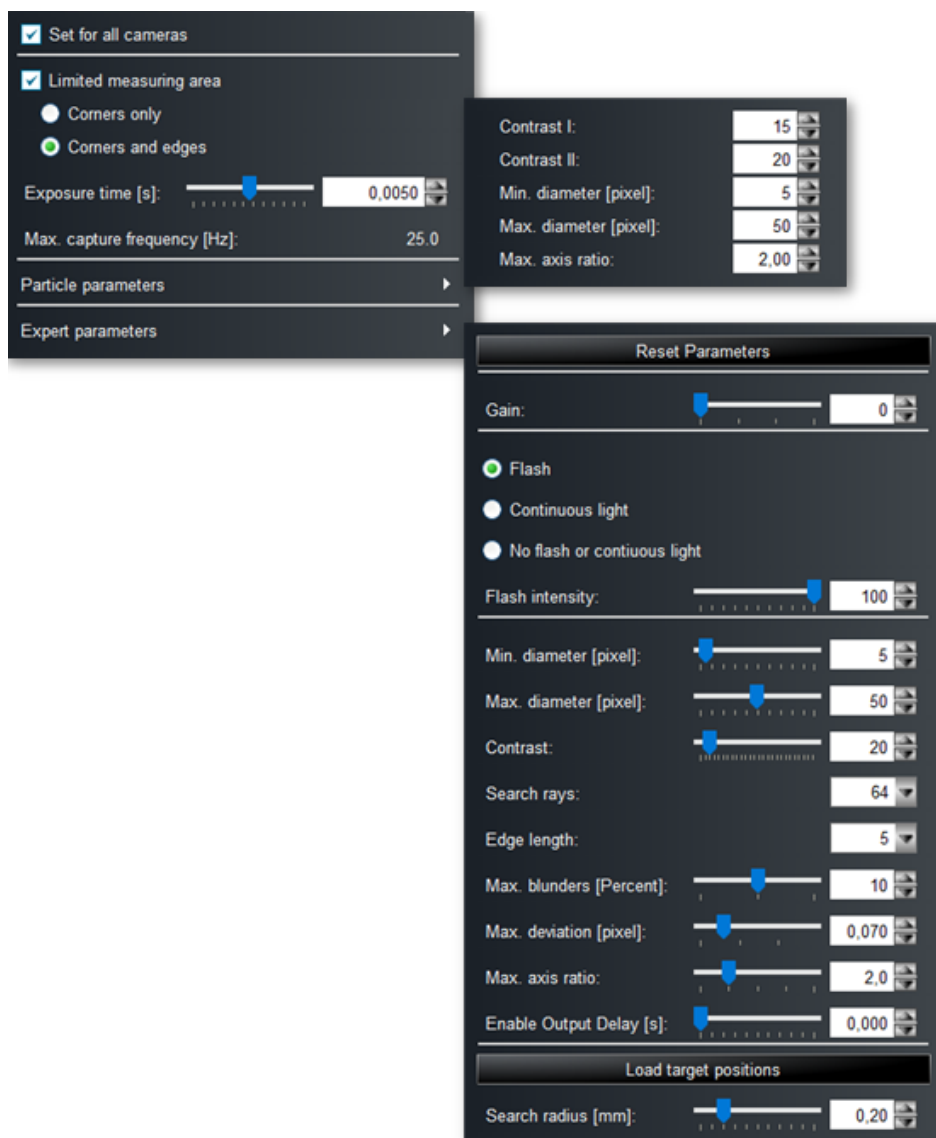


Figure 133: Dialog box of the camera parameters with particle and expert parameters

In the following, all camera parameters are described. The relevance of a camera parameter depends on the fact whether the images are captured from HF cameras, HR cameras or loaded from a storage medium. After a connection with the cameras or images is established, only the relevant parameters are displayed.

Limited measuring area:

By means of this checkbox it is possible to limit the measuring area. Here, there are two options. The measuring area can either be limited at the corners only (Figure 134 a), or at the corners and at the



edge (Figure 134 b). Targets which are outside the selected area are not included. The limits of the measuring area are represented by a blue line.

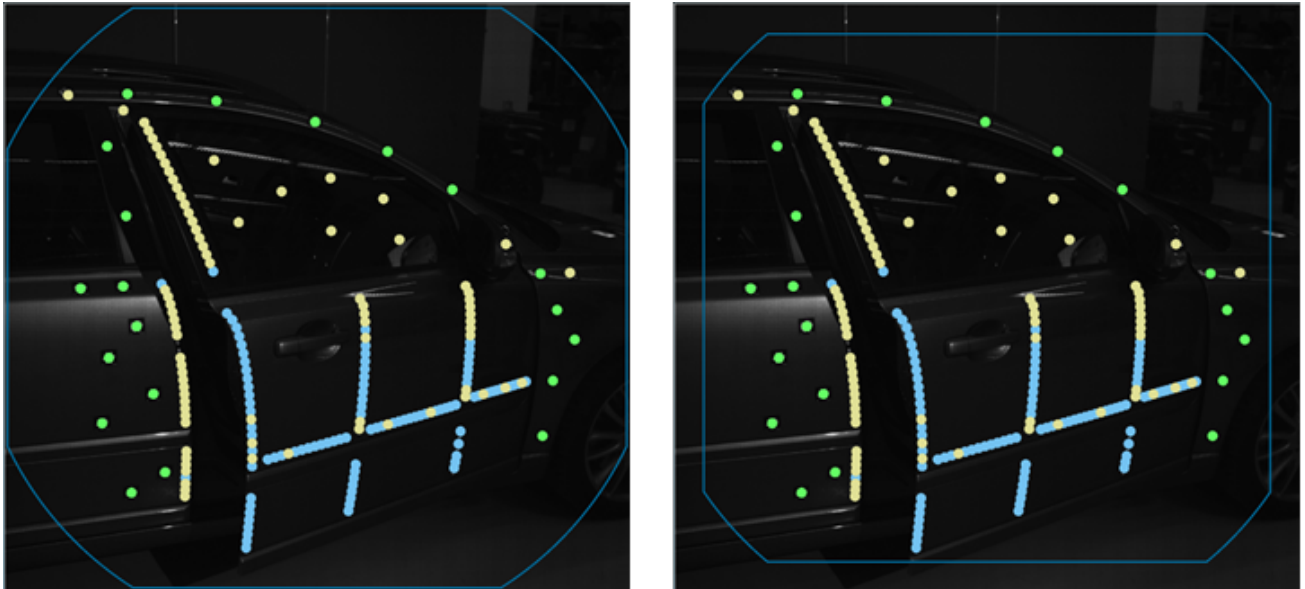


Figure 134: Limited measuring area: (a - left) only corners, (b - right) corners and edges

In the case of **HF cameras** the measuring area can additionally be limited by the capture frequency. If the exposure rate is higher than 495Hz, the possible measuring area decreases. This smaller measuring area is displayed depending on the capture frequency specified under measurement in the setting modes *Setting assistant*, *Image brightness* and *Sobel mode* as well as under Project Recording.

Exposure time [s]:

This camera parameter controls the exposure time when capturing images from **cameras**. The exposure time is the same for all cameras to ensure a synchronous capture time of all cameras. The highest possible frame speed is displayed underneath the exposure time. Among other criteria, it is depending on the specified exposure time.



6.3.1 Particle parameters

These camera parameters control the recognition of particles when capturing images from **HR and XR cameras and the data carrier**.

Parameter	Description
<i>Contrast I and Contrast II</i>	<i>Contrast I</i> shows the necessary brightness difference between all the pixels of a particle and the background as gray value difference. With <i>Contrast II</i> , a higher brightness difference can be defined which has to be reached by at least one pixel of the particle.
<i>Min. and max. diameter [Pixel]</i>	The minimum and maximum diameter of the particles in an image.
<i>Max. axis ratio</i>	This value shows the maximum ratio of the two main axes of a particle in an image.

Table 31: Particle parameters

6.3.2 Expert parameters

Parameter	Description
<i>Gain</i>	Intensifying the image brightness in case of an image capture from HR and XR cameras.
<ul style="list-style-type: none">• <i>Flash</i>• <i>Continuous light</i>• <i>No flash or continuous light</i>	Activating or deactivating the flash or the continuous light for the image acquisition of HR and XR cameras. Continuous light should only be used if it is intended to reach a capture frequency which due to the cooling times cannot be achieved with a flash.
<i>Flash intensity</i>	Specifying the flash intensity as luminous period in relation to the exposure time in case of an image capture from HR and XR cameras. Thus, a flash



Parameter	Description
	intensity of 100 (50) corresponds to a luminous period of the flash over the total (half the) exposure time.
<ul style="list-style-type: none">• <i>Minimum diameter [Pixel]</i>• <i>Maximum diameter [Pixel]</i>	Controlling the recognition of targets in case of an image capture from cameras and the volume. These parameters specify the minimum and maximum diameter of a target in an image.
<i>Threshold</i>	Controlling the recognition of targets in case of an image capture from HF cameras. The threshold shows the minimum brightness of a target. The default value is between 400 and 600.
<i>Contrast</i>	Controlling the recognition of targets when capturing images from HR and XR cameras and the volume. The contrast specifies the necessary brightness difference between targets and the background as gray value difference. The default value is between 20 and 30.
<i>Search rays</i>	Controlling the recognition of targets in case of an image capture from HR and XR cameras and the volume. It specifies the number of search rays necessary for finding the target edge.
<i>Edge length [Pixel]</i>	Controlling the recognition of targets in case of an image capture from HR and XR cameras and the volume. It describes the maximal length of the gray value transition between the target and the background.
<i>Max. blunders [Percent]</i>	Controlling the recognition of targets in case of an image capture from HR and XR cameras and the data carrier. It specifies how much percent of a target edge may be subject to blunder (because it is hidden or invisible).
<i>Max. deviation [Pixel]</i>	Controlling the recognition of targets in case of an image capture from HR and XR cameras and the data carrier. This value specifies the minimum accuracy for the determination of the target centre.



Parameter	Description
<i>Max. axis ratio</i>	Controlling the recognition of targets in case of an image capture from HR and XR cameras and the data carrier. This value specifies the maximum ratio of the two main axes of the target ellipse in an image.
<i>Enable Output Delay [s]</i>	Creating the Enable Output Signal for the image acquisition with HF cameras which can for instance be used for the synchronisation with external measurement technology. The signal is generated from an extension of the clock pulse of the camera by the specified period of time. A continuous output signal (constant high level) is hence generated in the case that the defined period of time is longer than the dT of the specified capture frequency. Please note that after having completed the last capture the Enable Output Signal still remains at the high level by the respective period of time.
<i>Load target positions</i>	Loading the positions and numbers of the position-coded measuring targets for each camera, both for calibration and for measurement.
<i>Search radius [mm]</i>	Controlling the search radius of position-coded measuring targets around the loaded position. It depends on sensor size, lens and measuring volume. Please contact the Hexagon Commercial Office (Hexagon CO) responsible for your country before changing this parameter.

Table 32: Expert parameters

6.4 Measurement parameter tool bar

The dialog window of the measurement parameter tool enables the setting of different measurement parameters. By means of the measurement parameters it is controlled how the measurement results are calculated from the recognised targets.



Figure 135: Measurement parameter tool

The measurement parameters are subdivided into tracking parameters, surface parameters and expert parameters (Figure 136).

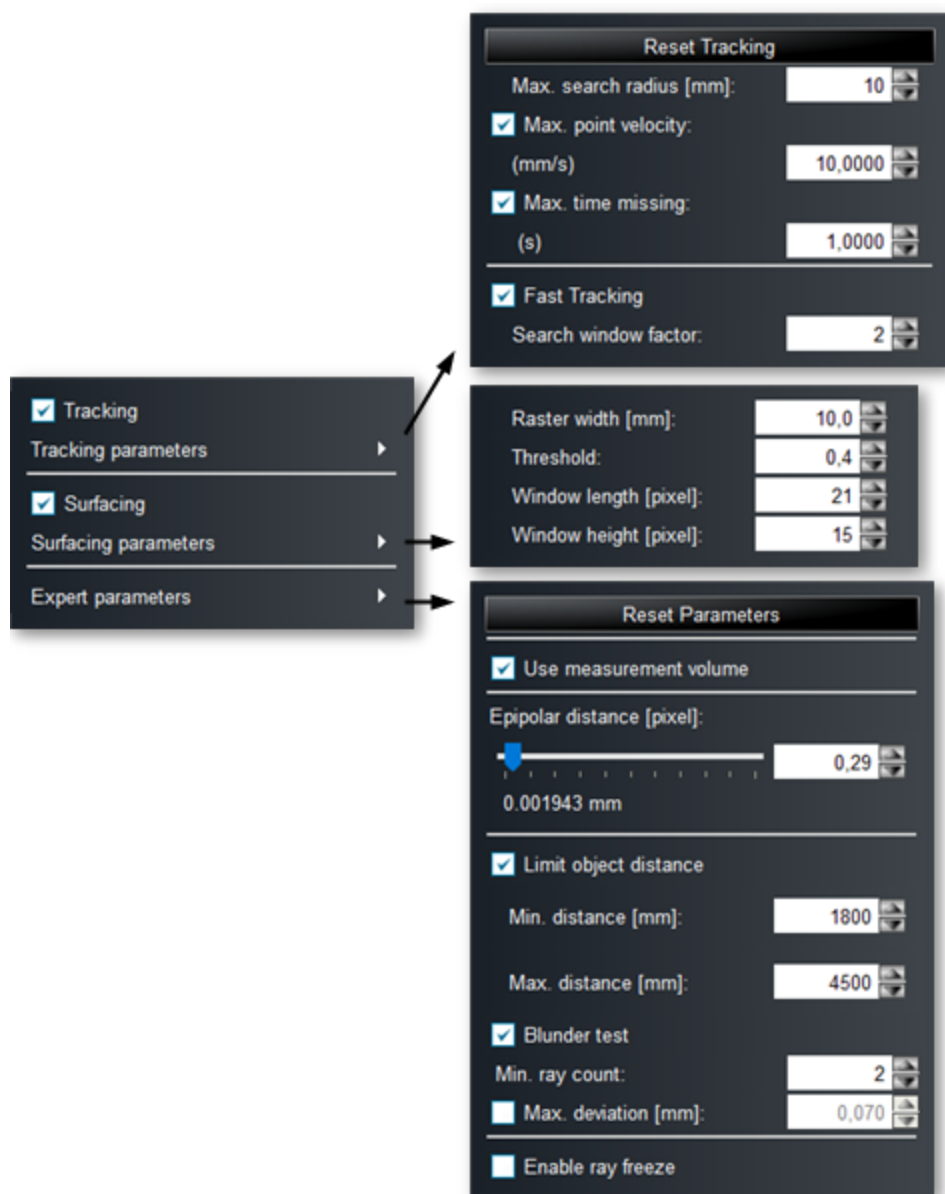


Figure 136: Dialog window of the measurement parameters



6.4.1 Tracking parameters

Parameter	Description
<i>Tracking</i>	<p>Activating or deactivating the tracking of uncoded targets.</p> <p>During tracking it is attempted to track the uncoded targets across several epochs and thus giving them always the same point number. The starting point is always the currently measured position of an uncoded target. Starting from this position, it is searched for the identical target in the preceding epochs using a predefined search radius. The tracking parameters mentioned in the following determine the size of this search radius and the number of preceding epochs which are to be searched. With the Tracking function being activated, a table Tracking positions is additionally displayed. Here, starting positions for the tracking can be preset (see section Table 'Tracking positions').</p>
<i>Reset tracking</i>	<p>Deleting the preceding epochs which are internally stored for the tracking.</p> <p>Therefore, it may be possible that there are only defined starting positions in the next measurement and no preceding epochs in which it can be searched for identical targets. The tracking parameters are not affected by resetting the tracking. The tracking parameters are reset by using the expert parameters.</p>
<i>Max. search radius [mm]:</i>	<p>Specifying the maximum radius in which it has to be searched for the identical target in the preceding epochs.</p>
<i>Max. point velocity [mm/s]</i>	<p>Reducing the search radius.</p> <p>The value specifies the velocity which is expected as a maximum of an uncoded target. From this, an adapted search radius is calculated for each preceding epoch. The more far back this epoch to be searched for is in the past, the larger the search radius gets – up to the limit defined in Max. search radius.</p>



Parameter	Description
<i>Max. time missing [s]</i>	<p>Specifying in how many preceding epochs the identical target shall be searched for.</p> <p>The value specifies how long a target may be missing. Regardless of the specified time missing, at least three preceding epochs are always searched.</p>
<i>Fast tracking</i>	<p>Fast tracking accelerates the image measurement and only in conjunction with white light scanners leads to a significantly faster tracking measurement. Fast tracking only searches for the image points to be measured in the specified search window of the image points measured in preceding epochs. If an image point moves with a higher than the preset maximum point speed, it is located outside the searched area and subsequently is no longer recognised. Please only activate this parameter after consulting the Hexagon Commercial Office (Hexagon CO) responsible for your country.</p>
<i>Search window factor</i>	<p>Defining the size of the search window for the fast tracking.</p> <p>The search window of a target is generated by multiplication of this factor with the diameter of the measured target from the last epoch. The image measurement only takes place inside the search windows.</p>

Table 33: Tracking parameters



6.4.2 Surface parameters

Parameter	Description
<i>Surfacing</i>	<p>Activating or deactivating the measurement of textured surfaces.</p> <p>The surface is measured by matching corresponding image sections with two cameras. For each surface point to be measured, an image section is defined in the image of the first camera. Then, it is attempted to find this section in the image of the second camera. For this, the surface in both image sections needs to have a similar texture. From the positions of both image sections the surface point is calculated. For the surfacing always the first two cameras of a camera system are used.</p> <p>When the function Surfacing is activated, an additional table Surface positions is displayed. In this table the starting positions for the surfacing have to be preset (see section Table 'Surface positions'). The table Surface displays the measured surface points.</p>
<i>Raster width</i>	<p>Controlling in which spatial resolution the surface is determined.</p> <p>The measured surface is described by a raster of single 3D points. The raster width specifies the distance of the points in this raster.</p>
<i>Threshold</i>	<p>Controlling the reliability and sensitivity of the surface measurement.</p> <p>The value specifies the minimum correlation coefficient for which two image sections were rated as correspondent. The higher this value, the more reliable the measuring results. The smaller the value, the more sensitive the measurement, i.e. measurement results can also be achieved in difficult image sections, but then the probability of incorrect measurement is rising. Usually, this value should be larger than 0.4.</p>



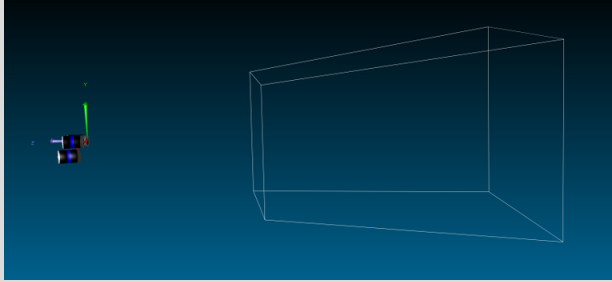
Parameter	Description
<i>Window length and window height [pixel]</i>	<p>Defining the size of the image sections (correlation window) with which a surface point is determined.</p> <p>The larger the size of the correlation window, the more reliable the matching. The smaller the size of the image section is selected, the more the measured surface point corresponds to the local geometry of the surface. This, however, increases the probability of incorrect measurements.</p>

Table 34: Surface parameters

6.4.3 Expert parameters

Parameter	Description
<i>Reset parameters</i>	Using this button the expert parameters can be reset to the default setting. The tracking and surface parameters are also reset.
<i>Using the measuring volume</i>	By activating the checkbox Use measuring volume, measurements which are located outside the calibrated measurement area are marked as invalid. Invalid points are not transmitted to an evaluation software connected to MoveInspect Pilot (see Figure 137). The measuring volume is determined by the calibration and in the 3D view can be displayed in the shape of a frustum of a pyramid. The display of the calibrated measuring volume in the 3D view can be switched on and off with the activation/deactivation of this measurement parameter. This option is only possible if the measuring volume is known.



Parameter	Description
	 <p>Figure 137: Display of the calibrated measuring volume in the 3D view</p>
<i>Epipolar distance [pixel]</i>	This measurement parameter controls the assignment of identical uncoded targets in the images of the different cameras. The value specifies the distance by which identical targets may be apart from the respective epipolar line. The default value is between 0.2 and 1 pixel. An increase in the epipolar distance leads to a higher probability of incorrect assignments.
<i>Limit object distance</i>	This checkbox enables the setting whether the measuring volume has to be limited. In this way it is possible to filter out unwanted measurement points.
<i>Min. and Max. distance</i>	With these measurement parameters the depth of the measuring volume is limited. The values specify the minimum and maximum distance of a target from the cameras.
<i>Blunder test</i>	By activating or deactivating this checkbox, the blunder test is activated or deactivated in the 3D coordinate calculation using a forward intersection.
<i>Min. number of rays</i>	With this parameter, the number of (image point) rays is set which shall be used for the calculation of the 3D coordinates of an object point. If there are fewer (image point) rays available for the calculation of the 3D coordinates than have been preset with this parameter, the



Parameter	Description
	corresponding object point is coloured in red in the data window and not transferred to an external software.
<i>Max. deviation [mm]:</i>	This parameter defines the maximum standard deviation which an object point may have after the 3D coordinate calculation using a forward intersection. If the standard deviation of the object point coordinates after the forward intersection is larger than the defined value, the corresponding object point is coloured in red in the data window and not transferred to an external software.
<i>Enable ray freeze</i>	With this option, a special case within the software is activated. It can be determined with how many rays (cameras) the measuring points are to be captured. Then, the number of rays is kept for all following epochs. If one ray is dropped in the following epochs, the corresponding measuring point is invalid. Please activate only after having consulted the Hexagon Commercial Office (Hexagon CO) responsible for your country.

Table 35: Expert parameters



6.5 Tables

In the submenu item *Measurement*, a data window is displayed (Figure 138). It consists of the tabs *Measurement*, *Pool* and *6DoFs*. When the functions *Surfacing* and *Tracking* are activated, the tabs *Surface*, *Tracking positions* and *Surface positions* are additionally displayed. The table *External Sensors* is displayed if external sensors have been used in the configuration. In the 3D window, only the points of the selected table are displayed.

stereo with pco.dimax

Measurement Surface Pool Tracking positions Surface positions 6DoFs External sensors

	No.	Name	Type	X [mm]	Y [mm]	Z [mm]	Sx [mm]	Sy [mm]	Sz [mm]	Rays
1	350			1245.1368	514.5487	54.2138	0.3116	0.3116	0.3116	2
2	358			558.0312	968.9084	-13.8341	0.2670	0.2670	0.2670	2
3	373			771.2611	885.8310	-0.0918	0.2998	0.2998	0.2998	2
4	375			-71.6122	204.3139	62.2360	0.0602	0.0602	0.0602	2
5	395			44.4765	1037.7984	-25.1506	0.2078	0.2078	0.2078	2
6	396			1358.1251	305.4015	66.7827	0.1981	0.1981	0.1981	2

Figure 138: Data window in the submenu item *Measurement*

6.5.1 Table 'Measurement'

In this table, the measured 3D points of the targets, the adapters and the probe are displayed for the current epoch. All the targets which were recognised as reference targets or adapter targets are sorted out and are not displayed in the table.

It may happen that the measurement of all or single points is invalid. These points are displayed in red in the table (Figure 139). Invalid points, for example, arise in case of a failed referencing (possibly not enough reference targets visible) or due to an invalid probing.



stereo with pco.dimax										
Measurement	Surface	Pool	Tracking positions	Surface positions	6DoFs	External sensors				
	No.	Name	Type	X [mm]	Y [mm]	Z [mm]	Sx [mm]	Sy [mm]	Sz [mm]	Rays
5	431		⊙	280.51	1023.06	-23.29	0.22	0.22	0.22	2
6	441		⊙	-19.60	897.58	24.03	0.13	0.13	0.13	2
7	1394		⊙	24.44	914.16	331.54	0.31	0.31	0.31	2
8	1395		⊙	32.18	896.05	335.66	0.33	0.33	0.33	2
9	1396		⊙	39.96	877.90	339.47	0.32	0.32	0.32	2
10	1397		⊙	47.69	859.69	343.04	0.31	0.31	0.31	2

Figure 139: Data window in the submenu item *Measurement* with invalid measurements

6.5.2 Table 'Surface'

This table displays the results of the surface measurement. The table only appears when the surface measurement is activated (see [Surface parameters](#) in the measurement parameter tool bar).

6.5.3 Table 'Pool'

This table serves as a pool for any points. In this table, for example, points can be collected which were measured in different epochs. The table is not updated by incorporating a new epoch. In addition, all manually measured points are written in this table.

6.5.4 Table 'Tracking positions'

This table allows to define starting positions for uncoded targets. These starting positions support the tracking and the assignment of the uncoded targets. In the measurement the name of a starting point is applied from the appropriate target. Point numbers are not adopted. Changes in the starting positions have only an effect in the measurement of the first epoch or after resetting the tracking (see section [Tracking parameters](#)). Jointly using starting positions and reference points is not supported.

6.5.5 Table 'Surface positions'

In this table the 3D starting position of the measurement of textured surfaces are to be specified.

At least 4 starting positions are required on the surface to be measured. These describe the measuring area as a limiting polygon. In case there are not sufficient starting positions available, the software displays an error message and the surface measurement cannot be executed.



6.5.6 Table 'External sensors'

The table *External Sensors* is displayed as soon as external sensors are part of the configuration (see [Tab 'Systems'](#)).

All those measurement values are displayed in the table which have been transferred from the connected sensors to the software when prompting the measurement. The values can be transferred to an evaluation software (e.g. to the AICON 3D Studio).

6.6 Minimized application (Mini App)

If MoveInspect Pilot is applied in connection with an inspection software, the application mostly plays a minor role and status information cannot be seen directly. To keep in view all relevant information while working with the inspection software, it is possible to switch to a minimised version of MoveInspect Pilot in the measurement.



To do so, click the button in the [Dialog box 'Mode'](#). This minimised version is always in the foreground and only includes the most necessary data: status information about the system, the probe and the measuring results. If there is evidence of a decalibration, it is possible to directly switch into the calibration by using the button. After the calibration is finished, it is switched back to the minimised view.

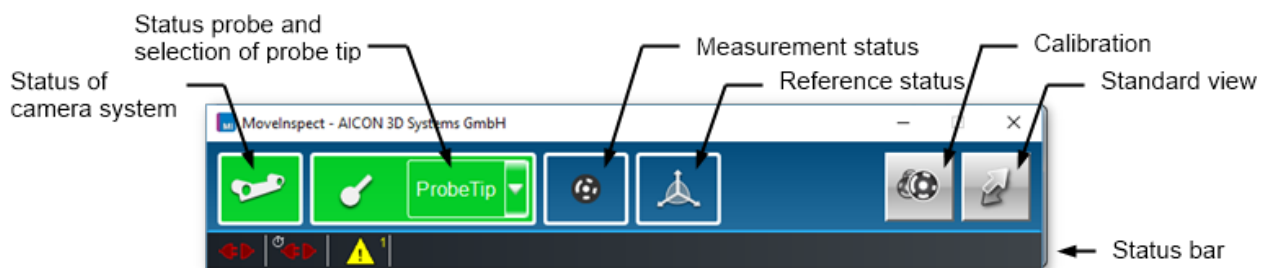



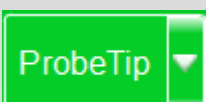


Figure 140: Mini App



The functions of the Mini App are listed in Table 36 :

Symbol	Function	Description
	Status of the camera system	This information specifies that all cameras are connected.
		This information specifies that at least one camera is not connected.
	Probe Status	This information specifies that the measuring probe is not selected.
		This information specifies that the measuring probe is connected and a probe and a probe tip have been selected.
		This information specifies that the measuring probe is not connected or a probe or a probe tip have been not selected.
	Selection of probe tip	<p>List with available probe tips.</p> <p>This information specifies whether a probe tip has been selected. The name of the currently selected probe tip is displayed. The probe tip can be changed via the selection list. When using a probe-group, also the probe name is displayed.</p>
	Status measurement	<p>Specifies whether a measurement has been successful.</p> <p>The display depends on whether a probe is being used.</p>
		<p>Measurement was successful.</p> <p>If a probe is being used, the measurement is successful as soon as the probe can be measured successfully.</p> <p>If no probe is being measured, the measurement is indicated as successful, if at least one target has been measured and all measured values are marked as valid, indicating that no predefined threshold values have been exceeded.</p>



Symbol	Function	Description
		Measurement partially successful. Targets were measured, but some or all targets are marked as invalid.
		Measurement failed.
	Status dynamic reference	Specifies whether the measurement of the dynamic reference was successful.
		Successful dynamic referencing.
		Dynamic referencing failed. The criteria were not met while referencing are displayed in the tooltip.
	Status one-shot reference	Specifies whether the measurement of the one-shot reference was successful. In case of a saved one-shot referencing, the status remains in blue colour. The tooltip displays name and date of the saved one-shot referencing. The coordinate system of this saved one-shot referencing is applied to the following epochs.
		Successful one-shot referencing. The coordinate system was not saved for the following epochs and is defined anew with each epoch.
		One-shot referencing failed. The coordinate system cannot be saved for the following epochs and is defined anew with each epoch. The criteria that were not met while referencing are displayed in the tooltip.



Symbol	Function	Description
	Calibration	Switch to calibration. Attempt to establish a connection to the system. After a successful calibration, the view automatically changes back to the minimised view and the software changes to the measurement mode.
	Standard view	Using this button allows to change back to the standard software view.
 	Status bar	Status of the online interface.
 		Status of the RealTime interface.
 		Status of the camera temperature.
		Status <i>Save images</i> .
		Warning display.
		Information display.
 		Battery status of the MI.Probe operating unit.

Table 36: Symbols and functions of the Mini App



Context menu:

The context menu of the Mini App is accessed by a right mouse click in the Mini App. It provides the following functions Table 37.

Function	Description
<i>New reference</i>	Capturing reference points and create a new reference (see Dynamic referencing).
<i>Load reference</i>	Creating a new reference with loaded 3D points (see Dynamic referencing). To load the 3D points, select the file with the reference points in the file selection dialog which opens next.

Table 37: Functions of the context menu in the Mini App

Note:

By closing the Mini App with *Close* in the task bar, the entire application is closed, not only the minimised view. If the application is closed while being displayed as Mini App and connected with a camera system (not with image files), MoveInspect Pilot tries to reestablish the camera connection and automatically switches to the Mini App view when opening the application the next time.



6.7 Dynamic referencing

For a dynamic referencing it is possible to create a new reference from targets, either in the menu *Measurement* or in the Mini App.

6.7.1 Distribution of the targets for dynamic referencing

The targets for the dynamic referencing (reference points) should be distributed evenly in the measurement volume.

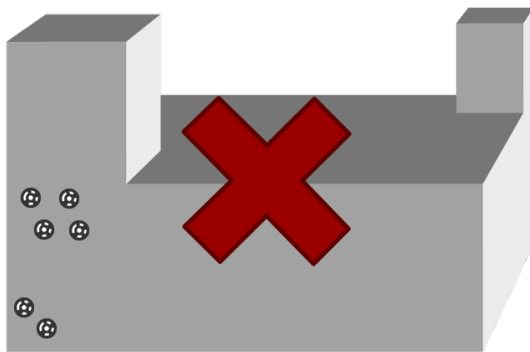


Figure 141: Bad distribution of the reference points

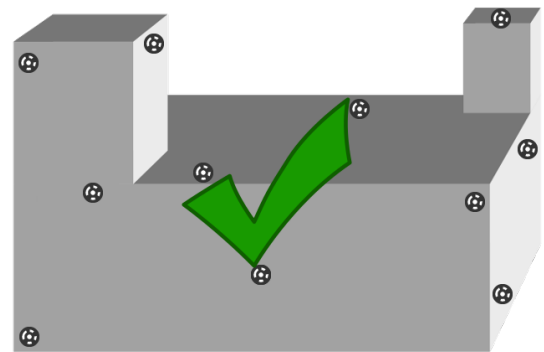


Figure 142: Good distribution of the reference points

The number of required targets depends on the size of the measuring volume and the number of positions.

- Recommended for a measuring field of 1 x 1m (2D) with one position: 10-12 targets
- Recommended for a measuring volume of 1 x 1 x 1m with one position: 15-20 targets

For the size of a car or bigger (50-80 targets) the use of a DPA is recommended to determine the reference.

6.7.2 Create a dynamic referencing

The reference can be loaded and created from measuring points or from a file. To create a new reference, the following steps are required:

New reference in the measuring menu:

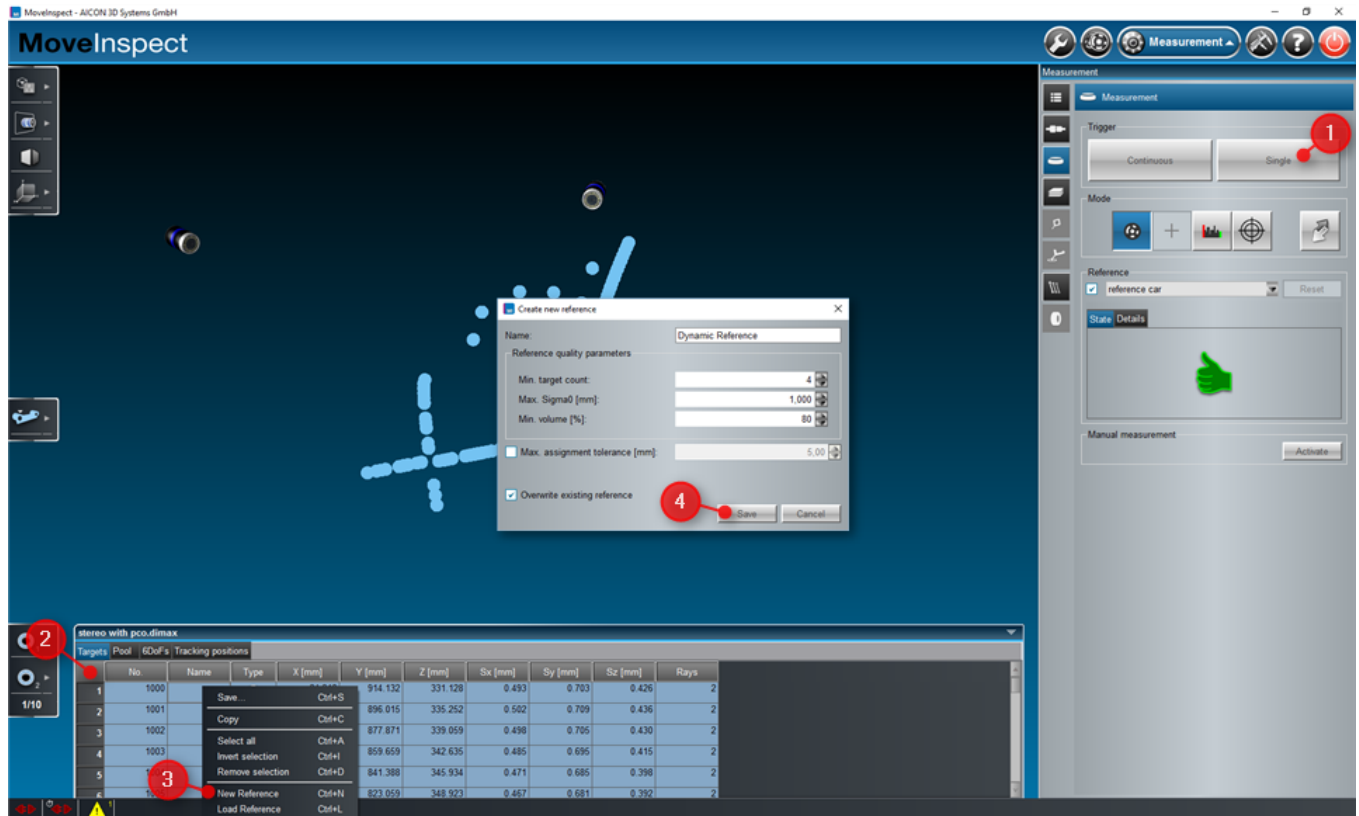


Figure 143: New reference in the measurement menu

1. Trigger measurement.
2. Select the reference points in the table or in the 3D view.
3. Open the context menu of the table or the 3D view and select entry *New reference*. The dialog *Create new reference* appears.
4. Check reference parameter and confirm with *Save*. The reference is created and activated.

New reference in the Mini App:

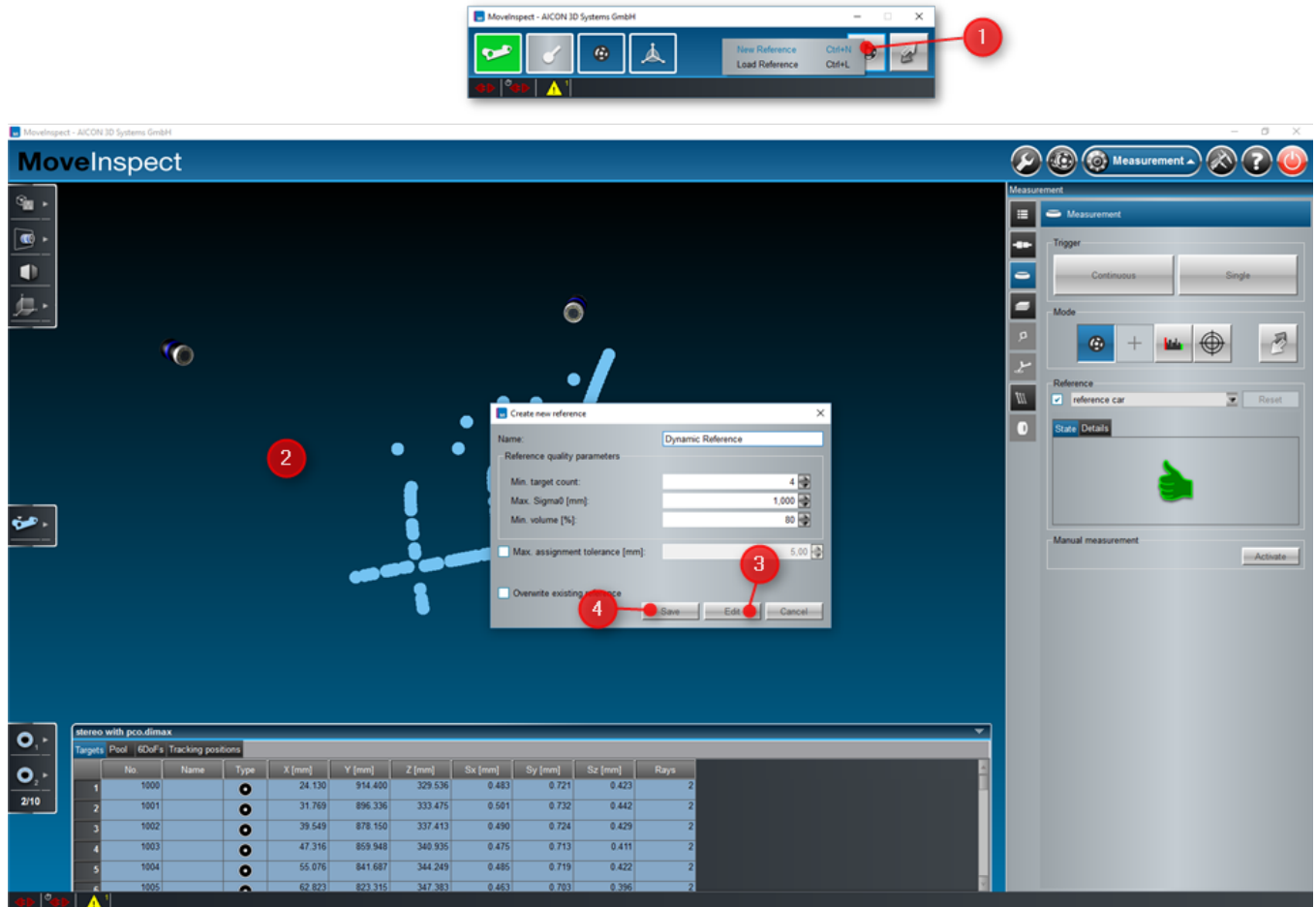


Figure 144: New reference in the Mini-App

1. Open the context menu of the Mini App and select *New reference*. This triggers a measurement, all measured points are selected. The main view and the dialog *Create new reference* appear.
2. Check selected reference points in the 3D view.
3. Optional: Click *Edit* to change the selection. After having changed the selection, start again to create a reference via the context menu of the table or the 3D view. The dialog *Create new reference* appears again.
4. Check reference parameter and confirm with *Save*. The software changes back to the minimised view.

Load reference:

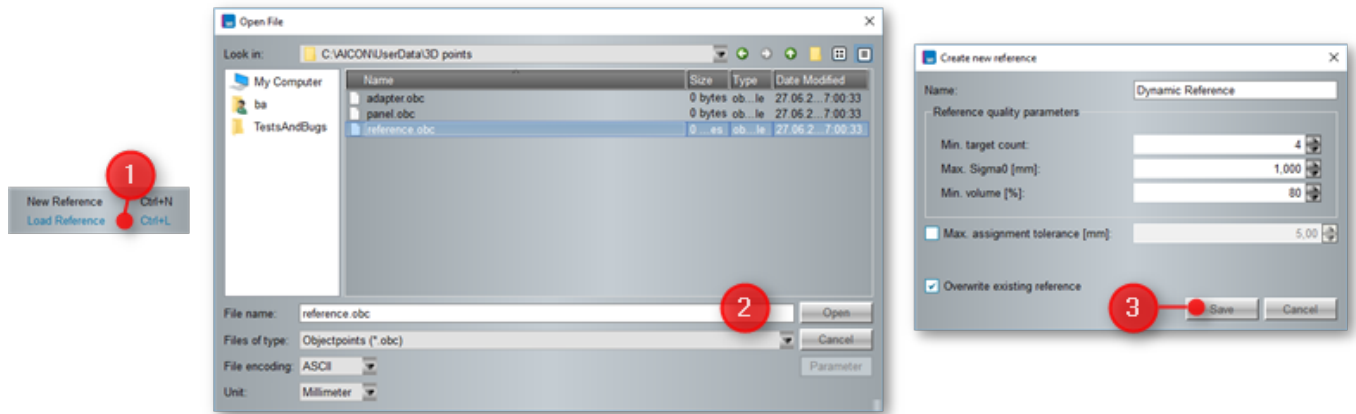


Figure 145: Loading a reference

1. Open the context menu of the table, of the 3D view or of the Mini App and select the entry *Load reference*.
2. Select file with reference points in the file selection dialog and open it. The dialog *Create new reference* appears.
3. Check reference parameter and confirm with *Save*. The reference is created and activated.

Note:

For the reference parameters, default settings are stored. In the *Administration*, Submenu item *References*, the default parameter are displayed and set (see section [Set default parameters](#)).

6.8 Submenu item 'Project recording'

This submenu item allows to capture and save measurements as projects. Depending on whether the software is connected to cameras or image files, different windows appear (see sections [Project recording with cameras](#) and [Project recording with image data](#)).

6.8.1 Project recording with cameras

When the software is connected to cameras, it is possible to capture an arbitrary number of epochs as project in the submenu item *Project recording* (Figure 146). A captured project saves the captured images of the epochs as well as the current configuration. To support high data transfer rates the images are saved in an optimised format.

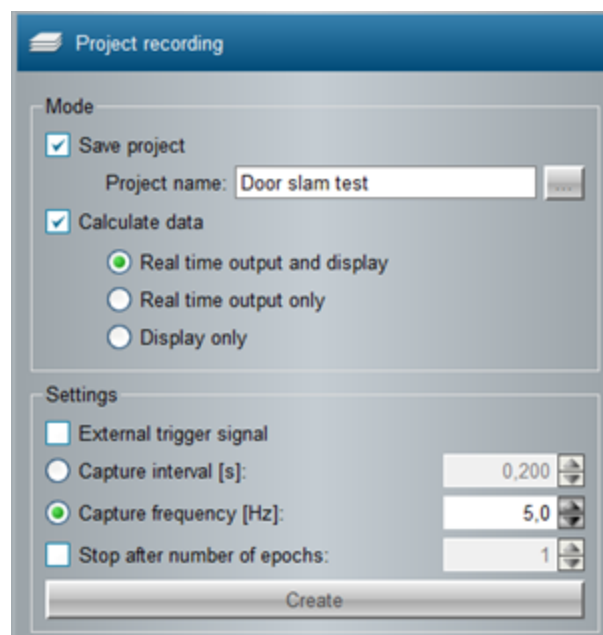


Figure 146: Dialog boxes for connection with cameras

In the input field *Project name* the project has to be given a name. When creating the project, a directory of the same name is created in which the session is saved. The path to this directory can be selected via the corresponding button "...". By default, projects are saved under `C:\AICON\MI-Projects`.

Evaluating the data and saving the measurement results usually only takes place after the recording is completed. By activating the activity box *Calculate data* the evaluation takes place simultaneously with

the recording. The data can only be displayed in MoveInspect Pilot (*display only*), only be exported via the real time interface (*real time output only*) or both displayed and exported via the real time interface (*real time output and display*).

The checkboxes *External trigger signal* and *External start signal* in the dialog box *Settings* are available only if these are supported by the cameras. In the checkbox *External trigger signal* it can be defined that the single capture times are given by an external signal. If the checkbox is deactivated, the capture times are defined by the frame rate setting. In the checkbox *External start signal* it can be defined that the capture may not start before an external signal is given (e.g. from a light barrier). If this checkbox is deactivated (and no external trigger signal is defined), the capture immediately starts after having clicked on *Start*.

By means of the input boxes *Capture interval* and *Capture frequency* it is possible to define the frame rate with which the session has to be captured. In the input field *Stop after number of epochs*, it can be specified if the measurement has to be automatically stopped after a certain number of epochs.

By clicking *Create* the cameras are prepared for the capture. After memory check for the project recording, the dialog box switches to the start of the project (Figure 147). A warning is emitted if one of the following conditions is met:

- Not enough memory for the selected number of epochs
- Less than five minutes recoding time possible for HF, less than ten minutes for HR or XR
- Less memory available than 300 MB

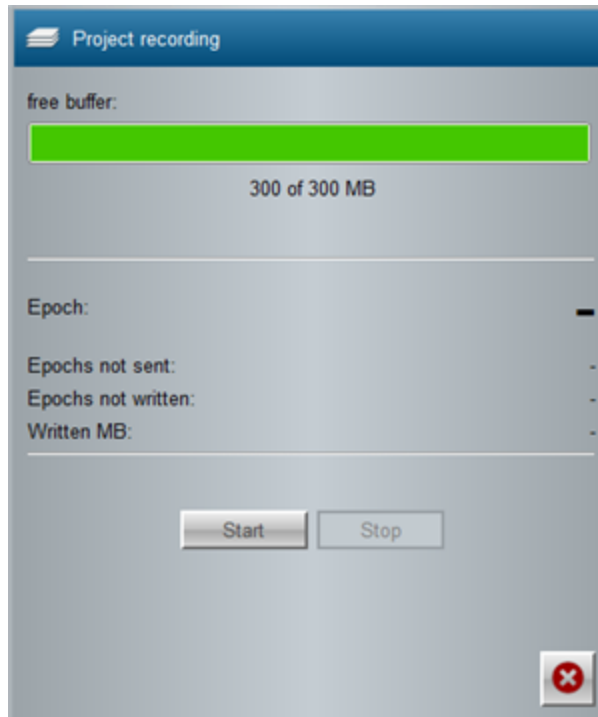


Figure 147: Dialog box after clicking *Create*

By clicking *Start* the capture is started. The capture can be interrupted and continued again by clicking *Pause*. During the capture the images are stored in the data carrier. If the data transfer rate of the captured images is higher than the writing rate of the data carrier, the images are first stored in a buffer. When the buffer is full, single epochs may be lost. The buffer level and the number of epochs and lost epochs is displayed in a window during the capture (Figure 147).

By clicking *Finish*, the capture is finished. A message appears asking whether or not the project has to be evaluated and exported directly (Figure 148).

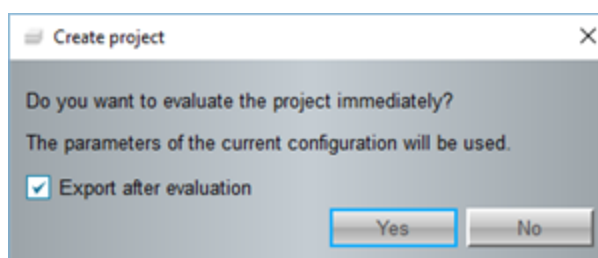


Figure 148: Creating a project at the end of a session



The project can be further processed in the menu *Projects*. Using this menu also allows to specify to process the projects at a later stage (section [Submenu item 'Project overview'](#)).

6.8.2 Project recording with image data

When the software is connected to image files, the dialog box *Projects* enables a project directly to be created from these image files (Figure 149). A project stores the epochs of a capture with all images and evaluated measurement results.

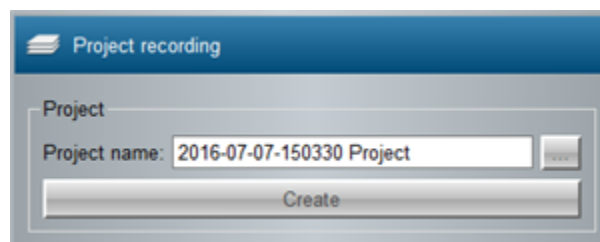


Figure 149: Dialog box *Project* in the submenu item *Sessions and projects*

Insert a name in the input field *Project name* the project. When creating the project, a directory of the same name is created in which the session is saved. The path to this directory can be selected via the corresponding button "...". By default, projects are saved under `C : \AICON\MI-Projects`.

By clicking *Create*, the image files are copied to the project directory and a project file for the measurement results is created (Figure 150). Then, the project can be further processed in the menu *Projects*.

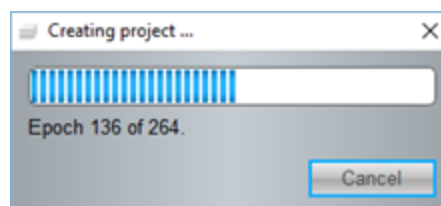


Figure 150: Creating a project

The measurement results are only calculated during the evaluation process based on the project configuration. After creating a project, a message appears asking whether the project should be directly evaluated and exported (Figure 148).



6.9 Submenu item 'Adapter points'

This submenu allows to calibrate the coordinates of adapter points with a probe. A window with the dialog box Probing with a table listing the adapter points appears (Figure 151).

In the dialog box Probing it is possible to configure the measurement with the probe in analogy to section [Dialog box 'Probing'](#).

The table lists all adapter points selected in the configuration. Points that were defined as Fixed during the adapter creation are not listed (see section [Create and edit an adapter](#)). For calibrating an adapter point, the point has to be selected first by marking the checkbox with a tick. In the following probing the selected adapter point is calibrated. The new point coordinates are used from the next measurement onward. After an adapter point was calibrated, the next point is selected automatically.

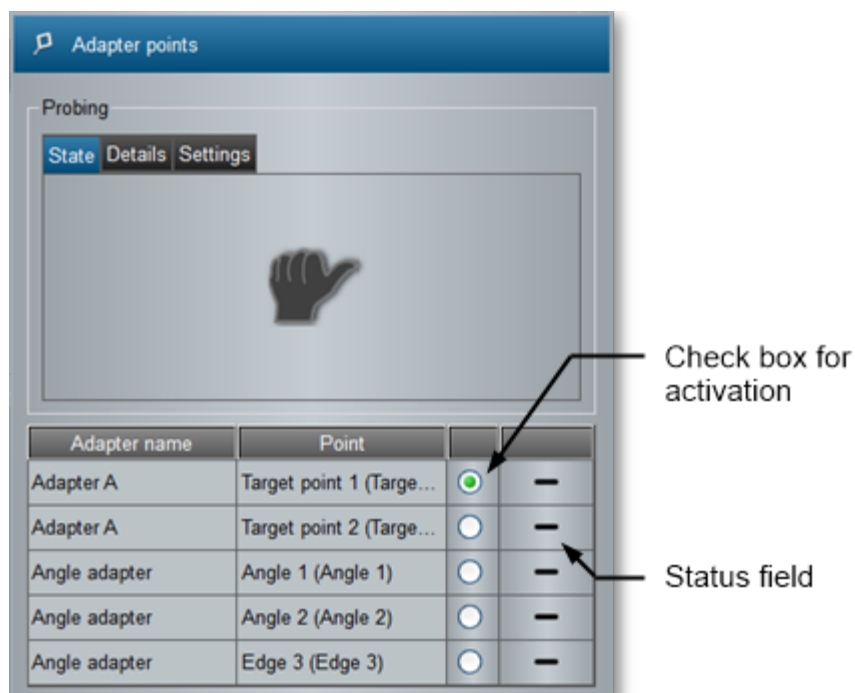


Figure 151: Submenu item *Adapter points*



6.10 Submenu item 'Probe tip calibration'

This submenu item allows to calibrate probe tips. It is also possible to check the current probe tip calibration.

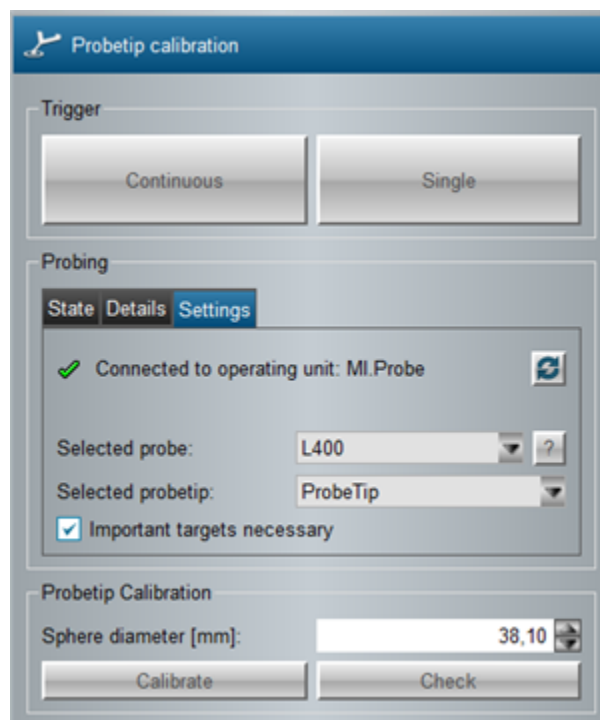


Figure 152: Submenu item *Probe tip calibration*

6.10.1 Dialog box 'Trigger'

In the dialog box *Trigger* it is possible to capture images from the cameras or from the data carrier, depending on the previously selected connection type.



Figure 153: Dialog box *Trigger*

By clicking *Continuous*, the images are captured in continuous epochs. By clicking the button again, the image capture is stopped. By clicking *Single*, the image capture for exactly one epoch is triggered. The number of the triggered epochs is displayed in the epoch counter of the [Camera tool bar](#).



6.10.2 Dialog box 'Probing'

In the dialog box *Probing* it is possible to configure measurements which were performed with the probe and the measurement status as well as details of the probe measurements are displayed.

Under the tab *State* the current state of the measurement of the MI.Probe is displayed. A successful measurement is signalled by a green thumb (Figure 154). If the measurement was not successful, a red thumb appears.

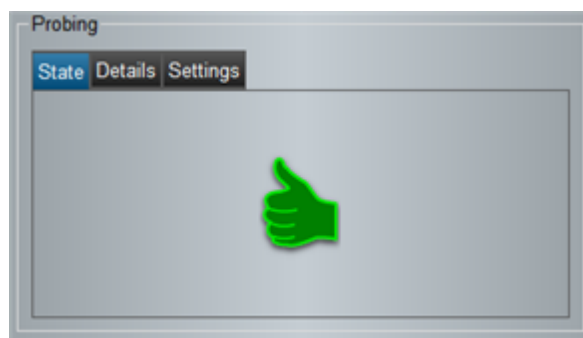


Figure 154: Dialog box *Probing*, *State* (here: Successful measurement)

Under the tab *Details* the measured targets are displayed. Here, a distinction is made between *Targets*, *High targets* and *Important targets* (Figure 155). Under *Targets*, the quantity of all measured targets on the MI.Probe is displayed. Under *High targets* and *Important targets*, the number of targets is displayed which were previously defined as such in the administration (section [Submenu item 'Probes'](#)). If fewer targets are measured than specified in the administration, the respective line is highlighted in red. Then, the measurement is not successful. In case of no important or high targets being defined in the administration, these are not listed in the *Probing* dialog box under the tab *Details*.

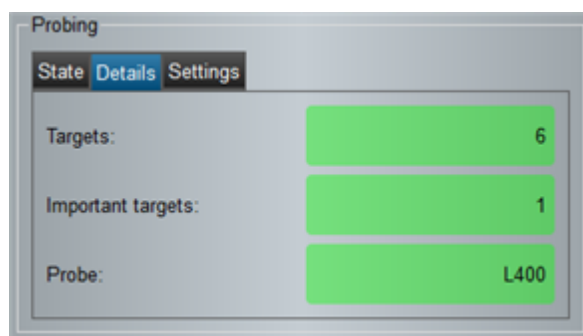


Figure 155: Dialog box *Probing*, display of details (here: successful measurement)

The tab *Settings* shows further parameters which can be set by the user. The operating unit status bar shows whether the software could successfully connect to the probe operating unit (Figure 156). When the connection was successful, a green tick is displayed, otherwise the *Operating unit query* can be activated to connect the probe with the software. The probe operating unit is previously selected in the configuration (see section [Tab 'Systems'](#)).

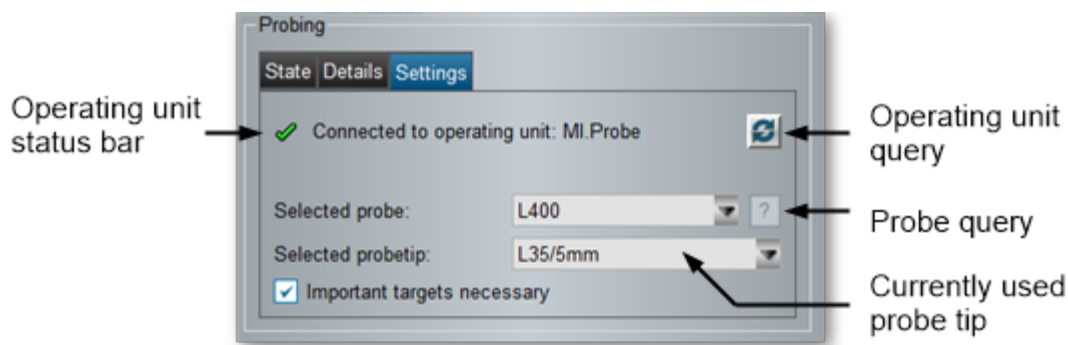


Figure 156: Dialog box *Probing, Settings*

The drop-down list *Selected probe* shows which of the existing probes shall be used for the measurement. When measuring with the MI.Probe, a change in the probe is automatically recognised and the drop-down list is updated correspondingly. Active probes are authenticated automatically on triggering, prompting the probe ID to be transmitted via the trigger signal. In the same way, it is possible to update the selection by clicking *query*. It is also possible to manually select the probe from the list. When measuring with a probe-group (see section [Tab 'Probe-group'](#)), the selection list serves to display the last recognised probe. Additionally, the measurement can be configured for the respectively selected probe (e.g. activating/deactivating the checkbox *Important targets necessary*). The probes of a probe group (MI.Probe minis) are recognised on the basis of their geometry.

The drop-down list *Selected probe tip* shows which probe tip is used for the current measurement. When changing the probe tip, always the currently used probe tip has to be selected.

The quality of the probe measurement can be influenced by the respective setting of *Important targets necessary*, the *minimum number of important targets* and the *minimum number of high targets*. These measurement parameters are to be specified for the probe in administration under [Submenu item 'Probes'](#). With the parameter *Important targets necessary*, it is possible to specify under the tab measurement whether the same measurement target which has been marked as important in the



administration must be among the measured measurement targets. In the case of the MI.Probe, this is the target near the probe tip. If the criteria defined by the parameters are not fulfilled, the probe measurement is invalid and is displayed in red in the coordinate table accordingly (see Figure 157). The coordinates of invalid measurement points are not transferred to the evaluation software connected with MoveInspect Pilot.



	No.	Name	Type	X [mm]	Y [mm]	Z [mm]	Sx [mm]	Sy [mm]	Sz [mm]	Rays
1	1006	Probe (triggered)	●	192.03	-32.40	-1231.74	0.05	0.02	0.10	---
2										

Figure 157: Invalid probe measurement

6.10.3 Dialog box 'Reference'

The dialog box *Reference Probetip Calibration* allows to select and activate a dynamic reference for the calibration of a probe (Figure 158). If the checkbox is activated and a reference is selected in the selection list, the coordinate system is defined anew with every record during the probe tip calibration, provided that the reference can be measured successfully. This option should only be used if a dynamic reference is absolutely necessary.

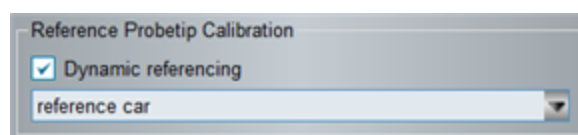


Figure 158: Selecting a reference in the dialog box *Reference Probetip Calibration*

During probetip calibration and with activated dynamic reference, the state as well as the details of the reference measurement are displayed (Figure 159). The section [Dialog box 'Reference'](#) gives more information about these tabs.

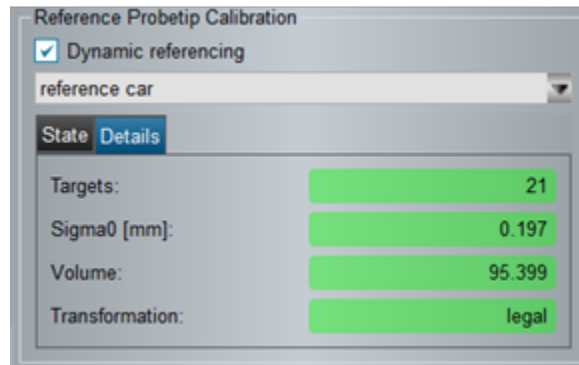


Figure 159: *State and Details* in the dialog box *Reference Probetip Calibration*

6.10.4 Dialog box 'Probe tip calibration'

By means of the dialog box *Probe tip calibration* the probe tip can be calibrated. Optionally, an already existing probe tip calibration can be checked. Prior to this, the diameter of the calibration sphere used for calibrating or checking the calibration has to be entered in millimetre (Figure 160).

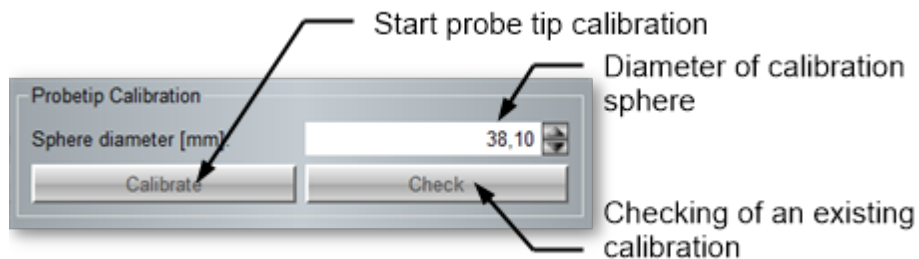


Figure 160: Dialog box *Probe tip calibration*



The recommended distance between camera system and calibration sphere is 1.5 m.



Figure 161: Recommended distance between camera system and calibration sphere

6.10.4.1 Calibrating a probe tip

With the option *Calibrate* the probe tip calibration is activated. The calibration requires a calibration sphere, its diameter has to be entered in the dialog box. The calibration sphere has to be probed with the probe tip to be calibrated. It is recommended to probe the positions on the sphere surface as shown in Figure 162; all in all, a minimum of 40 positions should be measured on the sphere surface. This can be carried out by single measurements on the sphere surface. Alternatively, the MI.Probe can be set into the scan mode (see [Button assignments](#)); 100 measurements and more can be quickly achieved with this setting. Furthermore, as many different probe tip directions as possible shall be applied during probing (orientation of the MI.Probe with respect to the sphere surface).

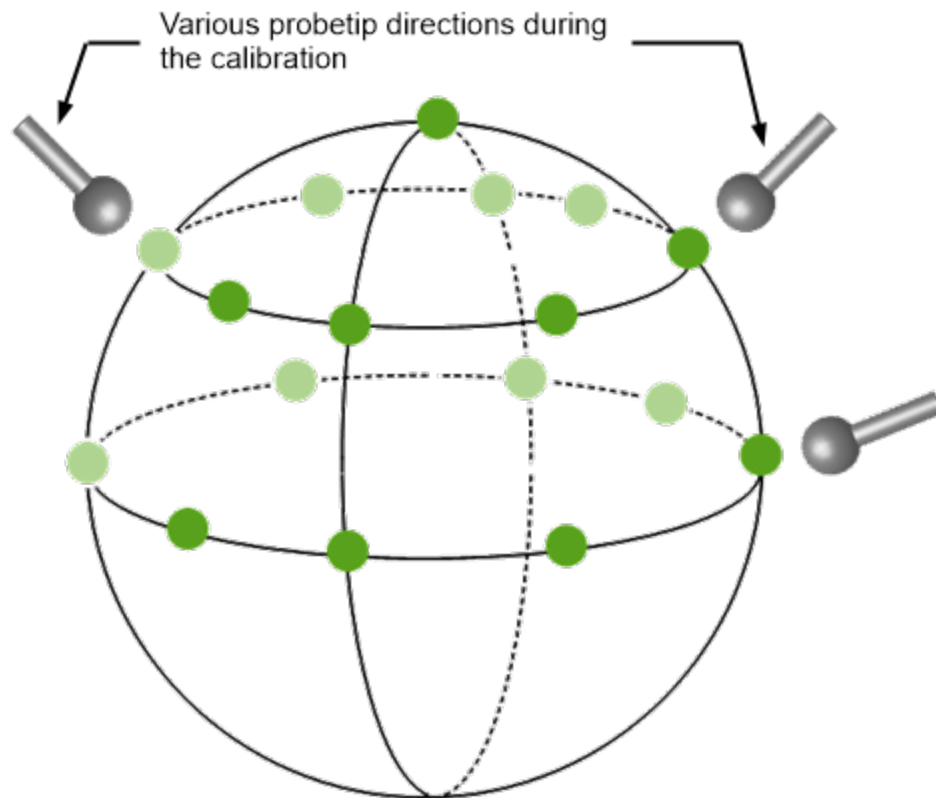


Figure 162: Probing positions for the calibration of a probe tip, measurement is triggered by pressing the trigger at the MI.Probe.

When clicking *Calibrate*, a dialog appears indicating the number of successful measurements and the status of the last measurement (Figure 163). The single probing positions are measured by pressing the trigger button at the MI.Probe.



Figure 163: Probe tip calibration: Display of the number of valid measurements and status of the last measurement

The software shows the successful probings on a virtual sphere surface (Figure 164). The probe tip's accuracy in the probe coordinate system in x, y and z direction is displayed in the fields *Sx [mm]*, *Sy [mm]* and *Sz [mm]*.

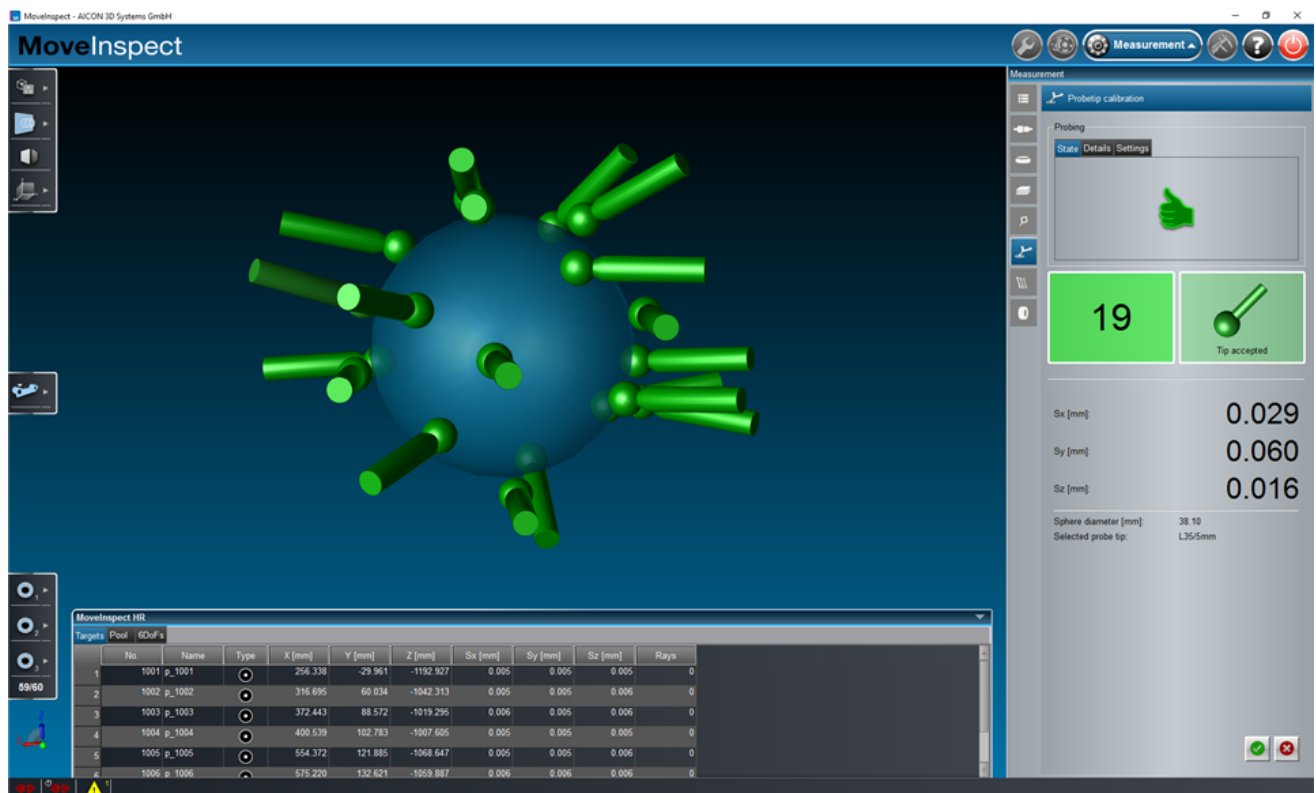
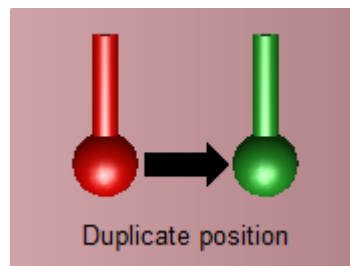


Figure 164: Probe tip calibration: Display of the measurements on the sphere, the number of valid measurements, the status of the last measurement and the display of results

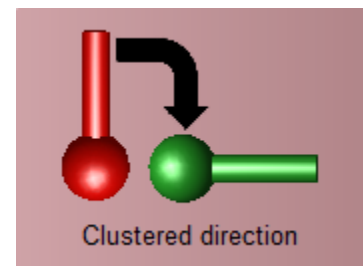
During probing, the orientation of the probe tip towards the sphere surface is checked. It is also checked if the probings are evenly distributed across the sphere surface. The user is informed when similar probe tip orientations have already been used in the probings. He is also informed when the measurements were made too densely, i.e. when the measured points are not evenly distributed on the sphere surface (Table 38).



Measurement accepted





Measurements with
this probe tip position
are existing already



Measurements with
this probe tip orientation
are existing already

Table 38: Status of probings during probe tip calibration

In the 3D view, the corresponding probing points are highlighted in red. Measurements which are marked in this way are not used in the calibration calculation. After the calibration have been calculated successfully, it can be saved by clicking  or cancelled by clicking . After completion of using the calibration assistant, a dialog is displayed in which a protocol of the calibration can be viewed and saved.



6.10.4.2 Checking a probe tip calibration

By means of the option *Check*, it is possible to check a probe tip calibration which was currently made or has already been saved. When clicking *Check*, a dialog is opening in which the number of successful measurements and the status of the last measurement is displayed. In addition, a tolerance value has to be entered and if this value is exceeded the result of the checking is coloured in red.

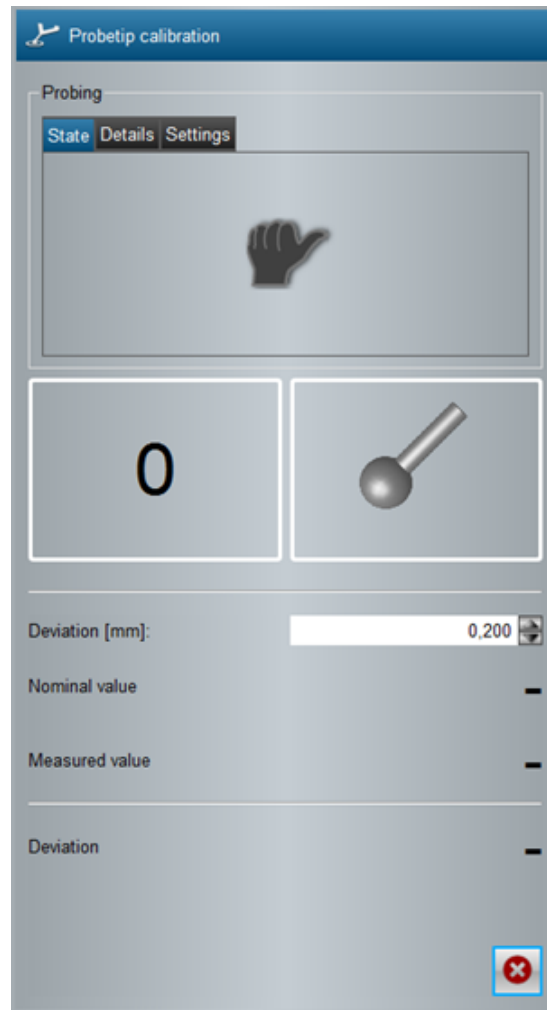


Figure 165: Checking of the probe tip calibration:
Input and display of the user-specific tolerance

The programme expects the probing of 5 positions on the calibration sphere which have to occur according to the scheme shown in Figure 166. The single probing positions are measured by pressing the trigger button at the MI.Probe.

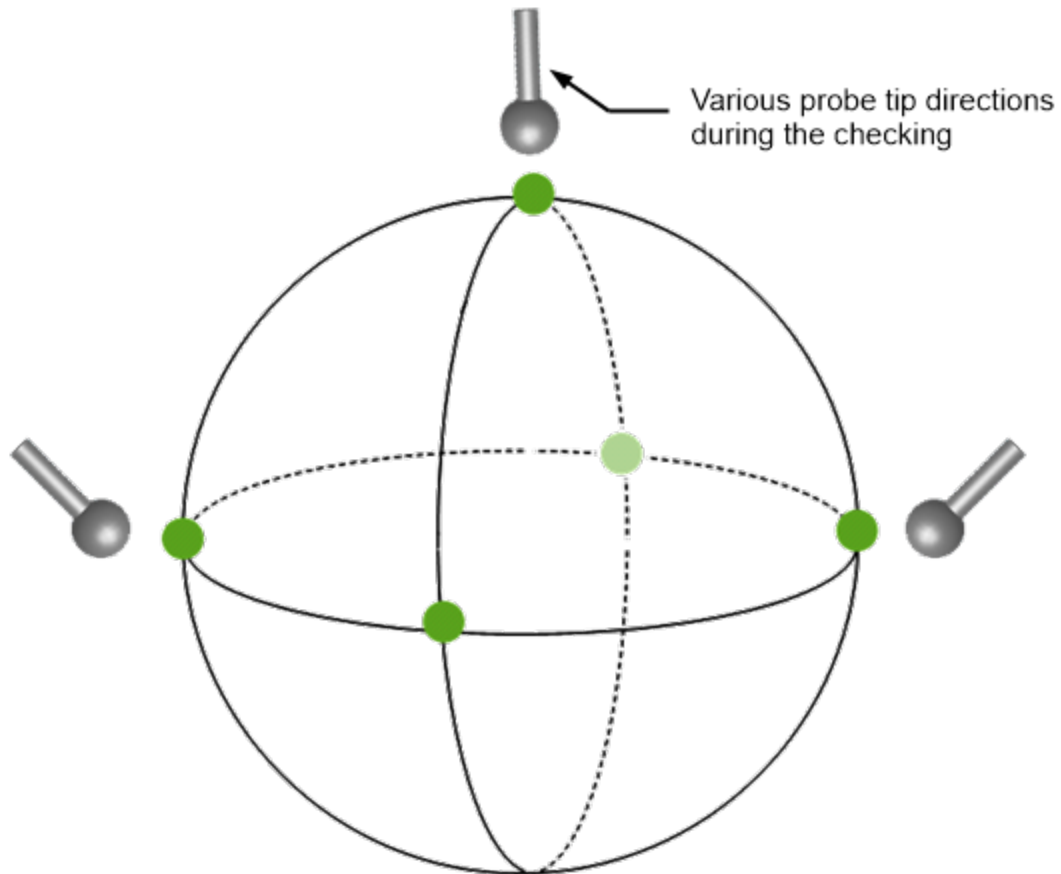


Figure 166: Probing positions for checking a probe tip calibration, the measurement is made by activating the trigger button at the MI.Probe

In the software the successful probings are displayed on a virtual sphere surface (Figure 167).

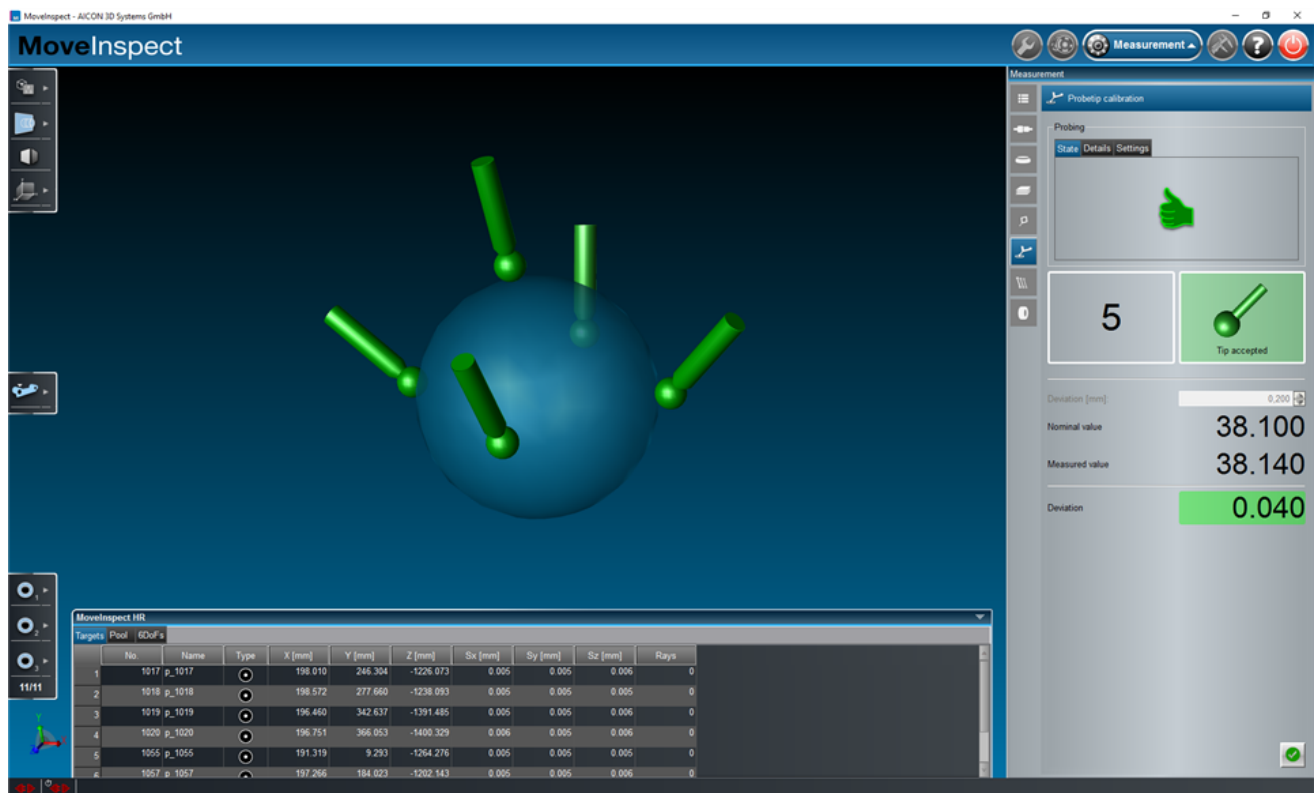



Figure 167: Successful check of a probe tip calibration

The sphere diameter is calculated and the result is compared with the entered nominal value after the last five probings were made. By clicking , the user can leave the dialog and the main window of the probe tip calibration appears. In addition, a dialog window to view and save a protocol of the probe tip verification is displayed.



6.11 Submenu item 'Accuracy check'

The accuracy check serves for checking the total system. For this purpose, a scale bar is selected from the list in the dialog box *Scale bar accuracy test*. The desired tolerance can be entered in the field *Tolerance*. Then, *Check* has to be activated for starting the Accuracy check (Figure 168).

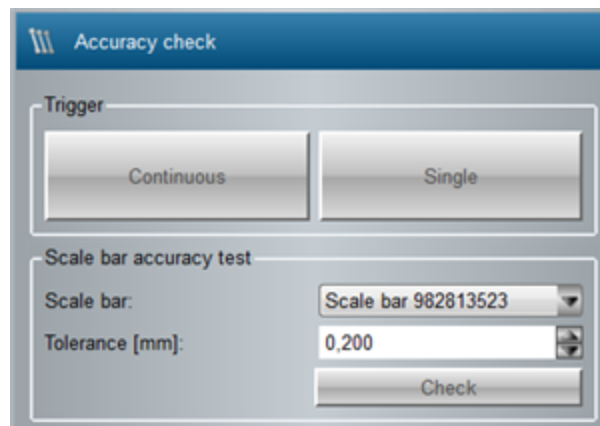


Figure 168: Dialog box *Scale bar accuracy test*

Hold the scale bar at the position to be checked in the measuring volume and measure by single trigger with a probe operating unit or by clicking *Single* in the dialog box *Trigger* (Figure 169). The result is the deviation of the measured length between both targets (actual length) from the reference length of the selected scale bar (nominal length). In the dialog window all lengths of the scale bar are displayed. The measurements are automatically allocated to the respective nominal length. It is not necessary to adhere to a particular sequence of the distance measurements. The number of performed measurements is displayed for each distance in the dialog window.

The result is subdivided into the values *Current* and *Mean*. Depending on the preset tolerance, the results are highlighted in green, yellow or red (Figure 169). The result is displayed in green if all measured distances are within the preset tolerance. The result is displayed in yellow as soon as a measured distance results in a deviation close to the specified tolerance (deviation between 85% and 100% of the tolerance value). As soon as a measured distance deviates by more than the given tolerance value from the nominal value, the result is displayed in red.

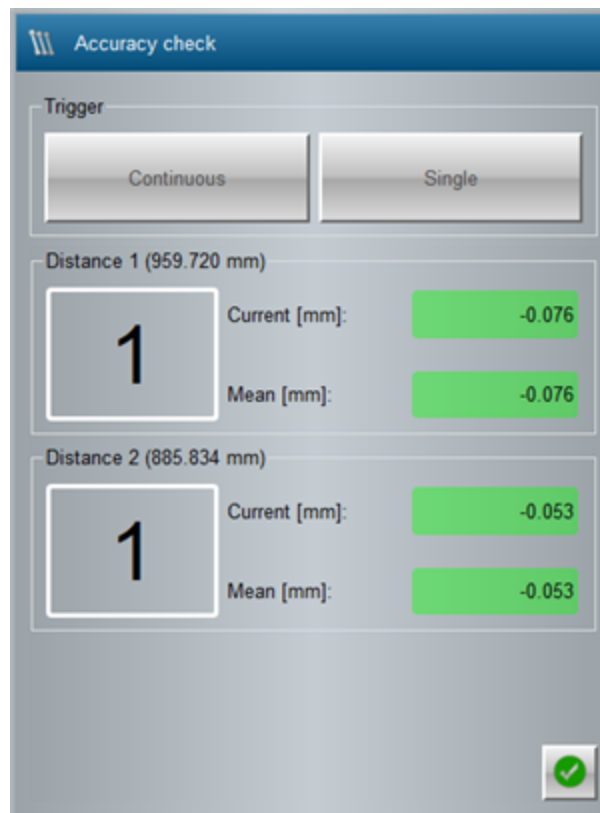


Figure 169: Display of the deviation from the nominal distance

By closing the accuracy check, a dialog window appears to view and save a protocol.

6.12 Submenu item 'Wheel calibration'

The wheel calibration allows to redetermine the 6DoF target point of the wheel adapter which by measuring the wheel movement is referred to a fixed wheel axle point. This requires a 6DoF adapter which is defined in the adapter menu (section [Submenu item 'Adapters'](#)). In addition, the Y-axis of the local wheel coordinate system should approximately point in the Y-direction of the reference coordinate system (according to current vehicle and driving axle coordinate systems).

For calibrating the wheel axle, the adapter or the wheel is rotated at least once around its own axis. The circular plane resulting from this movement and its corresponding normal are determined on the basis of the target point coordinates measured during the rotation of the adapter. The result of the wheel calibration is a new 6DoF reference point which can be shifted along the rotating axis (normal of circular plane) by entering an offset. In this way it is possible to determine for example the actual wheel centre as fixed 6DoF reference point. The crucial factor for the algebraic sign in the offset input is the direction of the Y-axis of the reference system. The offset value is deducted, i.e. a positive offset causes a correction along the rotating axis in the negative Y-direction of the reference coordinate system, and accordingly a negative offset causes a correction in the positive Y-direction.

For starting the wheel calibration, the respective adapter and its 6DoF reference point has to be selected (Figure 170). The image capture is activated using the trigger buttons *Continuous* or *Single*.

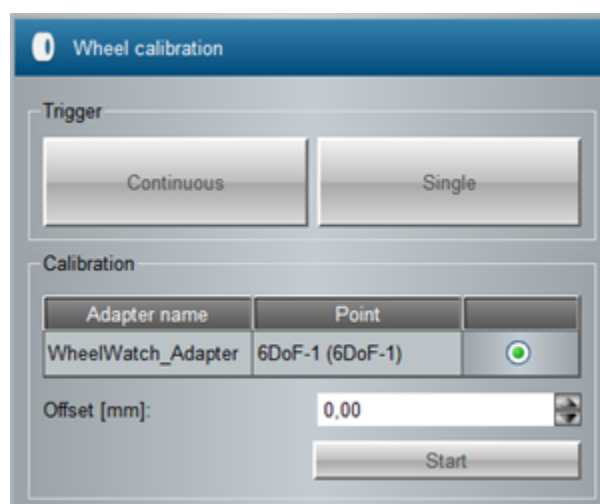


Figure 170: Menu item *Wheel calibration*

By clicking *Start*, the calibration assistant is started (Figure 171).

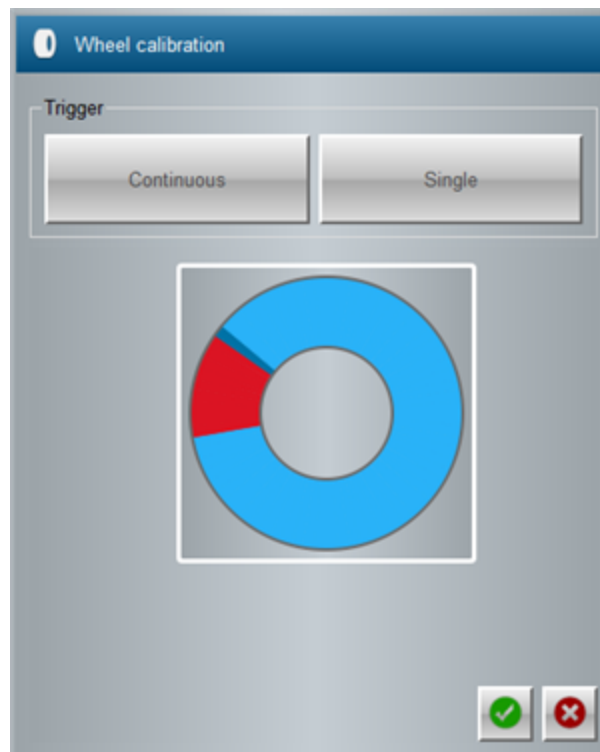


Figure 171: Wheel calibration assistant

The circular movement to be carried out is subdivided into 72 segments, in each of which at least one measurement has to be performed during the calibration. This process is online reflected by the colouring (Table 39). The process automatically stops when all segments have been captured.

Colour	Description
Light blue	Measurement performed in the segment
Dark blue	Current segment in which the wheel axle adapter is being measured
Red	Measurement is missing in the segment

Table 39: Colour display in the wheel calibration assistant

By clicking *Calibrate*, the calculation is started. For assessing the calibration result, the accuracy of the circle (sigma rotation) and the plane of the circle points (sigma plane) are displayed.

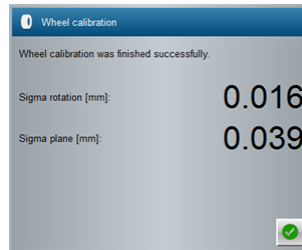


Figure 172: Result of wheel calibration

The newly arisen 6DoF reference point is saved for the adapter and can be seen in the menu *Adapters* under *Configuration* (see Figure 173 and section [Submenu item 'Adapters'](#)).

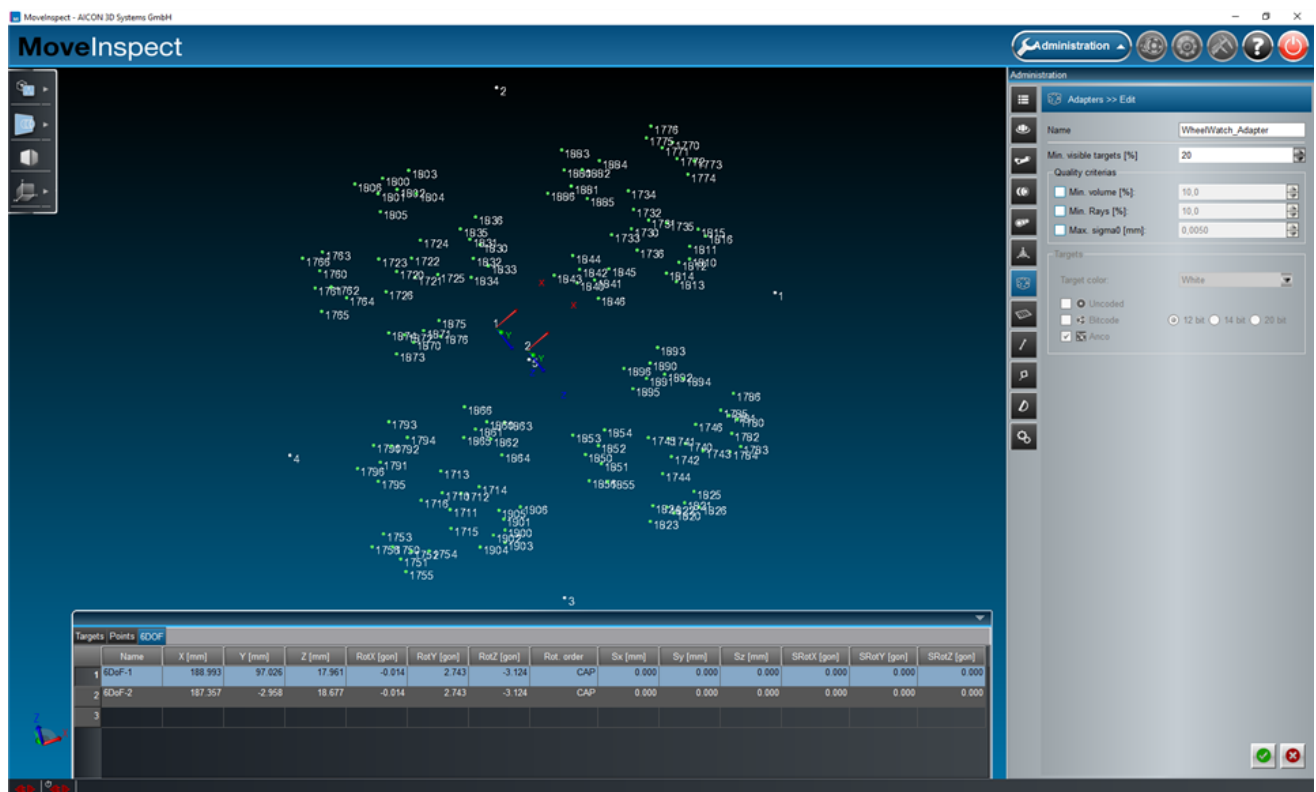


Figure 173: Resulting 6DoF reference point

7 Menu item 'Projects'

This menu item allows to evaluate and manage recorded measurements in projects.

A project includes all epochs of a measurement with its images. After the evaluation, the project also includes the calculated measurement results.

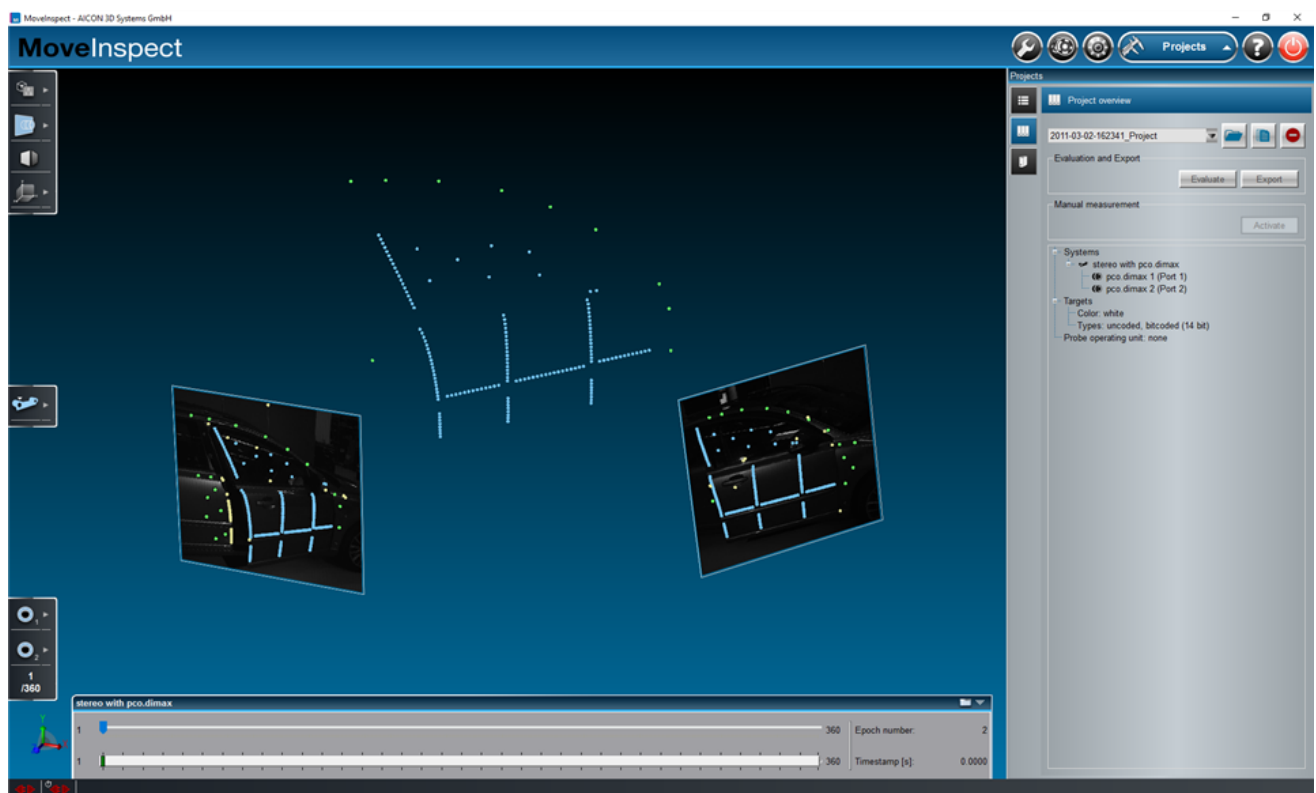


Figure 174: Menu item *Projects*

The activity window of the menu item *Projects* consists of the submenu items:

- *Project overview*
- *New project*

Submenu item	Description
<i>Project overview</i>	Opening, evaluating and exporting existing projects.
<i>New project</i>	Creating new projects from sessions or image files



In addition to the activity window and the 3D tool bar, the data window with epochs and tables as well as the camera tool bar and the measurement parameter tool is displayed.

7.1 Submenu item 'Project overview'

In the submenu item *Project overview*, it is possible to open, evaluate and export existing projects. Several projects can be opened at the same time.

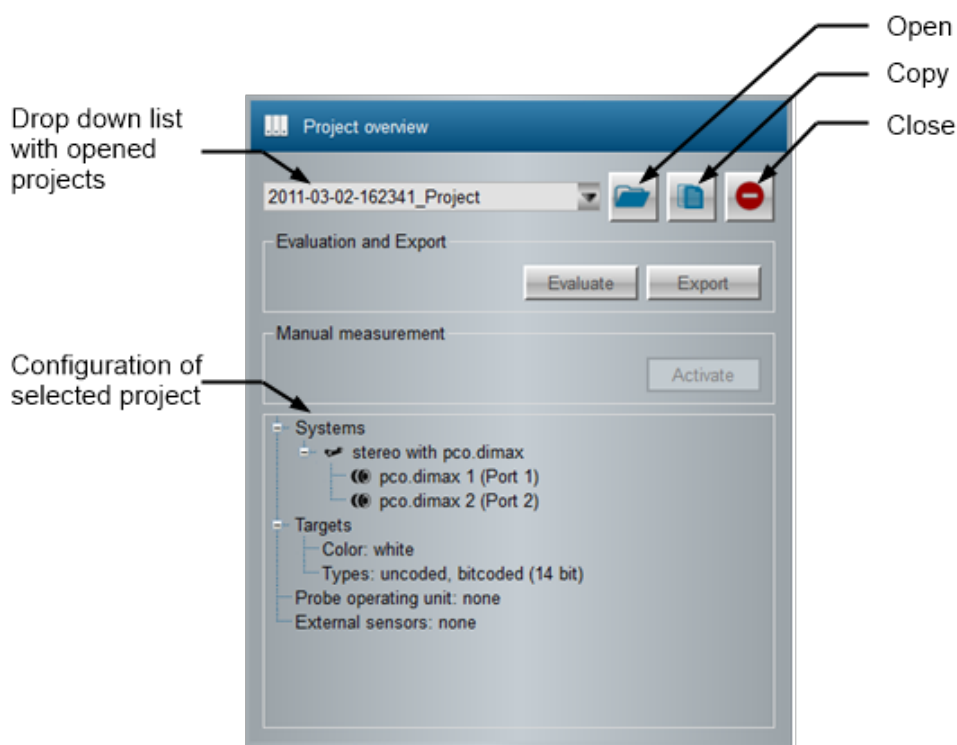


Figure 175: Submenu item *Project overview*

The drop-down list shows all open projects. The project selected there is displayed in the 3D window with its epochs.

Open an existing project by clicking *Open*. Each project is saved in a directory of its own. To open a project, select the corresponding file with the ending **.mpf* or **.mpfx* (MoveInspect Project File) in this directory.

Via *Close* the selected project can be closed. It is deleted from the list of open projects. The contents of the project directory, however, are not deleted. The project directory is usually located under C:\AICON\MI-Projects, its folder has to be deleted manually.

Via *Copy* the selected project can be saved in the project directory using another name. Thus, several evaluations can be carried out and saved with different measurement and camera parameters.

7.1.1 Dialog box 'Evaluation and Export'

Clicking *Evaluate*, all epochs of the selected project are evaluated according to its configuration.

For the evaluation process, each project has its own configuration with its own measurement and camera parameters. This configuration initially is a copy of the active configuration of the menu item *Measurement*. A project generated from image files acquires the active configuration at the time of the project generation. Using the [Camera tool bar](#) and the [Measurement parameter tool bar](#), the original measurement and camera parameters can be adjusted for the evaluation of the selected project. Any changes made to the measurement and camera parameters do only apply for this project. The results of the evaluation are saved automatically.

Afterwards, the evaluated project can be exported (click *Export*). Various formats are available for the export (Figure 176). For example, a project file for the AICON 3D Studio can be generated. This file with the file extension *.apf can be opened in the AICON 3D Studio for further processing and an analysis of the project. When exporting a project file it can be determined whether in addition to the project file also the measurement images should be made available for further evaluation purposes. It can be specified whether none, all or only the images of the first epoch are to be exported.

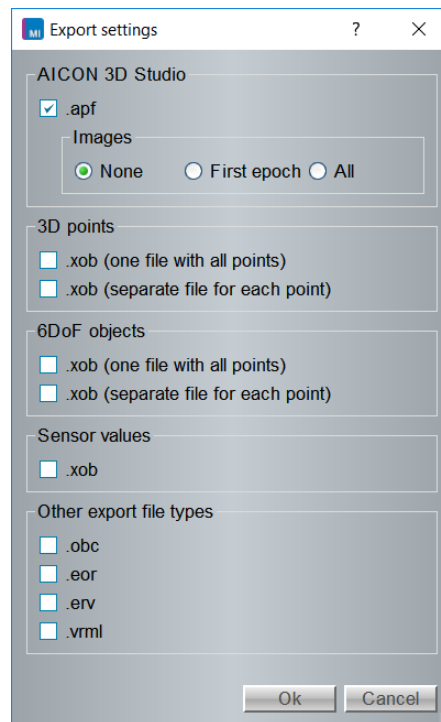


Figure 176: Export settings

In addition, `XOB files` can be exported. The export of `XOB files` is divided in

- 3D points
- 6DoF
- External sensors (if available)

To export the measured 3D points or 6DoF objects, there are two options for each:

- Export all results to a single XOB file,
- export the results for each point (or each 6DoF object) to an separate XOB file.

The `XOB format` offers the possibility to export files which can be configured freely. A file configuration which has been used previously can be saved in a so called template. This can be specified in the export settings and managed with *Settings* (Figure 177).

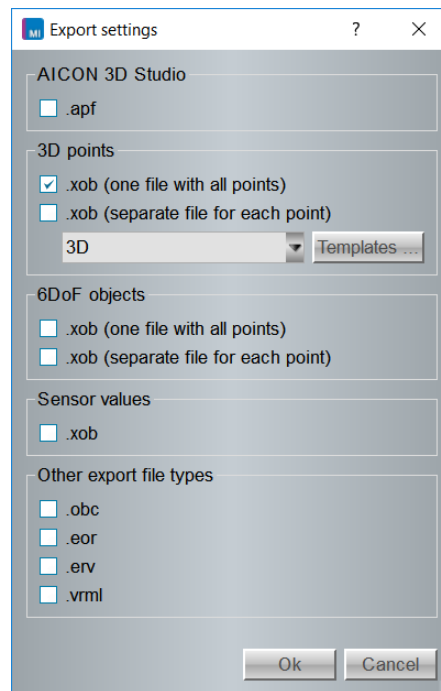


Figure 177: XOB export settings

Clicking *Templates* opens the *XOB template maintenance* window in which new templates can be created and existing templates can be processed or deleted (Figure 178).

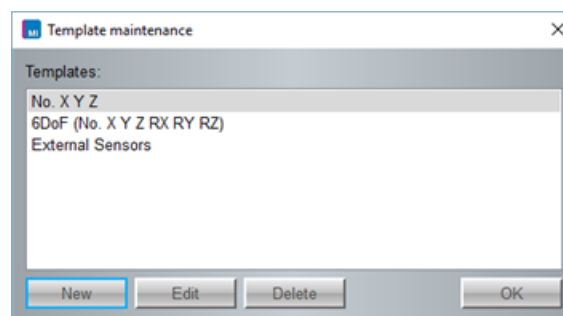


Figure 178: XOB template administration

The generation (*New*) or adjustment (*Edit*) of a template is carried out in the *Template Parameters* window (Figure 179). In this dialog the elements to be exported are selected and the parameters, such as for instance the decimal separator or the data separators, are specified.

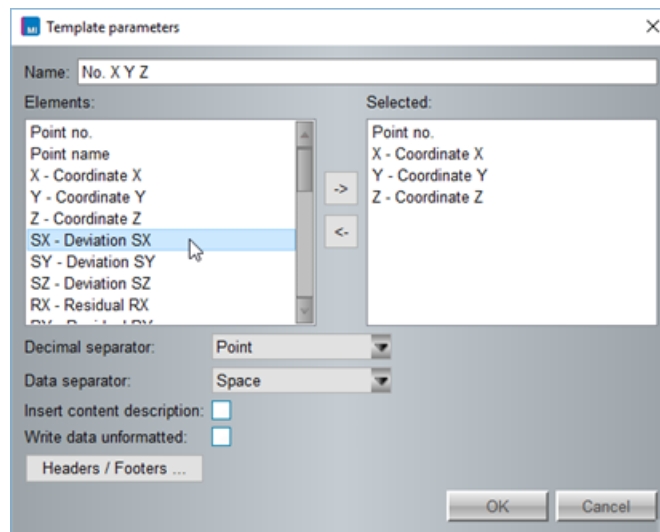


Figure 179: Dialog *Template parameters*

The elements can either be added to or deleted from the template by a double click the desired element or by clicking the arrows.

The following additional files can be exported:

- EOR files, containing the external orientation (EOR) of adapters used
- OBC files, containing the point numbers, coordinates and standard deviations of the 3D points in the file format described under [OBC format \(object coordinates\)](#)
- VRML files for the visualisation of measured trajectories
- ERV files describe the trajectories on the basis of the position and velocity of the measured points

7.1.2 Dialog box 'Manual measurement'

The dialog box *Manual measurement* allows to measure any points with the mouse (Figure 180). This function generates starting points for the tracking or surfacing.



Figure 180: Dialog box *Manual measurement*

For the manual measurement, trigger either an image acquisition under *measurement* or select an epoch under *projects*. The manual measurement can only be activated in a 2D view with camera images and can also only be carried out in a 2D view. An overview displays all the camera images as well as a single image view in which only the current image of the selected camera is displayed. To open the camera image view see section [Display of 3D view / camera images](#). By clicking *Activate* the manual measurement is activated. While the manual measurement is active, no further image acquisition can be prompted under measurement.

When pressing the *Alt* key, the mouse cursor changes to a crosshairs (Figure 181). With this crosshairs, the user has to click the point to be measured in the image as precisely as possible. This point has to be measured in another camera in the same way. For finding the point in the other images more easily, a line is displayed on which the point to be measured has to be located (Figure 182).

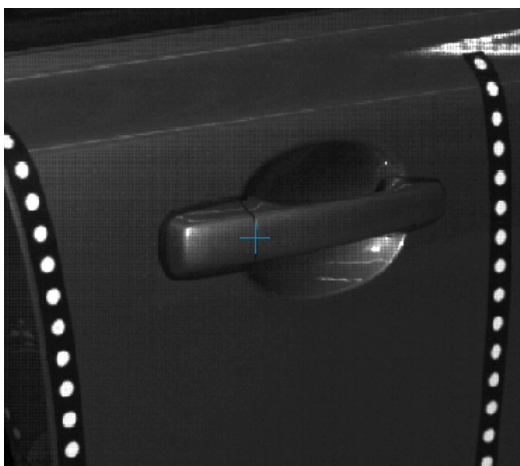


Figure 181: Manual measurement in image 1

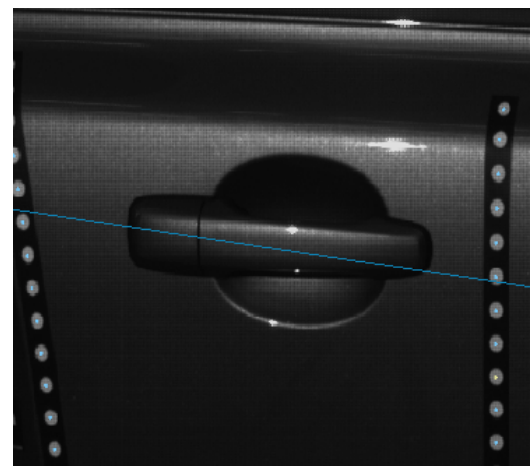


Figure 182: Manual measurement in image 2

After measuring the point in the second image, its 3D coordinates are determined and displayed in

table *Pool*. If no further points are to be measured, the manual measurement is finished by clicking *Deactivate*.

7.2 Submenu item 'New Project'

In the submenu item *New project*, it is possible to create new projects from existing sessions or images files.

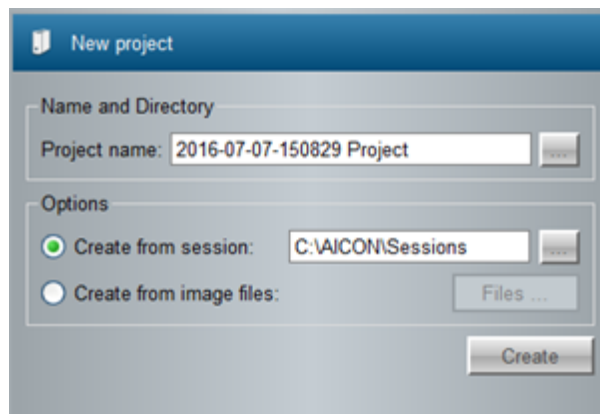


Figure 183: Submenu item *New project*

Insert a name for the project in the input field *Project name*. The project is saved in a directory with this name. The path to this directory can be selected via the corresponding button "...". By default, projects are saved under `C:\AICON\MI-Projects`.

The dialog box *Options* allows to select whether the new project is created from a session or from image files. If the option *Create from session* is selected, select the desired session as a file with the ending `*.session` via the file selection button "...". If the option *Create from image files* is selected, select the desired image files for each camera of the current configuration as well as the original capture interval (see section [Dialog box 'Connection'](#)). By clicking *Create*, the project is created and opened.



7.3 Epoch and data window

The menu item *Projects* includes an epoch and data window. The part of the data window can be maximised and minimised.

7.3.1 Epoch window

The epoch window allows to navigate through the epochs of a project. For this, a slider and a selection bar is provided.

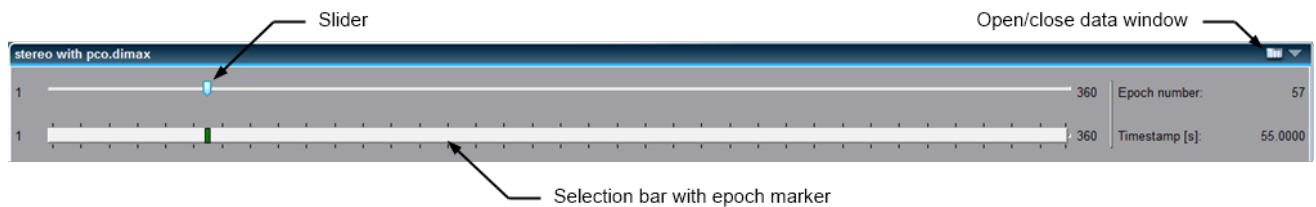


Figure 184: Epoch window in the menu item *Projects*

The selection bar determines the epoch interval within which the user can navigate with the slider. The beginning and end of the slider relate to the beginning and end of the epoch interval. The epoch interval is determined by the size and position of the selection bar. The size and position can be changed by using the mouse function drag-and-drop (Figure 185). The position of the current epoch in the overall project is specified by the green marker within the selection bar.



Figure 185: Enlarging and shifting the selection bar with drag & drop



7.3.2 Data window

The data window is displayed above the epoch window. It can be opened and closed with a button (Figure 186).

The data window includes the tables *Measurement*, *Pool* and *6DoFs*. When the functions surface measurement and tracking are activated or external sensors are used, additionally the tables *Surface*, *Surface positions*, *Tracking positions* and *External sensors* are displayed.

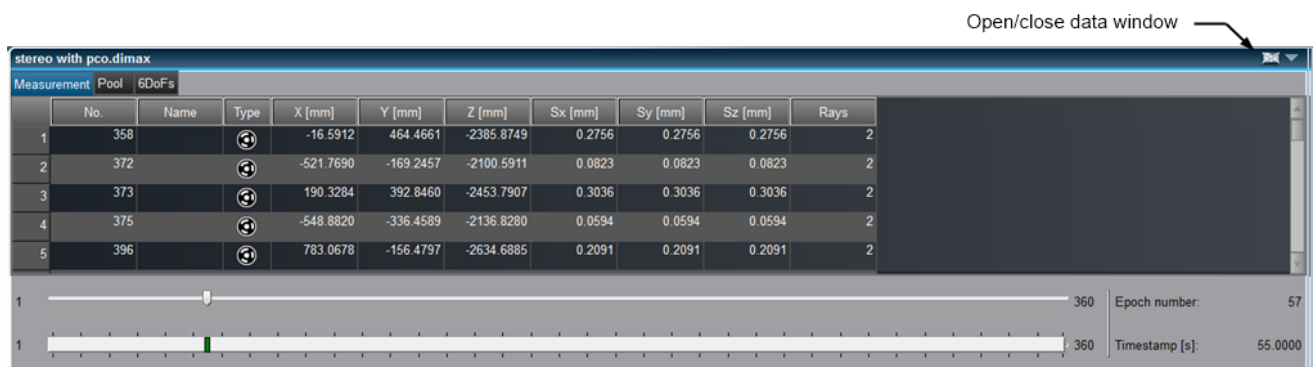


Figure 186: Data window in the menu item *Projects*

8 Menu item 'About MoveInspect Pilot'

The dialog box *About MoveInspect Pilot* (Figure 187) shows the current software version of MoveInspect Pilot and offers access to the online help, the user manual, a quick guide, the update info and the license data.



Figure 187: Dialog box *About MoveInspect Pilot*

Clicking *Online Help ...* opens the HTML online help in the standard browser. Supported browsers are Mozilla Firefox, Google Chrome, Opera, Internet Explorer and Microsoft Edge. The user manual in PDF format is opened by clicking *Manual*. Clicking *Quick guide* opens the short guide of MoveInspect Pilot, giving a brief description of the typical operating sequence with the software. *Update-Info...* displays information about the version changes of the software.

Clicking *License ...* opens a dialog window with the license details (Figure 188).

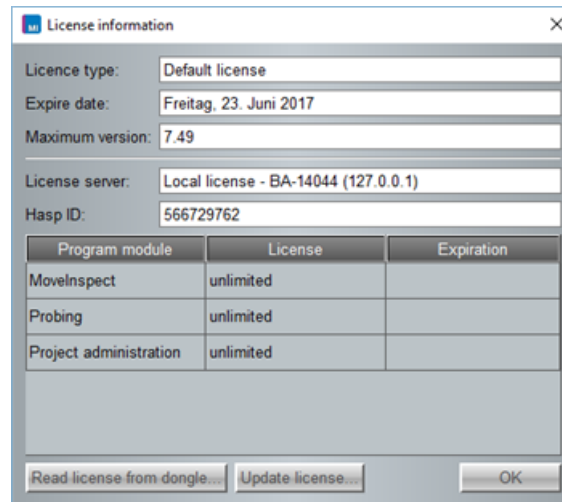


Figure 188: Dialog *License information*

The license type, the expiry date, the maximum version, the license server, the Hasp ID and the unlocked programme modules are displayed. Clicking *Read license data*, the dialog additionally offers the possibility to save the current license details of the connected dongle as a *.c2v file. Clicking *Update license*, the dongle license is updated with a *.v2c file.

By clicking *OK*, the dialog is closed.

9 Annex

9.1 Troubleshooting

9.1.1 Monitor resolution

► Problems with monitor resolution (e.g. icons are too small)

When using a laptop with a screen resolution of 4K may cause problems with the display within the MoveInspect Pilot software, e.g. non-customised font, icons that are too small or cut operating elements. The following steps have to be carried out:

1. Right mouse click on the icon of the MoveInspect software. Open the file location with the software files.

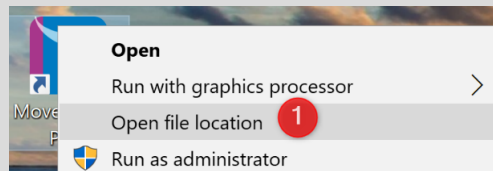


Figure 189: Menu item *Open file location*

2. Right mouse click on `MoveInspect.exe`. Click the menu item *Properties*.

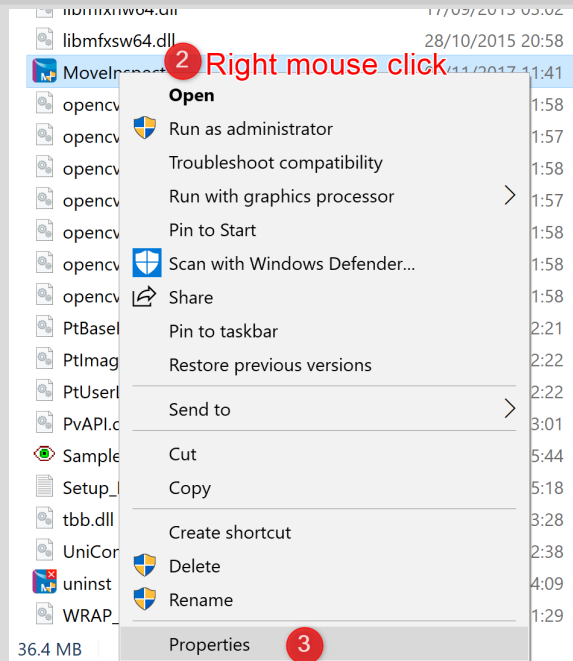


Figure 190: Menu item *Properties* of *MoveInspect.exe*

3. Click the tab *Compatibility* and select the option *Override high DPI scaling behavior*. Then select *Scaling performed by System*. Click *Apply*, then click *OK* and start the MoveInspect software.

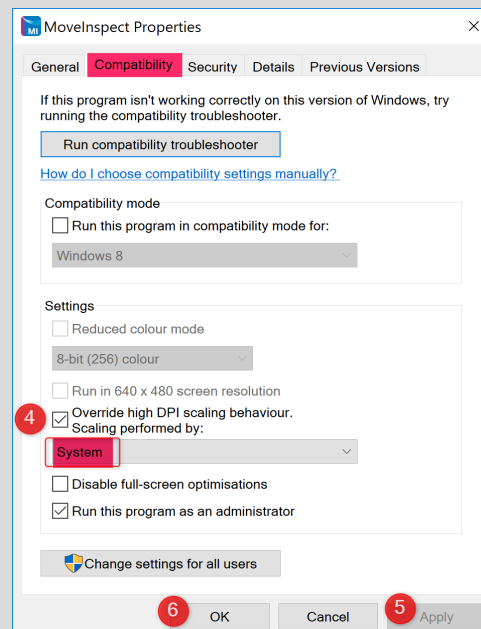


Figure 191: Settings in the tab *Compatibility*



9.1.2 Calibration

► Scale bar calibration fails - scale bar is not measured

Please check at first, if the correct calibration equipment has been selected.

Especially after a transport of the device it may happen that the initial orientation of the system is too bad and that the scale bar points cannot be assigned. In this case, a scale bar calibration with cross has to be carried out to determine the initial orientation (see as well [Determination of the initial orientation](#)). The following steps have to be carried out:

1. Start the menu *Calibration*.
2. Open the submenu item *Camera system and settings*.
3. In the dialog field Calibration equipment, activate and select cross.
4. Start the calibration and follow the instructions of the calibration assistant.

► Scale bar calibration fails - the default deviation of the calibration is too high

If the default deviation of the calibration is too high, this can have various causes:

- Please check at first, if the correct calibration equipment has been selected and if the scale bar distances are stored correctly in the software.
- The targets and/or the camera glasses are soiled. Please clean the targets and/or the camera glasses (see section [Cleaning](#)).
- The cameras' exposure time is set incorrectly. Check the settings with help of the mode Image brightness (see section [Dialog box 'Mode'](#)) and reset the image brightness and the gain, if necessary.
- Especially after transport of the device it may happen that the initial orientation of the system is too bad and that the scale bar points cannot be assigned. In this case, a scale bar calibration with cross has to be carried out to determine the initial orientation (see as well [Determination of the initial orientation](#)). The following steps have to be carried out:

1. Start the menu *Calibration*.



2. Open the submenu item *Camera system and settings*.
3. In the dialog field *Calibration equipment*, activate and select cross.
4. Start the calibration and follow the instructions of the calibration assistant.

If the calibration still fails after having carried out the above-mentioned procedures, please carry out the calibration with expert parameters and activate all parameters (see section [Dialog box 'Expert parameters'](#)).



9.1.3 HR/XR camera connection

► Connection with cameras is not possible

Please check the following error sources:

- is the syncbox connected to the PC and switched on?
- Are the cameras correctly connected to the syncbox?
- Has the correct configuration been selected in MoveInspect Pilot? Check the settings in the configuration, including the camera settings.
- Has the camera driver been installed correctly with the MoveInspect Pilot setup?
- Is the driver of the network interface card up to date? For Intel network interface cards, the recommended driver can be found on your USB data carrier.
`Driver\Network adapter\Intel® Network Adapter Driver for Windows 7 and Windows 10 PROWinx64.exe`
- Are the settings of the network adapter correct? After Windows updates, the settings might be reset. To adjust the settings, open *Network Connections* and open here *Properties* of the network adapter via the context menu.
 - In the tab *Networking* under used elements just select „*Vimba GigE Vision Filter Driver*“ and „*Internet protocol Version 4 (TCP/IPv4)*“.
 - Click *Configure* and open the tab *Advanced*:
 - Jumbo Packet: Set to 9014 Bytes or to the available maximum value
 - Transmit Buffers: Set to 512 or to the available maximum value
 - Receive Buffers: Set to 512 or to the available maximum value
 - Interrupt Moderation Rate: Extreme
 - Select „*Internet protocol Version 4 (TCP/IPv4)*“ and click *Properties*
 - IP address: 169.168.100.1
 - Subnet mask: 255.255.255.0
- Is the firewall deactivated for the network interface card?
- Does the programme `GigE-IPConfig` (`ipconfig.exe` in the MoveInspect Pilot installation directory) display all cameras?
 - No camera is displayed. Please check again the above-mentioned points.



- Only some cameras are displayed. Please check the IP addresses of the network adapter and of the cameras. The IP address of the network adapter must not be identical with the IP address of a camera. In addition, the IP addresses have to match each other, i.e., the first three groups of the IP address have to coincide, the fourth group of the IP address of the network adapter has to be smaller than and different from the cameras' addresses. The subnet mask has to be identical for network interface card and cameras. Use the address space 169.254.100.xxx and the subnet mask 255.255.255.0.
- If still not all cameras are recognised, check the above-mentioned points one more time. After that, exchange the connection of a camera that is not displayed for the connection of a camera that works to check the ports of the syncbox.
- Do the cameras provide images with the programme `AICON SampleViewer` (`SampleViewerAICONx64.exe` in the MoveInspect Pilot installation directory)?

► Cameras do not provide images

Please check the following issues:

- Reset the Syncbox. Switch it off and on again.
- Are the camera cables connected to the syncbox in the correct order? Camera 1 with port 1, camera 2 with port 2, etc. Check the port information in the MoveInspect Pilot configuration.
- For the *Streambytes per Second*, there is a suitable value set under *Administration - Environment - Hardware*. For a singular system, the value 120.000.000 is recommended.
- Please check also the issues under *Connection with cameras is not possible*.



► Data transfer is interrupted, cameras get lost

This may have several causes:

- The network adapter is incorrectly set.
- The GigE filter driver has been installed incorrectly or is not activated.
- StreamBytesPerSecond is set too high.
- WLAN is activated and causes conflicts with the data transfer.
- CPU is busy.
- Cable is defect or no CAT5 or CAT6 cable is used.

For correct settings of the network adapter and its setup in MoveInspect Pilot see *Connection with cameras is not possible*.

If the listed procedures do not solve the problem, please contact the Hexagon Commercial Office (Hexagon CO) responsible for your country.

9.1.4 XR8 temperature control

► Cameras do not reach a stable temperature

The camera system first has to adapt to the ambient temperature. Switch off the camera system and wait at least half an hour before you switch it on again.

Check the set temperature range of the ambient temperature under *Administration - Environment - Hardware* and adapt it to the current conditions (see section [Tab 'Hardware'](#)).

9.1.5 MI.Probe

► MI.Probe cannot be switched on

Make sure that the USB cable is disconnected from the MI.Probe.



Press and hold the trigger button for at least 10 seconds until LED in the middle goes off, then let go. After that, press and hold the trigger button for 2 seconds until LED in the middle lights up.

► **MI.Probe cannot be connected**

Open the system control and remove all Bluetooth devices that are already coupled to the PC. After that, carry out the MI.Probe setup under *Administration - Environment - Hardware*. The USB port of the USB Bluetooth adapter must not be changed after installation.

Please check if the correct operating unit is selected in the configuration.

► **Set up of the MI.Probe with the assistant fails**

The failure of the assistant to connect the MI.Probe may have several causes. Please check if the following conditions are met:

- On the PC, Bluetooth is switched on.
- Further operating units are coupled to the PC. Please open the system control and remove all Bluetooth devices that are already coupled to the PC.
- The Windows Bluetooth driver is used. If there are further drivers (e.g. BlueSoleil) on the computer, please uninstall them.
- The USB port of the USB Bluetooth adapter was not changed during and after installation. If the port has been changed, repeat the installation.
- At first, the MI.Probe has been switched on (the LED in the middle lights up) and after that, it has been connected to the PC with the supplied USB cable.
- The driver for the MI.Probe has been installed correctly. Please check the following devices in the Windows Device Manager:
 - The device **USB Serial Converter** for the serial interface via USB connection has to be listed in the entry *Universal Serial Bus Controller* in the Device Manager. If the device **FT232R USB UART** is listed in *Other devices* and/or is accompanied by a "!" symbol, install the driver manually. The driver can be found on the MoveInspect storage medium under



Driver/MI.Probe (or in the subdirectory HAWC\ftdi_treiber(USB-COM) in the MoveInspect Pilot installation directory).

- The device **USB Serial Port** has to be listed in the entry *Ports (COM & LPT)* in the Device Manager. If the device is listed in *Other devices* and/or is accompanied by a "!" symbol, install the driver manually. To do so, click with the right mouse button onto the device and carry out the menu item *Update driver software...* The driver can be found on the MoveInspect storage medium under Driver/MI.Probe (or in the subdirectory HAWC\ftdi_treiber(USB-COM) in the MoveInspect Pilot installation directory).
- The correct passcode for the MI.Probe has been set. The default passcode is '0000'. For older models, the passcode is 'NOCIA'.
- Restart the computer and restart the MI.Probe connection.

If the setup of the MI.Probe is not possible despite the procedures described above, please contact the Hexagon Commercial Office (Hexagon CO) responsible for your country. At the setup of the MI.Probe, the log file C:\AICON\UserData\MIProbeSetup.log is created. This file contains information about the MI.Probe setup as well as possible error messages. Please make sure to include this file in your support request.

9.1.6 OptoCat

► Image acquisition failed

Scanning with the MI.Probe mini in combination with the StereoScan neo or the SmartScan is not possible. After a long waiting time, the error message *Image acquisition failed* is displayed.

Please deactivate the Vimba filter as follows:

- Click *System control* and *Network and Internet/Network and Sharing Centre*.
- Click the option *Change adapter settings*.
- Right mouse click on the network card and select *Properties*.
- Deactivate the AVT GigE Vision filter driver (Windows 7) or the Vimba GigE vision filter driver (Windows 10).

Note:

For measuring and evaluating with MoveInspect Pilot, please reactivate the filter.



9.1.7 Measurement

► Targets are not or badly recognized

- Clean the camera glasses and the targets (see section [Cleaning](#)).
- Check the exposure settings with the mode *Image brightness* (see section [Dialog box 'Mode'](#)) and reset the brightness and gain, if necessary.

► Measuring results are too bad

Please carry out a calibration and a measurement with warmed-up camera system. The measurement should be carried out in the same ambient temperature as the calibration. Check the set temperature range for the ambient temperature under *Administration - Environment - Hardware* (see section [Tab 'Hardware'](#)).

A recalibration is also required if the ambient temperature has changed significantly.

If after the recalibration the measuring results are still too bad, carry out an *Extended calibration* with the following steps:

1. Start the menu *Calibration*.
2. Open the submenu item *Recording and Calculation*. If a calibration is in progress, cancel it.
3. Activate *Extended calibration* in the dialog field *Calibration assistant*.
4. To start the calibration, click *Record* and follow the instructions of the calibration assistant.

► Adapter, reference or probe could not be measured

For adapter, references and probes, the quality criteria set in Administration apply. These criteria are displayed under Measurement in the details of the reference or of the probe.

Furthermore, the acceptance of these quality criteria can be influenced by parameters such as the activated measuring volume, an active minimum standard deviation or a minimum number of rays. Due to these parameters, measured 3D points can become invalid so that they are not included in the measurement.



Check the quality criteria and the parameter settings. To meet the quality criteria, if necessary change the position and orientation of the adapter, of the reference or of the probe or adjust settings.

9.1.8 Cleaning

Clean the external camera housing:

To clean the external camera housing of the MoveInspect camera system, use lukewarm water and a soft, clean cloth.

Attention: The camera glasses must only be cleaned with the provided cloth.

Clean the camera glasses:

Only use the provided cloth to clean the camera glasses.

Clean the targets:

In case of soiled targets, cleaning with isopropanol is recommended.



9.2 File formats

The software allows to import and export different ASCII data files. The respective file formats are described in the following sections. A point (.) always has to be used as decimal symbol.

9.2.1 OBC format (object coordinates)

project.OBC File of object coordinates

At least the first 4 columns have to be existing for the import.

A point (.) has to be used as decimal symbol.

File layout:

- | | |
|------------|---|
| 1. Column | Point number |
| 2. Column | Object coordinate X |
| 3. Column | Object coordinate Y |
| 4. Column | Object coordinate Z |
| 5. Column | Standard deviation in X |
| 6. Column | Standard deviation in Y |
| 7. Column | Standard deviation in Z |
| 8. Column | Rays = Number of images, in which the point was measured. |
| 9. Column | Image status 1 = active; 0 = inactive |
| 10. Column | Parameter NEW; Bundle adjustment: new point when not equal to 0 |
| 11. Column | Datum point when not equal to 0 |
-

Example of a data record:

1	-6.2603	-2.9778	2.0735	0.0000	0.0000	0.0000	8	1	1	1
2	-5.3611	-3.0224	2.0725	0.0000	0.0000	0.0000	14	1	1	1
3	-6.0002	-2.2587	0.0500	0.0000	0.0000	0.0000	9	1	1	1
4	-6.0167	-1.5198	0.0617	0.0000	0.0000	0.0000	13	1	1	1
5	-6.0169	-0.7405	0.0573	0.0000	0.0000	0.0000	9	1	1	1
6	-6.0004	-0.0010	0.0702	0.0000	0.0000	0.0000	6	1	1	1



9.2.2 OCN format (object coordinates with names)

project.OCN File of object coordinates with names

At least the first 5 columns have to be existing for the import.

A point (.) has to be used as decimal symbol

File layout:

1. Column	Point number
2. Column	Point name (enclosed in double quotes)
3. Column	Object coordinate X
4. Column	Object coordinate Y
5. Column	Object coordinate Z
6. Column	Standard deviation in X
7. Column	Standard deviation in Y
8. Column	Standard deviation in Z
9. Column	Rays = Number of images, in which the point was measured.
10. Column	Image status 1 = active; 0 = inactive
11. Column	Parameter NEW; Bundle adjustment: new point when not equal to 0
12. Column	Datum point when not equal to 0

Example of a data record:

1	„RPS1“	-6.2603	-2.9778	2.0735	0.0000	0.0000	0.0000	8	1	1	1
2	„RPS2“	-5.3611	-3.0224	2.0725	0.0000	0.0000	0.0000	14	1	1	1
3	„RPS3“	-6.0002	-2.2587	0.0500	0.0000	0.0000	0.0000	9	1	1	1
4	„Heck“	-6.0167	-1.5198	0.0617	0.0000	0.0000	0.0000	13	1	1	1
5	„Säule A“	-6.0169	-0.7405	0.0573	0.0000	0.0000	0.0000	9	1	1	1
6	„Säule B“	-6.0004	-0.0010	0.0702	0.0000	0.0000	0.0000	6	1	1	1



9.2.3 PHC format (image coordinates)

project.PHC File of image coordinates

File layout:

1. Column	Image number
2. Column	Point number
3. Column	Image coordinate x
4. Column	Image coordinate y
5. Column	Standard deviation a priori x
6. Column	Standard deviation a priori y
7. Column	Residuals in x
8. Column	Residuals in y
9. Column	Internal code for the measuring method
10. Column	Image status: active when not equal to zero
11. Column	Internal parameter

Example of a data record:

4	1	-15.93779	7.03855	0.0250	0.0250	-0.0118	0.0052	2	1	0
4	2	3.34647	6.61287	0.0250	0.0250	0.0180	-0.0049	2	1	0
4	3	-4.85052	-11.36457	0.0250	0.0250	0.0293	0.0012	2	1	0
4	4	-5.48542	-7.47678	0.0250	0.0250	0.0052	0.0156	2	1	0
4	5	-5.78863	-5.04599	0.0250	0.0250	-0.0112	0.0361	2	1	0
5	6	-5.90888	-3.47931	0.0250	0.0250	-0.0177	0.0144	2	1	0
5	7	-5.99567	-2.40973	0.0250	0.0250	0.0006	0.0199	2	1	0
5	8	-6.06818	-1.57614	0.0250	0.0250	0.0487	0.0092	2	1	0





9.3 Shortcuts

General shortcuts:

Key	Description
F1	Displaying the Online help
Ctrl + Q	Switching off the software

Shortcuts in the menu *Administration*:

Key	Description
Esc	Suspending the functions <i>Add and Process</i> . Any changes are discarded. Clicking the Esc key is equivalent to clicking  .
Ctrl + S	Assuming the functions <i>Add and Process</i> . Any changes will be saved. Clicking the shortcut Ctrl + S is equivalent to clicking  .



Shortcuts in the menu *Calibration* and the menu *Measurement*:

Key	Description
Alt + S	<p>Saving images:</p> <p>All images which taken with the connected cameras are saved as Bitmaps in the selected folder. By pressing again Alt + S or by changing the menu, the function <i>Saving images</i> is deactivated again. A respective symbol is displayed in the status bar for as long as the function <i>Saving images</i> is activated.</p>
Alt + P	<p>Saving PHC files:</p> <p>Measured points are saved in <code>.phc</code>-files in the selected folder. By pressing again Alt + P or by changing the menu, the function <i>Save PHC files</i> is deactivated again. A respective symbol is displayed in the status bar for as long as the function <i>Save PHC files</i> is activated.</p>
Alt + N	<p>Saving NUM_PHC files:</p> <p>Measured points are saved in <code>num_*.phc</code>-files in the selected folder. Uncoded points are saved with their respectively assigned number. By pressing again Alt + N or by changing the menu, the function <i>Save NUM_PHC files</i> is deactivated again. A respective symbol is displayed in the status bar for as long as the function <i>Save NUM_PHC files</i> is activated.</p>



Shortcuts in the menu *Projects* in the epoch window:

Key	Description
Cursor keys left/right and up/down	<p>Pointing on the slider and pressing the <i>cursor keys right</i> and <i>up</i> prompts the display of the subsequent epoch, clicking the <i>cursor keys left</i> and <i>down</i> shows the preceding epoch.</p> <p>Pointing the cursor onto the selection bar, the bar is moved by one epoch.</p>
Page up/down	<p>Using the keys <i>Page up/down</i> every tenth epoch is displayed. Pressing the key <i>Page up</i> the slider jumps 10 epochs forward, using the key <i>Page down</i> it jumps 10 epochs backwards.</p> <p>Pointing the cursor onto the selection bar, the bar is moved by its width.</p>



Shortcuts in the 3D view:

Key	Description
Alt + right mouse key + move mouse	<p>Zooming onto the selected area:</p> <p>By simultaneously pressing Alt and the right mouse key, a window can be generated to zoom onto a specific section. Drawing the window from left to right allows to zoom into the window, drawing it from right to left allows to zoom out of the window.</p>
Shift + left mouse key + move mouse	<p>Moving the view:</p> <p>The view can be scrolled by moving the mouse while simultaneously pressing the Shift key and the left mouse key.</p>
Right mouse key + move mouse left/right	<p>Rotating around the screen axis.</p>
Left mouse key + move mouse	<p>Free rotation in 3D view:</p> <p>The 3D view is rotated around the point which has been selected by pressing the left mouse key. The mouse cursor changes into a rounded arrow with two heads.</p>
Scroll mouse wheel forward	<p>Zooming out of the 3D view.</p>
Scroll mouse wheel backwards	<p>Zooming the 3D view closer.</p>
Ctrl + left mouse key	<p>Point is selected/deselected or added to an existing selection / removed from an existing selection.</p>
Ctrl + Shift + left mouse key	<p>Drawing a polygon to select all points within this form. If a selection already exists, the points in the polygon are added to or subtracted from the selection, depending on their previous status.</p>



Key	Description
Ctrl + C	Copying selected 3D points to the clipboard.
Ctrl + X	Cutting out selected 3D points. The content is copied to the clipboard and deleted from the 3D view.
Ctrl + V	Copying the content of the clipboard to the currently open table, as far as it is an editable table.
Ctrl + A	Selecting all 3D points.
Ctrl + D	Deselecting the selection in the 3D view.
Ctrl + I	Inverting the selection in the 3D view.
Delete	Deleting selected points.
Ctrl + N	Creating a new reference with the selected 3D points. This function is only available in the measuring menu (see Dynamic referencing).
Ctrl + L	Creating a new reference with loaded 3D points. To load the 3D points, the file with the reference points has to be selected afterwards. This function is only available in the measuring menu (see Dynamic referencing).



Shortcuts in tables:

Key	Description
Ctrl + C	Saving selected cells on the clipboard.
Ctrl + X	Cutting selected cells. The content is copied onto the clipboard and deleted in the current table.
Ctrl + V	Copying contents of the clipboard into the table.
Ctrl + A	Marking the entire table.
Ctrl + D	Cancelling the selection in the table.
Ctrl + I	Reversing the selection in the table. Only possible when selecting whole rows.
Delete	Deleting selected rows.
Ctrl + N	Creating a new reference with the selected 3D points. This function is only available in the measuring menu (see Dynamic referencing).
Ctrl + L	Creating a new reference with loaded 3D points. To load the 3D points, the file with the reference points has to be selected afterwards. This function is only available in the measuring menu (see Dynamic referencing).
Enter	Leaving the editing mode of a cell. By using the arrow keys it is possible to move through the table again
Arrow keys left/right/up/down	Navigating through the table. The adjacent cell situated left/right/above/below of the currently highlighted cell is selected. By entering a number the cell can be adjusted directly.
Shift + Arrow keys left/right/up/down	Using the Shift and Arrow keys allows to highlight an area in the table. After clicking the first row of the area, the area can be expanded by simultaneously pressing the Shift key with the arrow keys.



Key	Description
Ctrl + Arrow keys left/right/up/down	Using Strg and the Arrow keys allow to highlight several coherent rows in the table. After clicking the first row of the area, the area can be expanded by simultaneously pressing the Strg key with the arrow keys. Using the arrow keys up and down the marked selection can be expanded to the entire rows.

9.4 MI.Probe

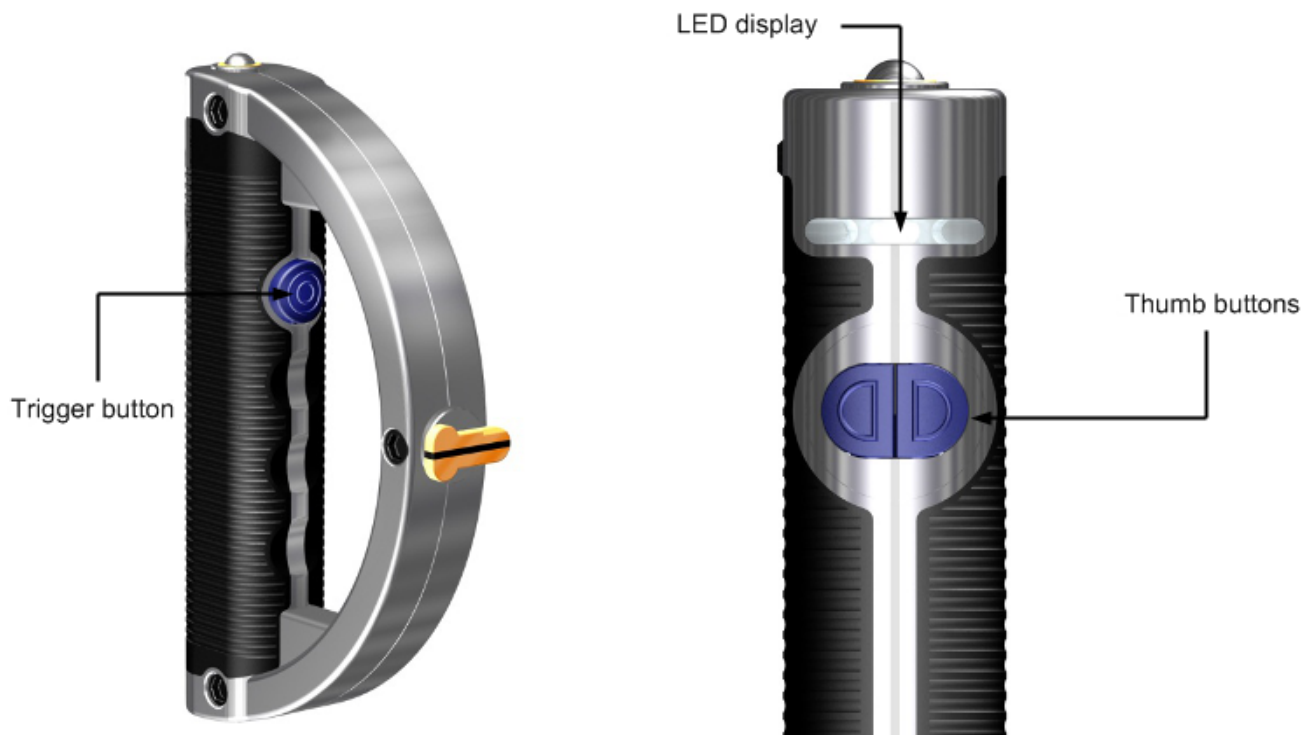


Figure 192: The MI.Probe

9.4.1 Button assignments

Button	Action	Function
Trigger button	Press	Trigger a single measurement, starting and stopping scanning



Button	Action	Function
Thumb button left	Press shorter than 1 second	Delete last probed point in PolyWorks®
Thumb button left	Press longer than 1 second	No action
Thumb button right	Press shorter than 1 second	Finish a geometry measurement (e.g. last probed point of plane was measured)
Thumb right	Press longer than 1 second	Switch between single and scan mode
Thumb button right and left	Press simultaneously	Activate the operating unit when in sleep mode
Trigger button	Press and hold for at least 10 seconds, then let go. After that, press and hold for 2 seconds until LED in the middle lights up.	Reboot the operating unit
Trigger button	Press and hold for 6 seconds until LED in the middle goes off	Switch off the operating unit In daily use the operating unit should not be switched off. After 5 minutes of disuse, the operating switches automatically to standby mode. Only switch off the operating unit for transport or if it is not used for a longer period of time.
Trigger button	Press and hold for 2 seconds until LED in the middle lights up	Switch on the operating unit after previous switch-off



9.4.2 LED display (Measuring mode)

The following information applies to the MI.Probe in measuring mode without USB charging cable:

LED	Color	Status
Left	Red permanent	Last measurement was not successful (only triggered measurements in single or scan mode).
Left	Green permanent	Last measurement was successful (only triggered measurements in single or scan mode).
Left	Red and Green	-
Left	Off	Probe is presently not ready for measuring.
Middle	Blue	Probe is active and a serial connection via Bluetooth was established.
Middle	Red	Probe ist aktiv aber es Probe is active, but there is no serial connection via Bluetooth.
Middle	Blue and Red (one of them flashing)	Battery is low.
Middle	Off	Probe is off or in stand-by mode.
Right	White	Scan mode is active, scanning has not started.
Right	Red	-
Right	White and Red	Scan mode is active, scanning is running.
Right	Off	Single mode is active.



9.4.3 LED display (Charging process)

The following information apply to the MI.Probe during the charging process. The LED display is only available if the MI.Probe is switched on or is in sleep mode. If the MI.Probe is switched off, no information about the charging status is available.

Note: These functions are available for deliveries as of July 2018.

LED	Color	Status
Left	Green off	Deactivated charging process: Battery is not charged.
Left	Green blinking	Activated charging process: Battery is charging.
Left	Green permanent	Completed charging process: Battery is charged.

9.5 AICON Probe PolyWorks® 4.02.12.1 for PolyWorks® 2017

AICON Probe PolyWorks® is compatible with PolyWorks® 2017.

This plug-in is tested and released for the use with MoveInspect Pilot (version 7.12) for the PolyWorks® version 2017.

The basic functions are also compatible with the PolyWorks® versions 11, 12, 2014, 2015 and 2016, but they are no longer tested or adjusted.

9.5.1 Installation

The PolyWorks® plug-in for the use with MoveInspect Pilot, the AICON Probe PolyWorks®, is integrated in the MoveInspect Pilot setup and can be jointly installed with the MoveInspect Pilot by activating the respective checkbox. To do so, the PolyWorks® software must have been already installed. The PolyWorks® Plug-in is always installed for the last installed PolyWorks Version.

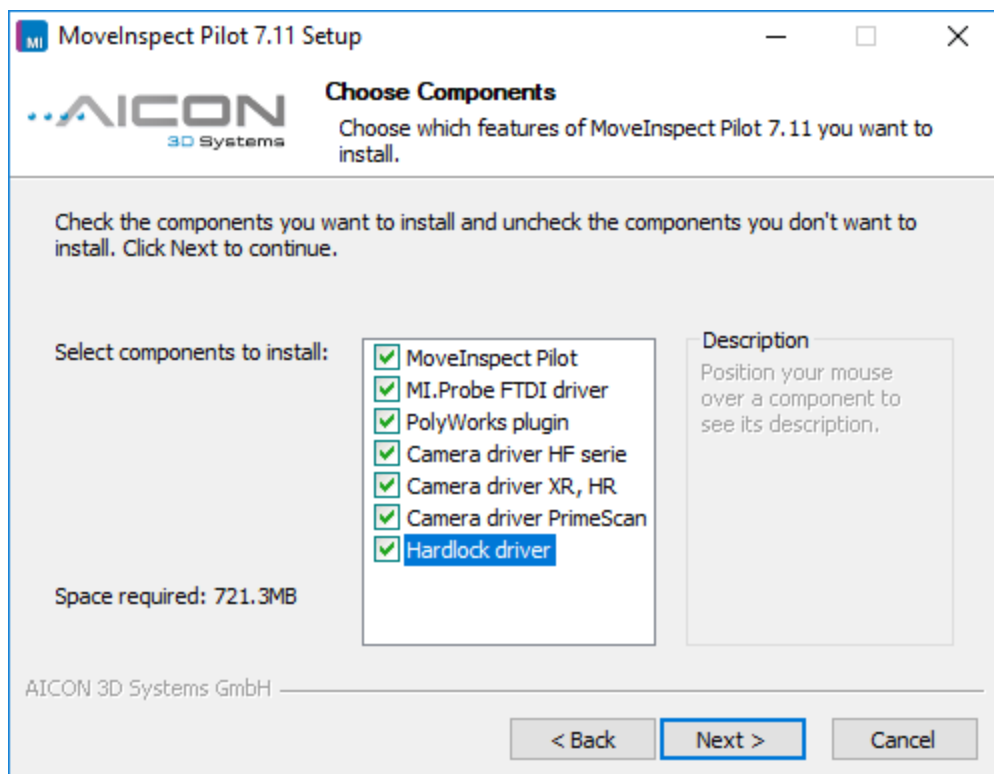


Figure 193: Installation of the PolyWorks® Plug-in with the MoveInspect Pilot setup

9.5.2 Activate the plug-in in PolyWorks®

For activating the plug-in, it is necessary that PolyWorks® is being run as administrator. This is done by right-clicking the programme link and subsequently left-clicking the menu item *Run as administrator* in the appearing context menu. (Figure 194).

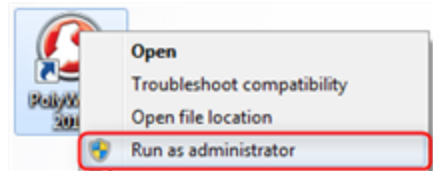


Figure 194: Run PolyWorks® as Administrator

First, the *PolyWorks/Workspace Manager* (Figure 195) starts. In the menu item *Tools*, the *options* are to be selected.

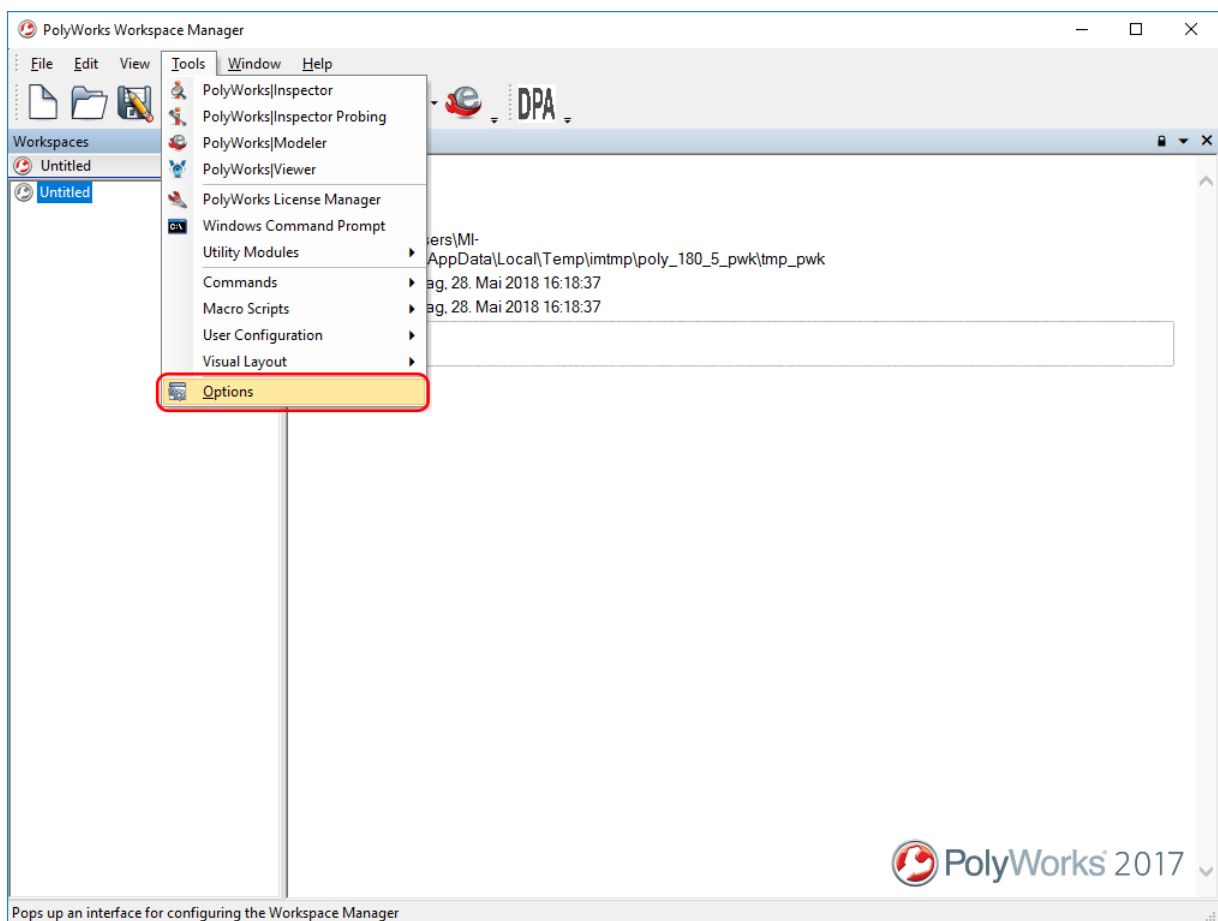


Figure 195: PolyWorks® Workspace Manager

In the options, the menu item *Plug-ins* has to be selected and for the plug-in the checkbox *AICON 3D Systems GmbH – Probe PolyWorks* has to be marked with a tick (Figure 196).

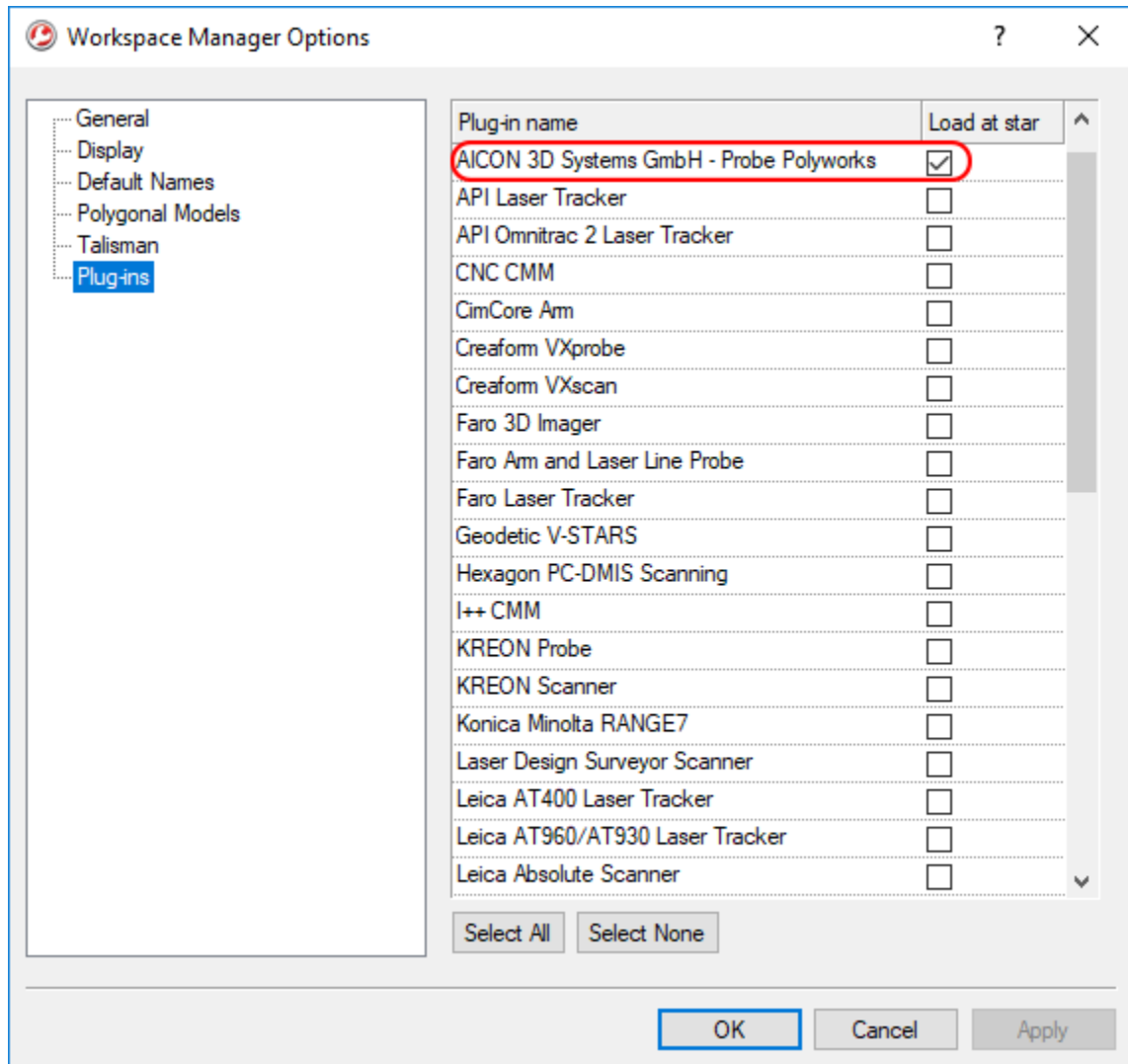


Figure 196: Administration of plug-ins in the menu *Options*

9.5.3 Start IMInspect / IMInspect Probing

After activating the plug-in and depending on the license type, the Workspace Manager allows to start:



IMInspect or



IMInspect Probing

9.5.4 Establish a connection between PolyWorks® and MoveInspect Pilot

A click *Establish connection* in the tool bar of the AICON PolyWorks® plug-in selects automatically the plug-in *AICON Probe PolyWorks* as measuring device and establishes the connection to MoveInspect Pilot:



Figure 197: Tool bar of the AICON PolyWorks® plug-in

The connection status is displayed in *Device selection*.



Symbol	Description
	Not connected
	Connected

Table 40: *Device selection* displays the connection status



9.5.5 AICON default configuration for PolyWorks®

The default configuration for PolyWorks® is an interface preconfigured by AICON engineers. Apart from the symbols for the most important PolyWorks® functions, it also includes a tool bar with special functions of the AICON Probe PolyWorks® (Figure 198).

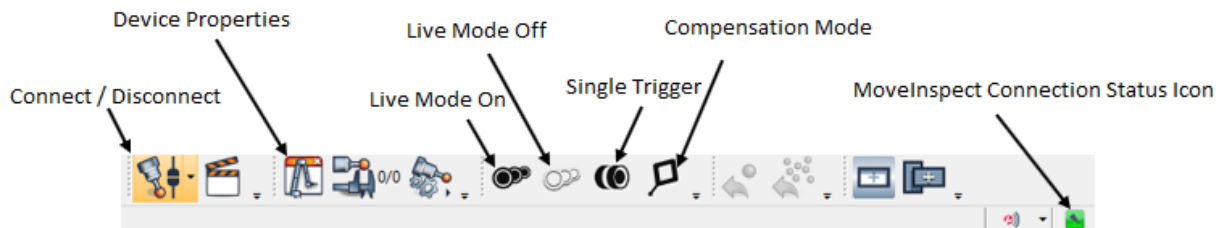


Figure 198: Special functions of the AICON Probe PolyWorks® in the PolyWorks® tool bar

Table 41 lists the functions of the AICON Probe PolyWorks® in the PolyWorks® tool bar:










Symbol	Description
	Connect with MoveInspect Pilot
	Disconnect from MoveInspect Pilot
	Device properties
	Start continuous image capture
	Stop continuous image capture
	Trigger a single measurement
	Change compensation: Probe orientation or compensation point
	Status MoveInspect Pilot: Disconnected
	Status MoveInspect Pilot: Connected

Table 41: Symbols and functions of the AICON Probe PolyWorks® in the PolyWorks® tool bar



9.5.6 AICON Probe PolyWorks® – Settings and functions

The PolyWorks plug-in *AICON Probe PolyWorks* is configured in the device settings of PolyWorks®, these are linked to the following symbol:



About: Version information

The tab *About* includes version information of the PolyWorks® plug-in (*AICON Probe PolyWorks*) and of the receiver DLL. (Figure 199).

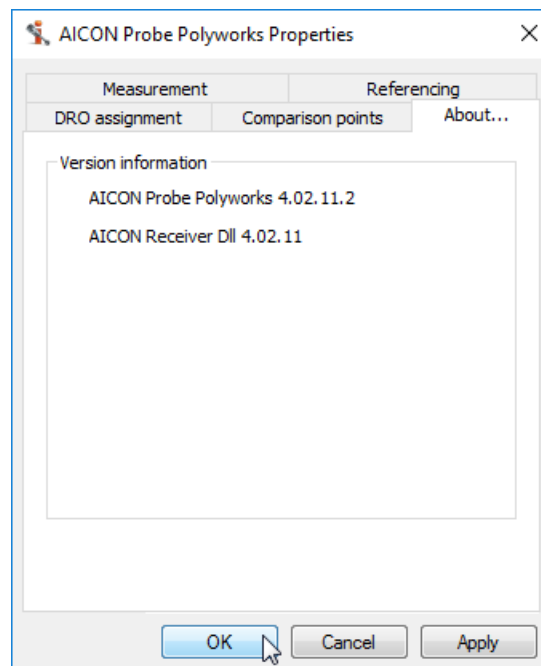


Figure 199: AICON Probe PolyWorks® settings, version information



Tab *Measurement*

The tab *Measurement* allows to configure PolyWorks® so as to fit to the measuring task. Here it is possible to configure the measuring mode according to the application and adjust the transfer of measuring points.

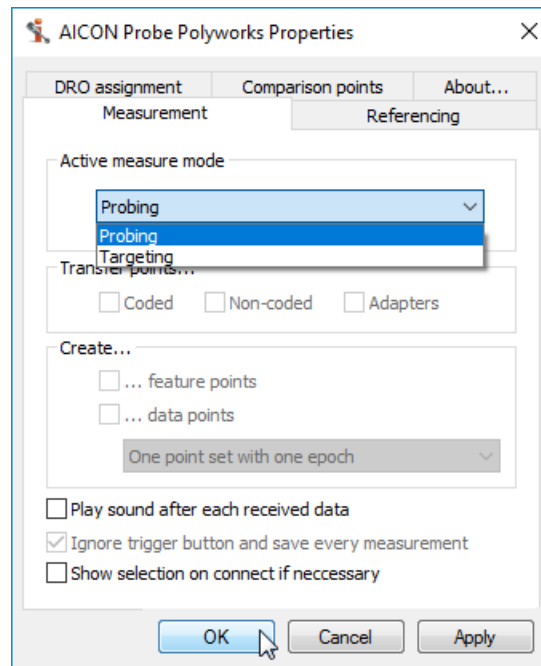


Figure 200: AICON Probe PolyWorks® settings, *Measurement*

Please note: It is important that only the respectively required type of point transfer is selected, otherwise unnecessary data or feature points are generated.

Measuring mode *Targeting*

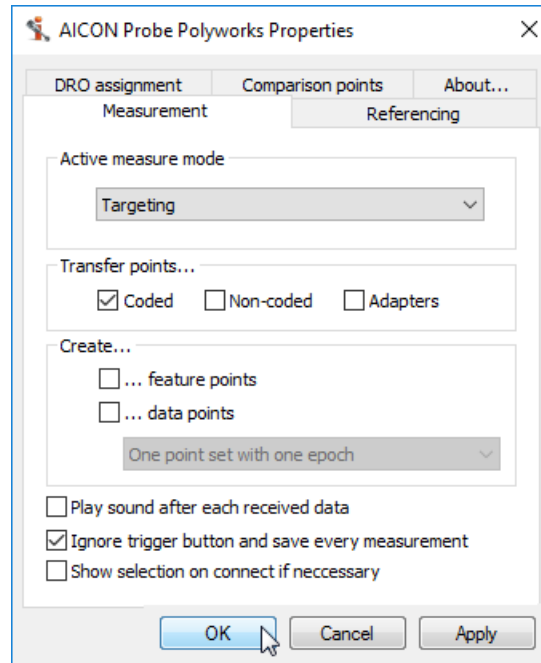


Figure 201: AICON Probe PolyWorks® settings, *Measurement*, Measure mode *Targeting*

With the *Targeting* mode being activated, all points measured in MoveInspect Pilot are transferred to PolyWorks®. Probe tip coordinates are transferred like the targeting points with a diameter of 0 mm.

Function	Option	Description
<i>Transfer points as</i>		Configuring the type of the transferred point. The following options are available:
	<i>Coded</i>	Transfer coded points.
	<i>Uncoded</i>	Transfer uncoded points.
	<i>Adapter</i>	Transfer points with name.
	<i>Feature points</i>	Points are directly generated as point features.
	<i>Data points</i>	The transferred points are added to a data point cloud or filed as a single data point cloud per epoch (<i>Save epochs separately</i>).



Measuring mode *Probing*

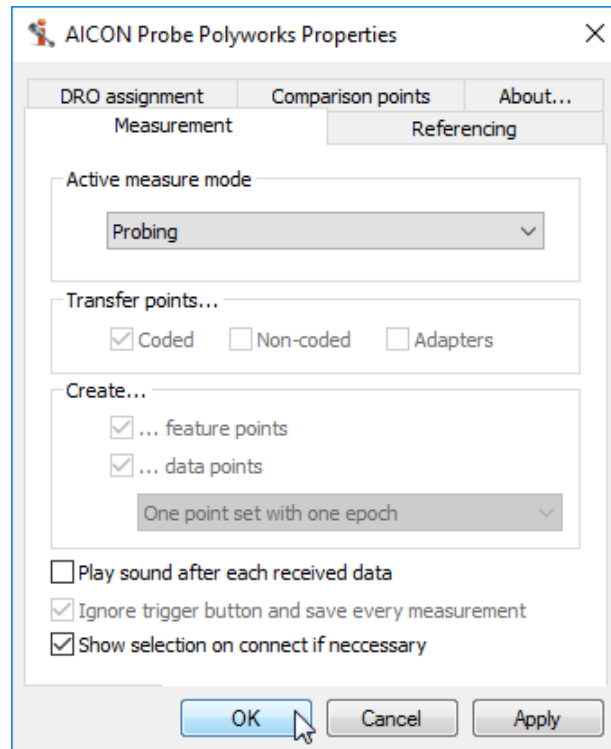


Figure 202: AICON Probe PolyWorks® settings, *Measurement*, Measure mode *Probing*

With the *Probing* mode being activated, the coordinates of the probe tip are exclusively transferred to PolyWorks®. The transferred points are always transferred as data points, an adjustment is not possible.



Tab Reference

To use a reference, set the *Reference mode* from *Off* to *Dynamic* or to *One-shot*. In addition, select a reference or create a new one.

A new reference can be created either from selected points or by importing it from a file.

In case of a dynamic referencing the coordinate system is redetermined with each subsequent record, as far as the reference is measured successfully.

For a dynamic referencing it is possible to create a new reference from targets. For this purpose, the targets for the dynamic referencing (reference points) should be distributed evenly in the measurement volume.

To set a new dynamic reference, the following steps are required:

1. Click *Connect with AICON Probe PolyWorks®*.
2. Click *device properties*.
3. Click *Referencing*.
4. Click *Measure feature points*.
5. Select all features in the PolyWorks® tree view.
6. Click *From selection*.
7. Enter a name for the new reference.
8. Confirm settings with *OK*. The new reference is activated automatically.

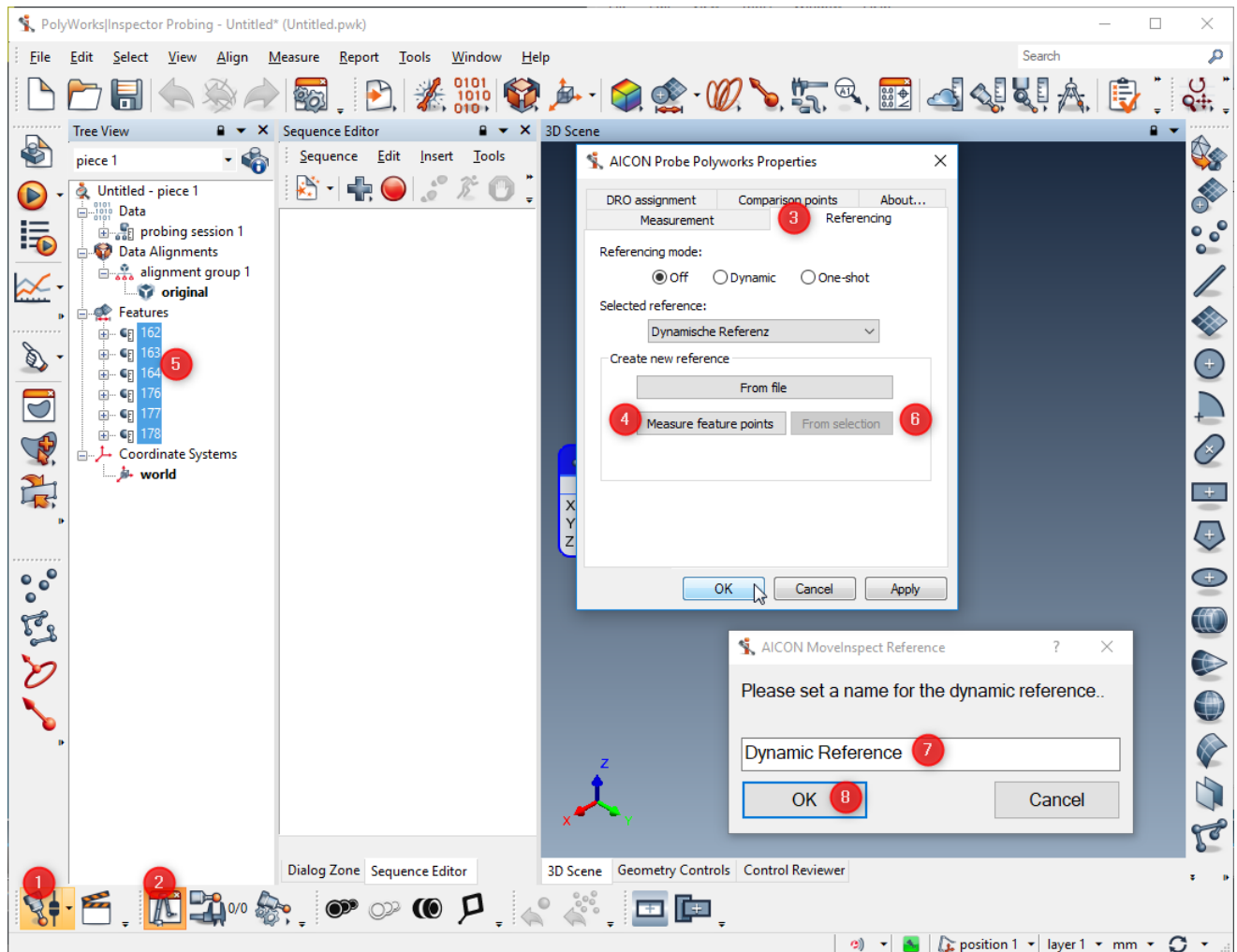


Figure 203: Set a dynamic reference

To use the One-shot referencing, the reference has to be measured successfully and has to be saved as One-shot epoch. After that, the coordinate system is not redefined anymore, but taken from the saved referencing.

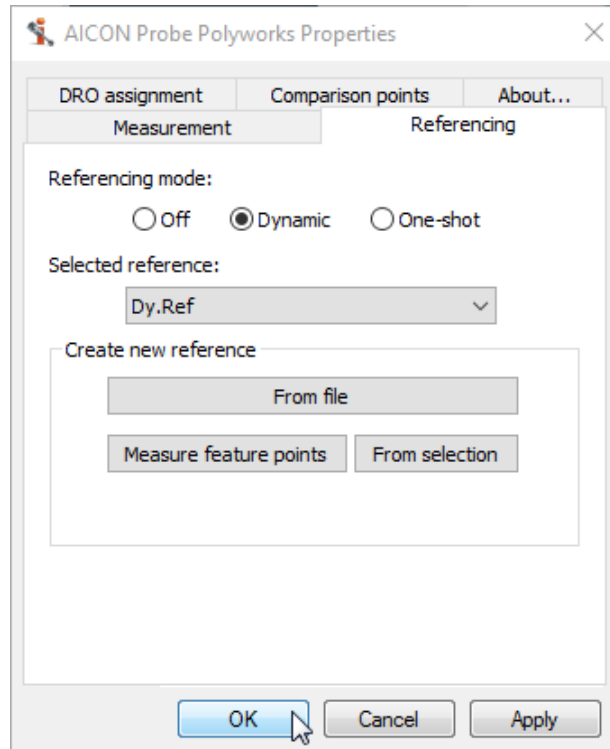


Figure 204: AICON Probe PolyWorks® settings, *Referencing*



Tab *DRO assignment*

The tab *DRO* allows to assign single points to a DRO window when the mode *Multiple* or *Single* is active (Figure 205).

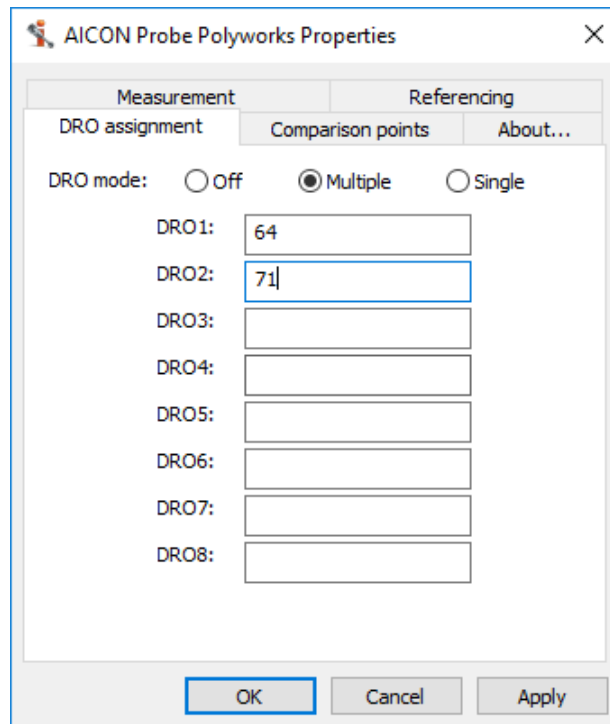


Figure 205: AICON Probe PolyWorks® settings, *DRO assignment*

This may be necessary for example for staking off several distances at the same time with *Build/Inspect*. In this way, the coordinates of up to eight points can displayed in the DRO windows at the same time (Figure 206).

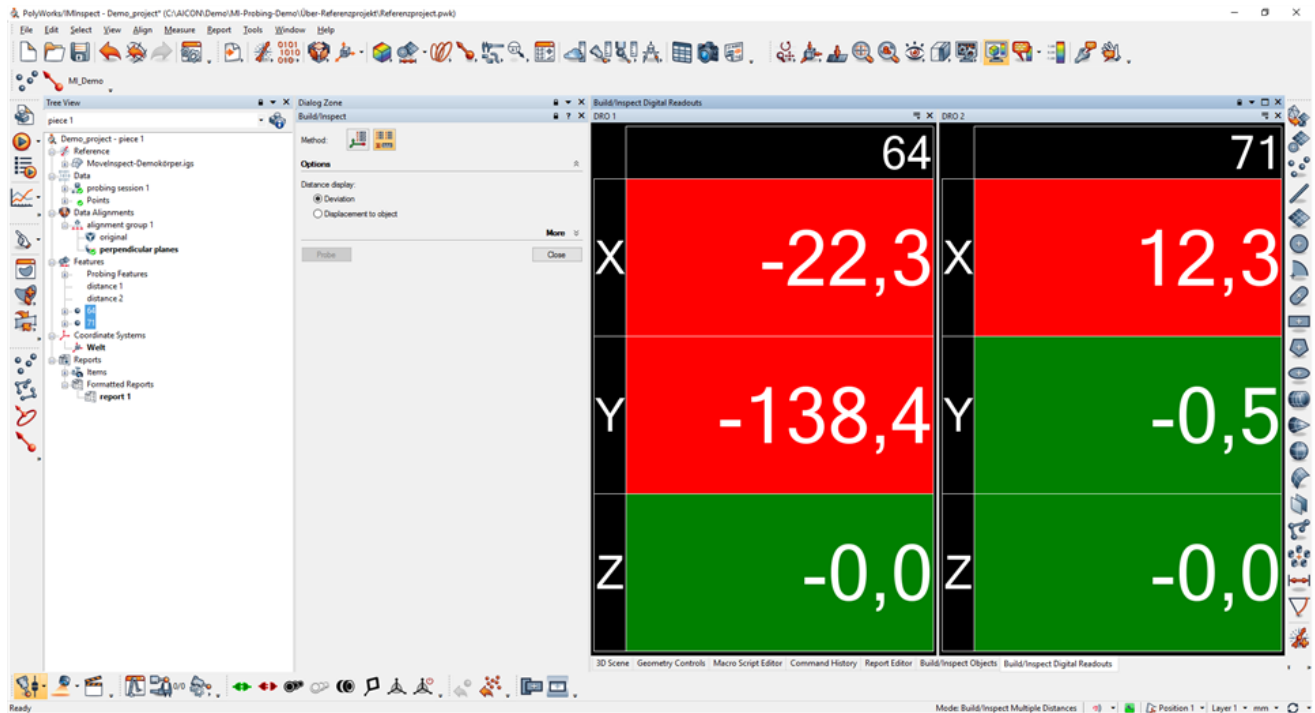


Figure 206: Display of DROs

To use DRO assignment, the measuring mode *Targeting* has to be selected in the settings of the *AICON Probe PolyWorks* in the tab *Measurement*. In addition, the generation of *Standard geometries* as well of *Data points* must be deactivated (Figure 207). These changes must be confirmed with *Apply*.

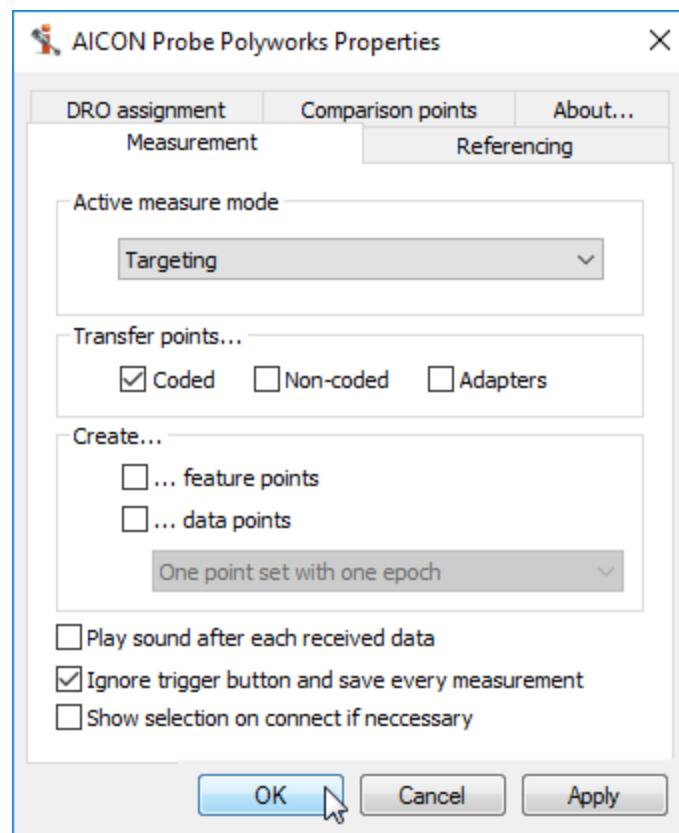


Figure 207: AICON Probe PolyWorks® settings, Measurement

Deformation points

To use deformation points, the measuring mode *Targeting* has to be selected in the settings of the *AICON Probe PolyWorks* in the tab *Measurement*. In addition, the generation of *Standard geometries* as well of *Data points* must be deactivated (Figure 207). These changes must be confirmed with *Apply*.

Under the tab *Deformation points* the radio button has to be set to *Use all available points* so that all points transferred by MoveInspect Pilot are used for the creation of a reference epoch. By means of the option *Use specific points* it is possible to filter the points for which a deformation point shall be generated:

- Single points: 2,5,156
- Number range: 2-500
- A combination of single points and number ranges: 2-50, 156, 250-500

Subsequently, click *Comparison Points*. The *Trigger Single Measurement* is activated, prompting a trigger signal to be transmitted to MoveInspect Pilot and triggering the measurement to determine the reference values. See Figure 208 and Figure 209.

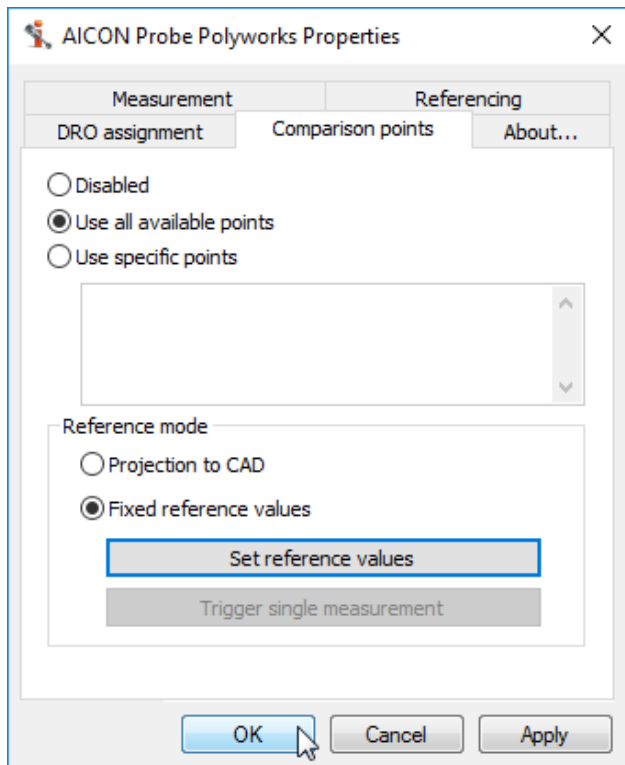


Figure 208: AICON Probe PolyWorks® settings,
Comparison points - Set reference values

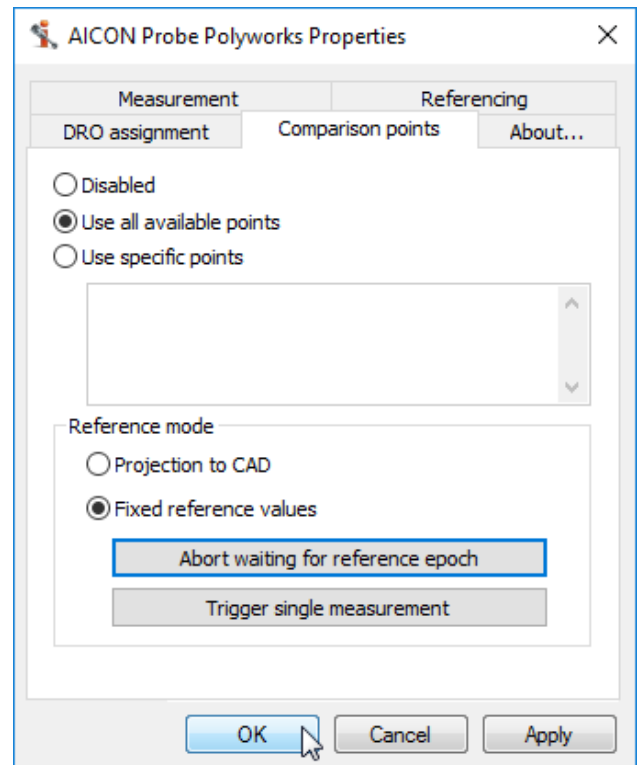


Figure 209: AICON Probe PolyWorks® settings,
Comparison points - Receive reference data

Then, a triggered measurement (e.g. with the MI.Probe, with *Single* in MoveInspect Pilot or by macro instruction *Trigger single*) has to be carried out. For each of the transferred points a deformation point is created (Figure 210).

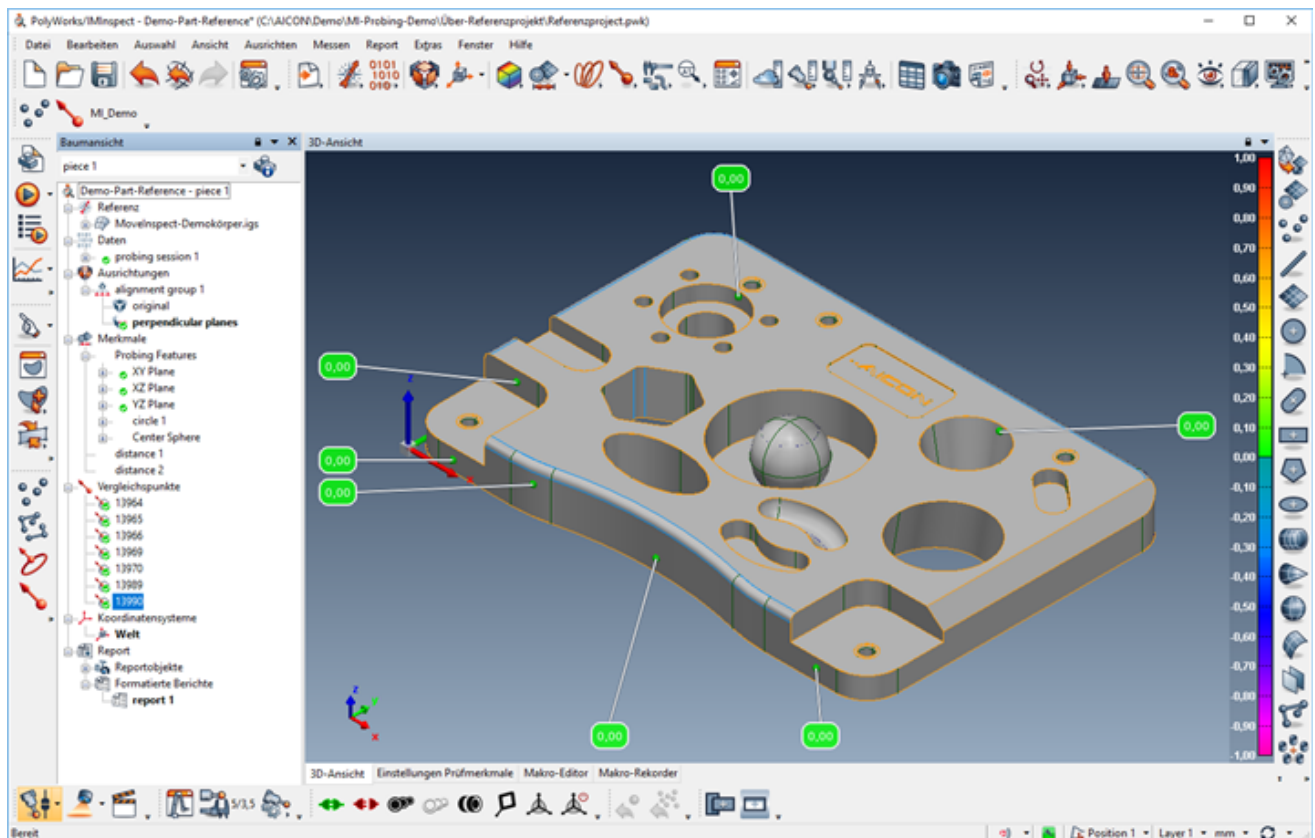


Figure 210: Deformation points in epoch t0

The window of the AICON Probe PolyWorks® settings can be closed (*Trigger single measurement* is displayed in gray again).

When further epochs are received (which include the defined points) the point deviations are displayed in the annotations and by means of vectors (Figure 211).

Note: If uncoded points are used, *Tracking* has to be activated in MoveInspect Pilot.

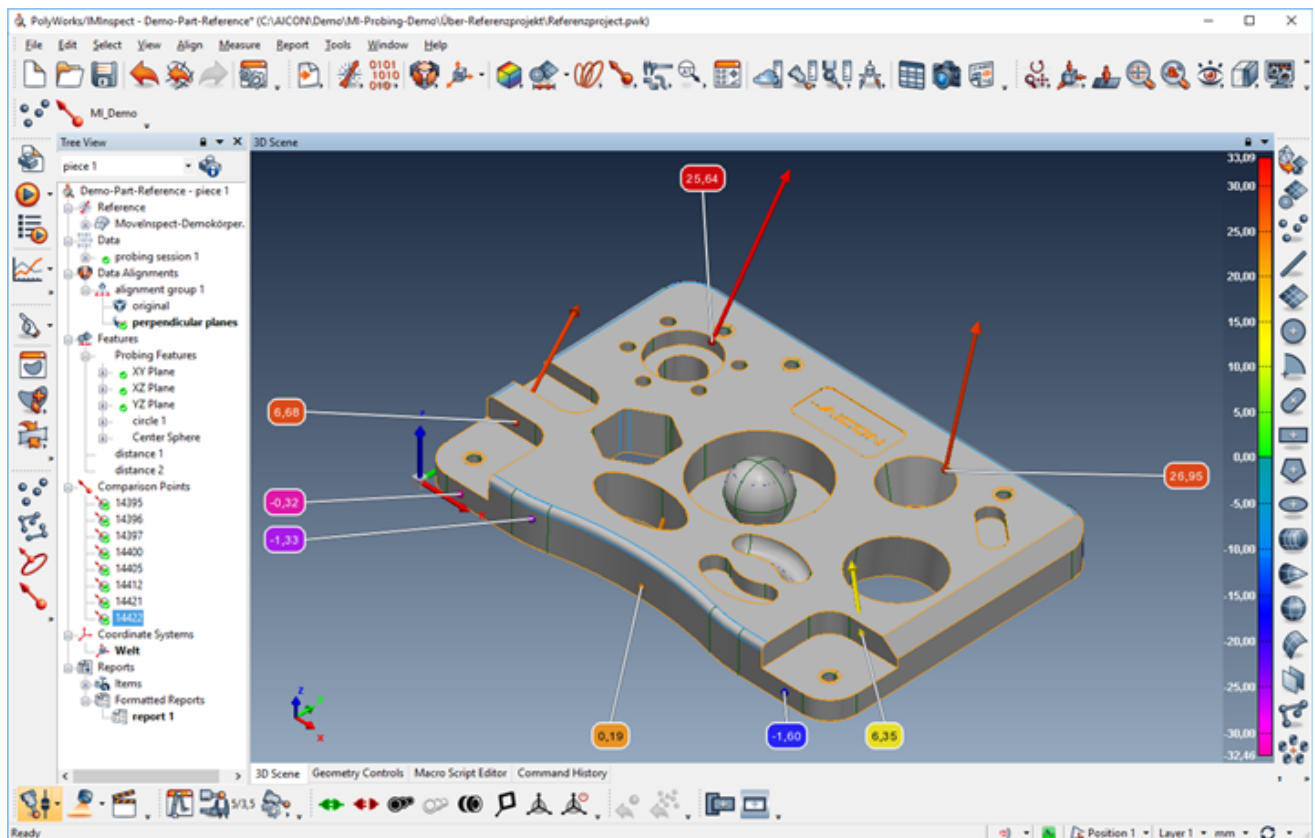



Figure 211: Deformation points in epoch t+1

For facilitating the interpretation of the colour representation it may be useful to define the colour scale

manually ( in the PolyWorks® function bar). The length of the vectors can be adjusted in the PolyWorks® options (Display → Comparison points → Error vector → Scaling factor) or with the macro command `MEASURE COMPARISON_POINT OPTIONS DISPLAY MEASURED DEVIATION_VECTORS SCALING_FACTOR (double)`.

The function *Comparison Points* of the AICON Probe PolyWorks® furthermore offers the possibility to project measurement points directly onto the closest by CAD area and to display the deviations as vector as well as numerically in the flags (Figure 213). To do so, the radio button *Projection to CAD* in the tab *Deformation Points* in the settings window of the AICON Probe PolyWorks® must be activated (Figure 212). The same procedure subsequently applies to all points which have been transferred to PolyWorks® (including the probe results in the Probing mode) until the setting has been deactivated.

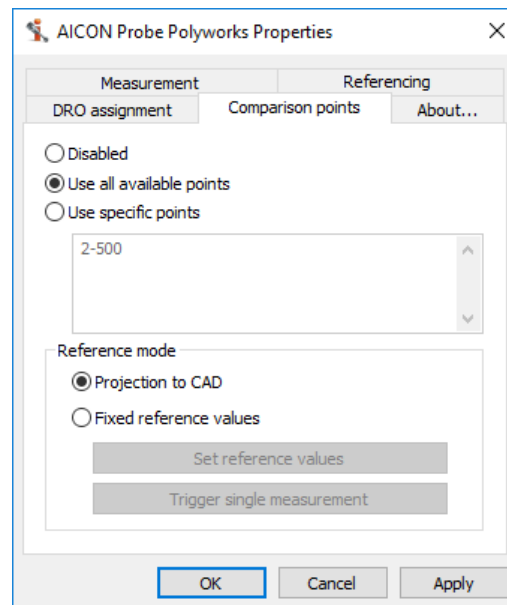


Figure 212: AICON Probe PolyWorks® settings, Deformation points - Projection to CAD

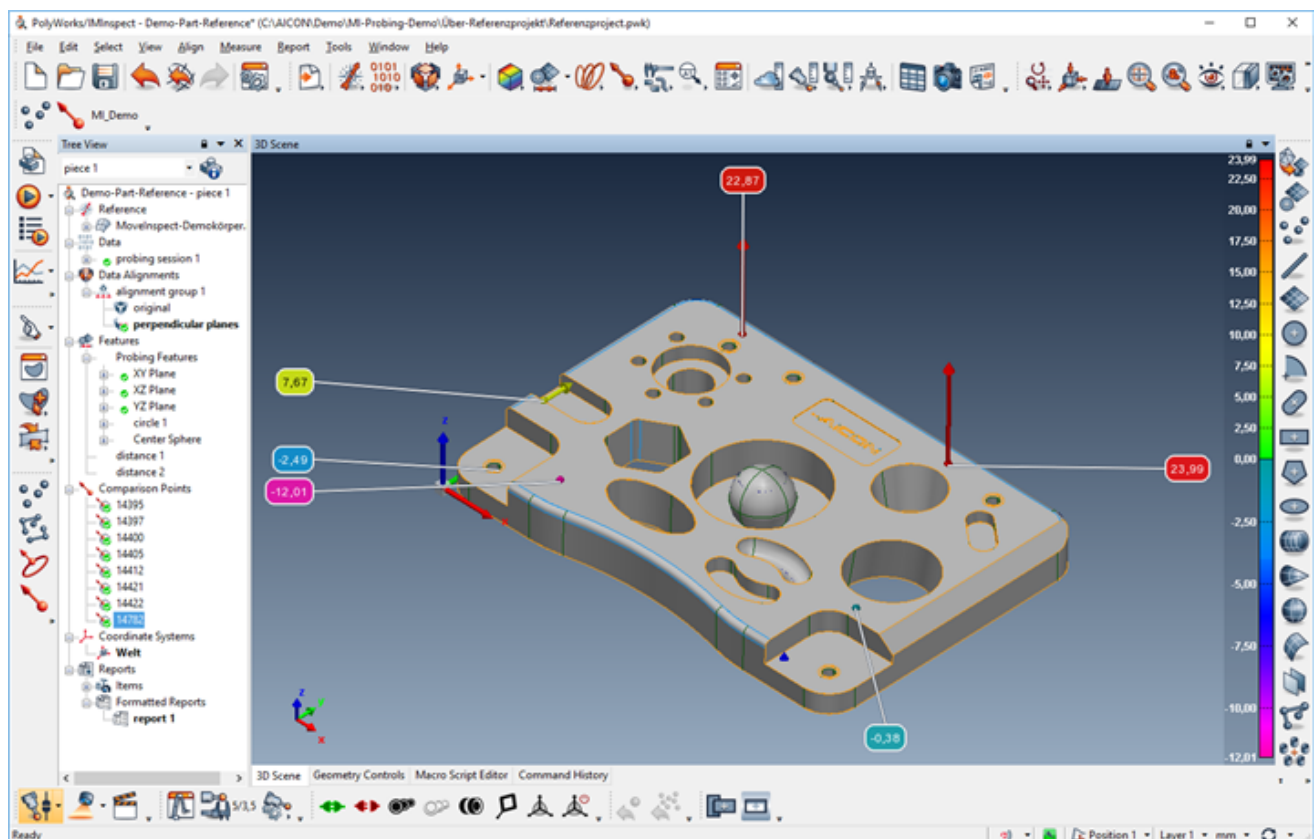


Figure 213: Projection to CAD



9.5.7 AICON Probe PolyWorks® – Macro instructions

PROBE DEVICE AICON CONNECTION START

Description :

Initiate the connection to an AICON data source

PROBE DEVICE AICON CONNECTION START WITH (string, integer)

Description :

Initiate the connection to an AICON data source on a specific computer

Argument(s)	Optional	In/Out	Description
string	no	in	Network name or IP-Address of the data source computer. This may also be "localhost".
integer	no	in	Port number of the data source. The default port is 19905.

PROBE DEVICE AICON CONNECTION STOP

Description :

Terminate the connection to an AICON data source

PROBE DEVICE AICON DATA RECEIVED (integer)

Description :

With this function you can check if there was any data received after the call to "PROBE DEVICE AICON TRIGGER SINGLE".

Argument(s)	Optional	In/Out	Description
integer variable	no	out	1 = data was received; 0 = no data received



PROBE DEVICE AICON DRO MODE GET (integer variable)

Description :

Gets the current DRO mode.

Argument(s)	Optional	In/Out	Description
integer variable	no	out	DRO mode (0 = Off; 1 = Multiple; 2 = Single)

PROBE DEVICE AICON DRO MODE SET (integer)

Description :

Sets the current DRO mode.

Argument(s)	Optional	In/Out	Description
integer	no	in	DRO mode (0 = Off; 1 = Multiple; 2 = Single)

PROBE DEVICE AICON DRO NAME GET (integer, string variable)

Description :

Gets the assigned point name of a specific DRO.

Argument(s)	Optional	In/Out	Description
integer	no	in	DRO index (1 - 8)
string variable	no	out	Assigned DRO name

PROBE DEVICE AICON DRO NAME SET (integer, string)

Description :

Sets the assigned point name of a specific DRO.

Argument(s)	Optional	In/Out	Description
integer	no	in	DRO index (1 - 8)
string	no	in	The name of the assigned point



PROBE DEVICE AICON MEASURE MODE SET (integer)

Warning :

This command is obsolete and cannot be used anymore. It has been superseded by the **PROBE DEVICE AICON SOURCE MODE SET** command.

PROBE DEVICE AICON NAME GET (string variable)

Description :

Returns the name of the current connected probe device. If no probe device is connected, the name is empty.

Argument(s)	Optional	In/Out	Description
string variable	no	out	Name of the connected probe

PROBE DEVICE AICON PLAY SOUND GET (integer variable)

Description :

Retrieve the state of the measurement sound.

Argument(s)	Optional	In/Out	Description
integer variable	no	out	May be "0" for disabled sound, or "1" for enabled sound.

PROBE DEVICE AICON PLAY SOUND SET (integer)

Description :

Enable or disable the beeping sound after each received measurement.

Argument(s)	Optional	In/Out	Description
integer	no	in	May be "0" for disabled sound, or "1" for enabled sound.



PROBE DEVICE AICON POINT TYPE GET (integer variable)

Description :

Retrieve the current target point type.

Argument(s)	Optional	In/Out	Description
integer variable	no	out	Target point type. May be "0" for no points at all, "1" for feature points, "2" for data points and "3" for feature points and data points.

PROBE DEVICE AICON POINT TYPE SET (integer)

Description :

Change the current target point type.

Argument(s)	Optional	In/Out	Description
integer	no	in	Target point type. May be "0" for no points at all, "1" for feature points, "2" for data points and "3" for feature points and data points.

PROBE DEVICE AICON REFERENCE ACTIVE GET (string variable)

Warning :

This command is obsolete and cannot be used anymore. It has been superseded by the **PROBE DEVICE AICON REFERENCE MODE GET** command.

PROBE DEVICE AICON REFERENCE ACTIVE SET (string)

Warning :

This command is obsolete and cannot be used anymore. It has been superseded by the **PROBE DEVICE AICON REFERENCE MODE SET** command.



PROBE DEVICE AICON REFERENCE GET LIST(string_array variable)

Description :

Get all available references.

Requirement :

MoveInspect v7.01.xx or higher.

Argument(s)	Optional	In/Out	Description
string_array variable	no	out	Array with all reference names

PROBE DEVICE AICON REFERENCE MODE GET (integer variable, string variable)

Description :

Get the current referencing mode (0 = Off, 1 = Dynamic referencing, 2 = OneShot referencing) and the name of the selected reference.

Requirement :

MoveInspect v7.01.xx or higher.

Argument(s)	Optional	In/Out	Description
integer variable	no	out	The current reference mode. (0 = Off, 1 = Dynamic referencing, 2 = OneShot referencing)
string variable	no	out	Name of the currently selected reference. Even if referencing mode is "off". May be empty if no reference exists.



PROBE DEVICE AICON REFERENCE MODE SET (integer, string)

Description :

Set the current referencing mode (0 = Off, 1 = Dynamic referencing, 2 = OneShot referencing) and the selected reference. If the reference is left empty, the last used reference is activated.

Requirement :

MoveInspect v7.01.xx or higher.

Argument(s)	Optional	In/Out	Description
integer	no	in	The reference mode. (0 = Off, 1 = Dynamic referencing, 2 = OneShot referencing)
string	no	in	The reference name to activate. If left empty, the selected reference is not changed.

PROBE DEVICE AICON REFERENCE NEW ADD (string, double, double, double)

Description :

Add a point to the current reference point collection. You must call **PROBE DEVICE AICON REFERENCE NEW BEGIN** before any point can be added.

Requirement :

MoveInspect v7.01.xx or higher.

Argument(s)	Optional	In/Out	Description
string	no	in	Number of the reference point
double	no	in	X coordinate value
double	no	in	Y coordinate value
double	no	in	Z coordinate value



PROBE DEVICE AICON REFERENCE NEW BEGIN (string)

Description :

Begin collection of points for a new reference point set. There can only be one open collection. To close the collection you have to call either **PROBE DEVICE AICON REFERENCE NEW CANCEL** or **PROBE DEVICE AICON REFERENCE NEW SEND**.

Requirement :

MoveInspect v7.01.xx or higher.

Argument(s)	Optional	In/Out	Description
string	no	in	Name of the new reference point set

PROBE DEVICE AICON REFERENCE NEW CANCEL

Description :

Cancel collection of new reference points. All collected points are lost.

Requirement :

MoveInspect v7.01.xx or higher.

PROBE DEVICE AICON REFERENCE NEW SEND

Description :

Stop collection of new points, create and activate reference.

Requirement :

MoveInspect v7.01.xx or higher.

PROBE DEVICE AICON REFERENCE ONESHOT CREATE

Description :

Save the current epoch as one shot reference. For this to work, OneShot referencing mode must be activated and at least one epoch must be successfully triggered.



PROBE DEVICE AICON SAVE SEPARATE GET (integer variable)

Description :

Retrieve the point set creation flag.

Argument(s)	Optional	In/Out	Description
integer variable	no	out	If this is 0, all received points are saved into one point set. If this is 1, a new point set is created for each measurement.

PROBE DEVICE AICON SAVE SEPARATE SET (integer)

Description :

Save all measurements into one point set or create separate point sets

Argument(s)	Optional	In/Out	Description
integer	no	in	0: All received points are saved into one point set. 1: A new point set is created for each measurement.

PROBE DEVICE AICON SOURCE MODE GET (integer variable)

Description :

Returns the current measure mode of the connected data source.

Argument(s)	Optional	In/Out	Description
integer variable	no	out	Mode of the device. (0 = Probing, 1 = Targeting)



PROBE DEVICE AICON SOURCE MODE SET (integer)

Description :

Set the mode of the connected data source.

Argument(s)	Optional	In/Out	Description
integer	no	in	Desired mode of the device. (0 = Probing, 1 = Targeting)

PROBE DEVICE AICON TRIGGER LIVE START

Description :

Sends a signal to the connected probe to start the live measurement.

PROBE DEVICE AICON TRIGGER LIVE STOP

Description :

Sends a signal to the connected probe to end the live measurement.

PROBE DEVICE AICON TRIGGER MODE GET (integer variable)

Description :

Get the current trigger mode. If active (=1) all points are accepted, if inactive (=0) only triggered points are accepted.

Argument(s)	Optional	In/Out	Description
integer variable	no	out	Trigger mode. May be "0" to accept only triggered points or "1" to override the trigger and accept all points.



PROBE DEVICE AICON TRIGGER MODE SET (integer)

Description :

Change the current trigger mode. If active (=1) all points are accepted, if inactive (=0) only triggered points are accepted.

Argument(s)	Optional	In/Out	Description
integer	no	in	Trigger mode. May be "0" to accept only triggered points or "1" to override the trigger and accept all points.

PROBE DEVICE AICON TRIGGER SINGLE

Description :

Sends a signal to the connected probe to trigger a single measurement.

PROBE DEVICE AICON USE NAME FILTER GET (integer variable)

Description :

Get the current name filter mode. If active, only points with dedicated names, if inactive all points are accepted.

Argument(s)	Optional	In/Out	Description
integer variable	no	out	Name filter mode. May be "1" to accept only points with dedicated names or "0" to accept all points.



PROBE DEVICE AICON USE NAME FILTER SET (integer)

Description :

Change the current name filter mode. If active, only points with dedicated names, if inactive all points are accepted.

Argument(s)	Optional	In/Out	Description
integer	no	in	Name filter mode. May be "1" to accept only points with dedicated names or "0" to accept all points.

9.6 IES Tilt Sensors for DPS

To use the IES Tilt Sensors with DPS its necessary to create them as external sensors in MoveInspect Pilot to transmit the data from the sensor own software *TiltView* to the 3D-Studio (Version 11.01.15 or newer). Therefor the following steps are necessary.

1. Enable DPS communication via TiltView.ini

To use the IES sensors with MoveInspect Pilot it is necessary to enable the data communication in the IES sensor software *TiltView*. Therefor the file `TiltView.ini` in the programme directory of the IES sensor software the entry `SERVER` in the section `DUPOS` has to be set to `ON`:

```
...  
[DuPos]  
SERVER=ON  
...
```

This needs to be changed once.

2. Embedding the sensor in in MoveInspect Pilot

To receive the sensor data from *TiltView* in MoveInspect Pilot the sensor has to be embedded as *External sensors*.

Therefore the sensor has to be created in the Administration ([Submenu item 'External sensors'](#)). The created sensor has to be added to the configuration ([Tab 'Systems'](#)).

After adding the IES sensors to the MoveInspect Pilot configuration (see [Tab 'Systems'](#)), the current values of all available IES sensors are scanned with each trigger and displayed in the table *External sensors* in the unit radian. If no sensor values are displayed in MoveInspect Pilot the *TiltView* software has to be started to be able to reconnect MoveInspect Pilot. *TiltView* only allows one client connection and doesn't recognise a disconnect of MoveInspect Pilot.

Now the *TiltView* software can be started and afterwards the MoveInspect Pilot can be connected to the cameras in the *Measurement* menu. With each camera trigger the current values of all available IES sensors are scanned and displayed in the table *External sensors* in the unit radian.

Please note:

If no sensor values are displayed in MoveInspect Pilot the *TiltView* software has to be started to be able to reconnect MoveInspect Pilot. *TiltView* only allows one client connection and doesn't recognise a disconnect of MoveInspect Pilot.

Sensor values are displayed without unit in MoveInspect Pilot because a different types of sensors are supported. However the values of IES-sensors are displayed in radian.

3. Adding sensors to a DPS template

To use the sensor values from MoveInspect Pilot for DPS measurements the sensors have to be added to a DPS template in the AICON 3D Studio. The sensors are added in the tab *Measure elements online* as *Angles* from type *Sensor* with the exact name displayed in the table *External Sensors* in MoveInspect Pilot (Figure 214).

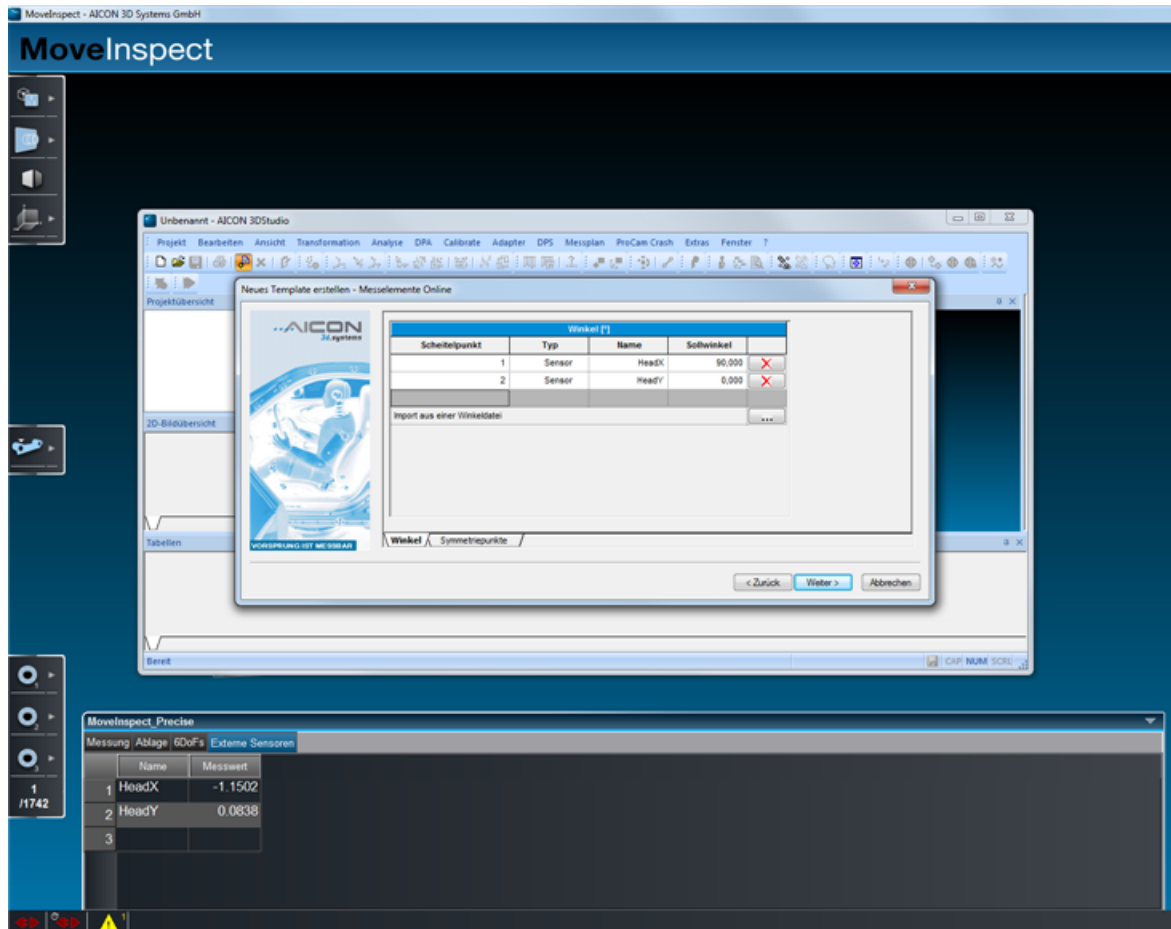


Figure 214: Adding sensors to the DPS template

4. DPS Measurements with the AICON 3D Studio

Now DPS Measurements can be started in the AICON 3D Studio with the template that contains the IES Tilt Sensors. After connecting MoveInspect Pilot with the AICON 3D Studio the sensor values are displayed whenever a measurement is triggered (Figure 215).

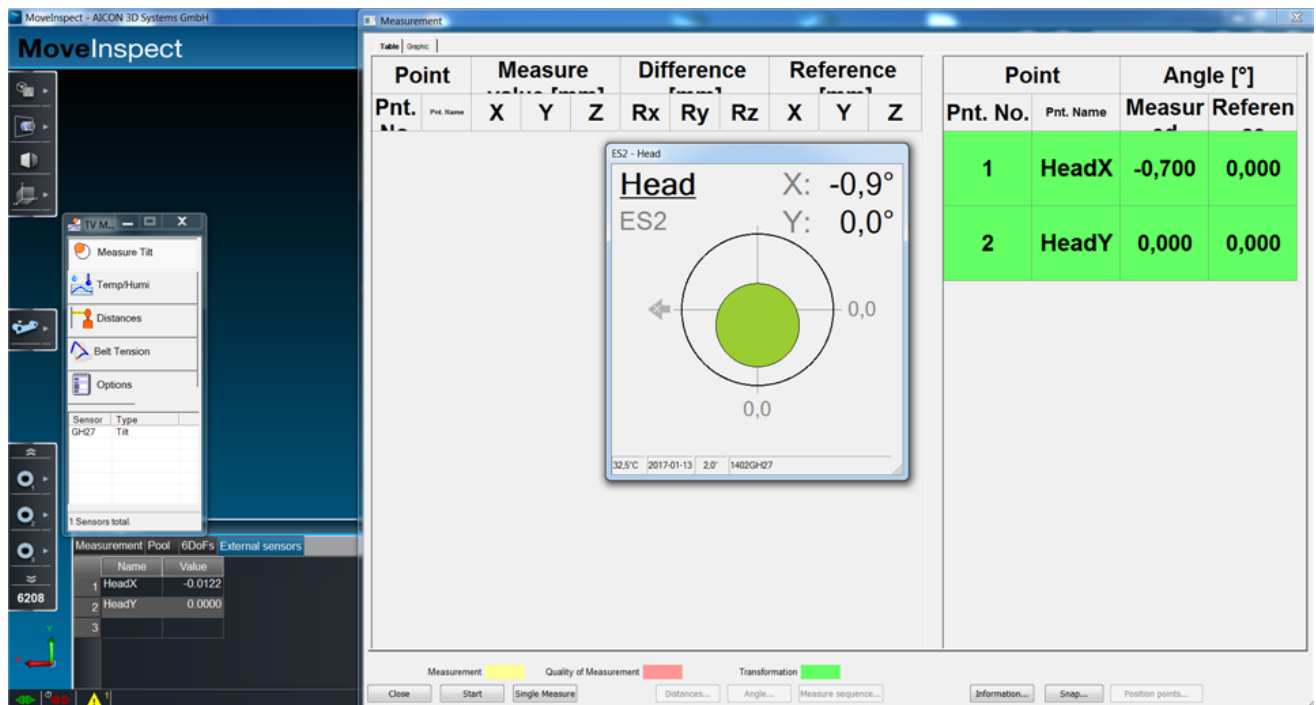


Figure 215: Result of a DPS measurement with sensors

Please note:

It is no error when the AICON 3D Studio displays a different sensor value than *TiltView*, as seen in Figure 216. *TiltView* has a different refresh rate than MoveInspect Pilot. MoveInspect Pilot is only grabbing values when the cameras trigger while *TiltView* is continuously grabbing sensor values with a fixed rate.



9.7 Remote control | Receiver DLL

All MoveInspect systems can be controlled by remote control via the AICON Receiver DLL. Integrators can integrate the MoveInspect systems into own applications, for example, automation solutions.

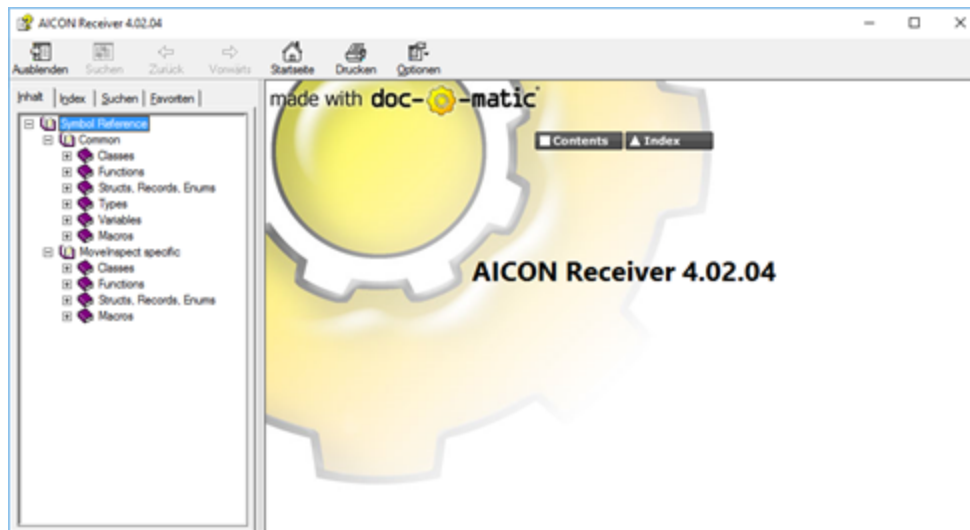


Figure 216: Interface description AICON Receiver DLL

For detailed information, specification and interface description, please contact the Hexagon Commercial Office (Hexagon CO) responsible for your country.

9.8 Specification: Real-time interface

The MoveInspect real-time interface allows the real-time transmission of points calculated in MoveInspect Pilot. The transmission of the 3D-points is based on the TCP/IPv4 protocol and can be transmitted to both the MoveInspect evaluation computer and to another computer in the network.

For receiving the measured points, AICON provides the MoveInspect real-time interface based on LabVIEW by National Instruments in different versions. These modules allow the visualization of movements (translation and rotation) of 6 DoF and single points over time as well as the presentation of the position of single points.

Furthermore, due to the provided interface description, it is possible to develop of one's own implementations of a client in any programming language (interface description in the annex).

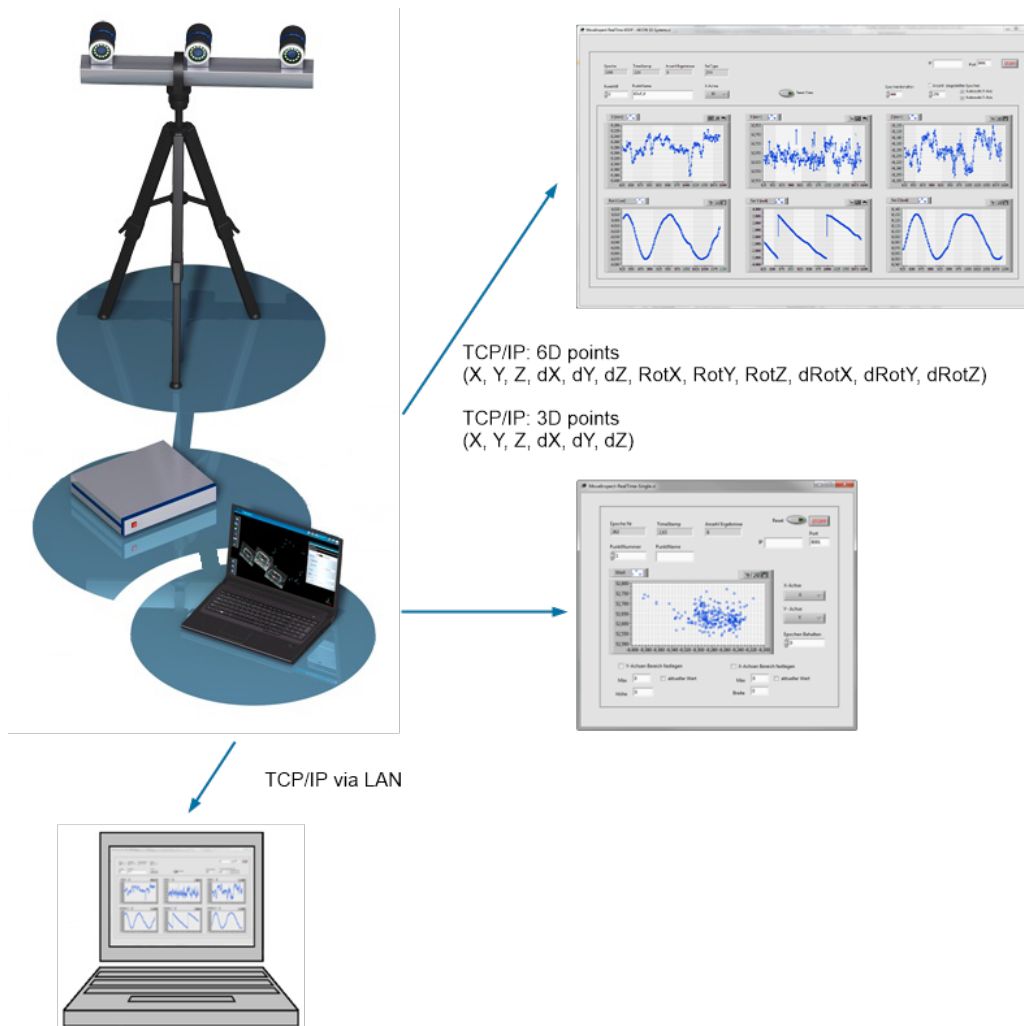


Figure 217: Real-time interface

9.8.1 LabVIEW real-time interface for MoveInspect

The LabVIEW real-time interface allows the visualization of the transmitted 6DoF and 3D-points.

The different interfaces are made available as executable „exe“-files.

In order to be able to use them, the installation of „LabVIEW 2012 f3 (32-Bit) Run-Time Engine“, which is included in the delivery, is necessary.

The delivery contains the following files:



- **MoveInspect-RealTime-6DOF.exe**

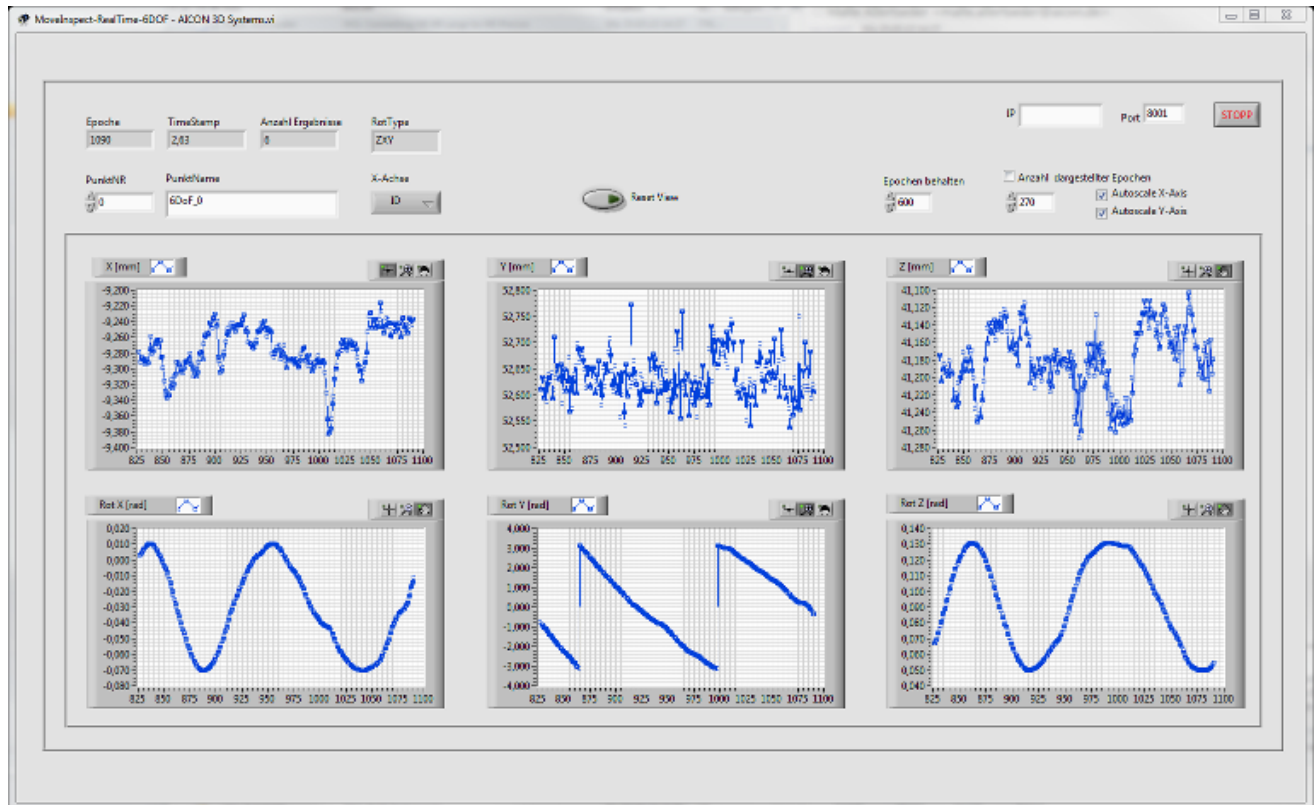


Figure 218: MoveInspect-Realtime-6DoF.exe



- **MoveInspect-RealTime-Single.exe**

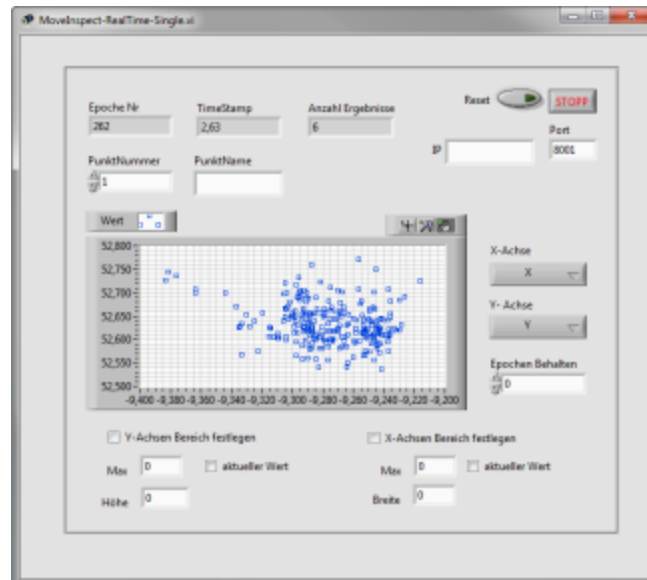


Figure 219: MoveInspect-Realtime-Single.exe

- **LVRTE2012f3std.exe**

Installation file for LabViewRunTimeEnvironment for LabVIEW 2012 f3 32-bit.

On request, the delivery of special versions and of the source files are also possible.

Please note:

For using the real-time interface, it is necessary to add the following line to the file `C:\Windows\System32\drivers\etc\services` (with administrator rights):

```
MI_REALTIME 8001/tcp #MoveInspect realtime communication
```

9.8.2 Description of the real-time format

General structure:

- **EpochHeader:** The EpochHeader describes the epoch and in which positions the measurement data (results) begin.
- **Results:** The raw data contains the image data and image information for one epoch. (3D- and 6D-points)



EpochHeader:

Position (Bytes)	Bytes	Short	Description
0	4	EpochNr	Number of the epoch
4	8	TimeStamp	Timestamp of the epoch
12	4	ResultCnt	Number of results beginning at position defined by ResultOffset
16	4	ResultOffset	Startposition of the results

Results: Consists of ResultHeader and ResultData

Short	Description
ResultHeader	General information about the results of measuring
ResultData	Results with measuring data
...	More results with ResultHeader and ResultData



ResultHeader:

Size (Bytes)	Short	Description
4	Station	Number of the station (measuring field). Starts with 0
4	ResultNr	Number of the measuring data (e.g. point number)
4	ResultNameByteCnt	Number of bytes of the ResultName
ResultNameByteCnt	ResultName	Name of the measuring result (ASCII)
8	State	64-bit geo-states of AICON
4	ResultType	Type of the measuring result (1 = 3D-point, 2 = 6D-point)
4	ResultByteCnt	Number of bytes for this result (to know the position of the next result)



ResultData: Consists only of 3D- and 6D-points

3D-point:

Size (Bytes)	Short	Description
8	X	X-Value
8	Y	Y-Value
8	Z	Z-Value
8	dX	Std.-Deviation of X
8	dY	Std.-Deviation of Y
8	dZ	Std.-Deviation of Z



6D-point:

Size (Bytes)	Short	Description
8	X	X-Value
8	Y	Y-Value
8	Z	Z-Value
8	dX	Std.-Deviation of X
8	dY	Std.-Deviation of Y
8	dZ	Std.-Deviation of Z
4	RotType	1 = XYZ, 2 = Rollei, 3 = ZXY
8	RotX	Rotational angle X-axis
8	RotY	Rotational angle Y-axis
8	RotZ	Rotational angle Z-axis
8	dRotX	Std.-Deviation of angle X-axis
8	dRotY	Std.-Deviation of angle Y-axis
8	dRotZ	Std.-Deviation of angle Z-axis

Example:

Position (Bytes)	Short	Value	Comment
0	EpochNr	13	
4	TimeStamp	0.13	
12	ResultCnt	3	Three results are coming in



Position (Bytes)	Short	Value	Comment
16	ResultOffset	20	
20	Station	0	First measuring field
24	ResultNr	240	
28	ResultNameByteCnt	8	
32	ResultName	"Point A\0"	
44	State	0x401	geo_stateActive + geo_stateCoded
52	ResultType	1	3D-point
56	ResultByteCnt	48	Size of information is 6 * 8 bytes
60	X	23.454	
68	Y	12.332	
76	Z	-4.222	
84	dX	0.12	
92	dY	0.13	
100	dZ	0.24	
108	Station	1	Second measuring filed
112	ResultNr	1001	
116	ResultNameByteCnt	7	
120	ResultName	"Pnt. B\0"	
130	State	0x01	geo_stateActive
138	ResultType	1	3D-point
142	ResultByteCnt	48	Size of information is 6 * 8 bytes
146	X	26.454	
154	Y	22.332	



Position (Bytes)	Short	Value	Comment
162	Z	-34.222	
170	dX	0.16	
178	dY	0.16	
186	dZ	0.34	
194	Station	1	Second measuring field
198	ResultNr	1	
202	ResultNameByteCnt	8	
206	ResultName	"my 6DOF\0"	
214	State	0x01	geo_stateActive
222	ResultType	2	6D-point
226	ResultByteCnt	98	Size of information is 12 * 8 bytes + 4 bytes
230	X	26.454	
238	Y	48.332	
246	Z	-34.222	
254	dX	0.16	
262	dY	0.14	
270	dZ	0.33	
278	RotType	3	
282	RotX	0.454	
290	RotY	1.332	
298	RotZ	-2.222	
306	dRotX	0.016	
314	dRotY	0.014	



Position (Bytes)	Short	Value	Comment
322	dRotZ	0.034	

Package-size: 330 bytes

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