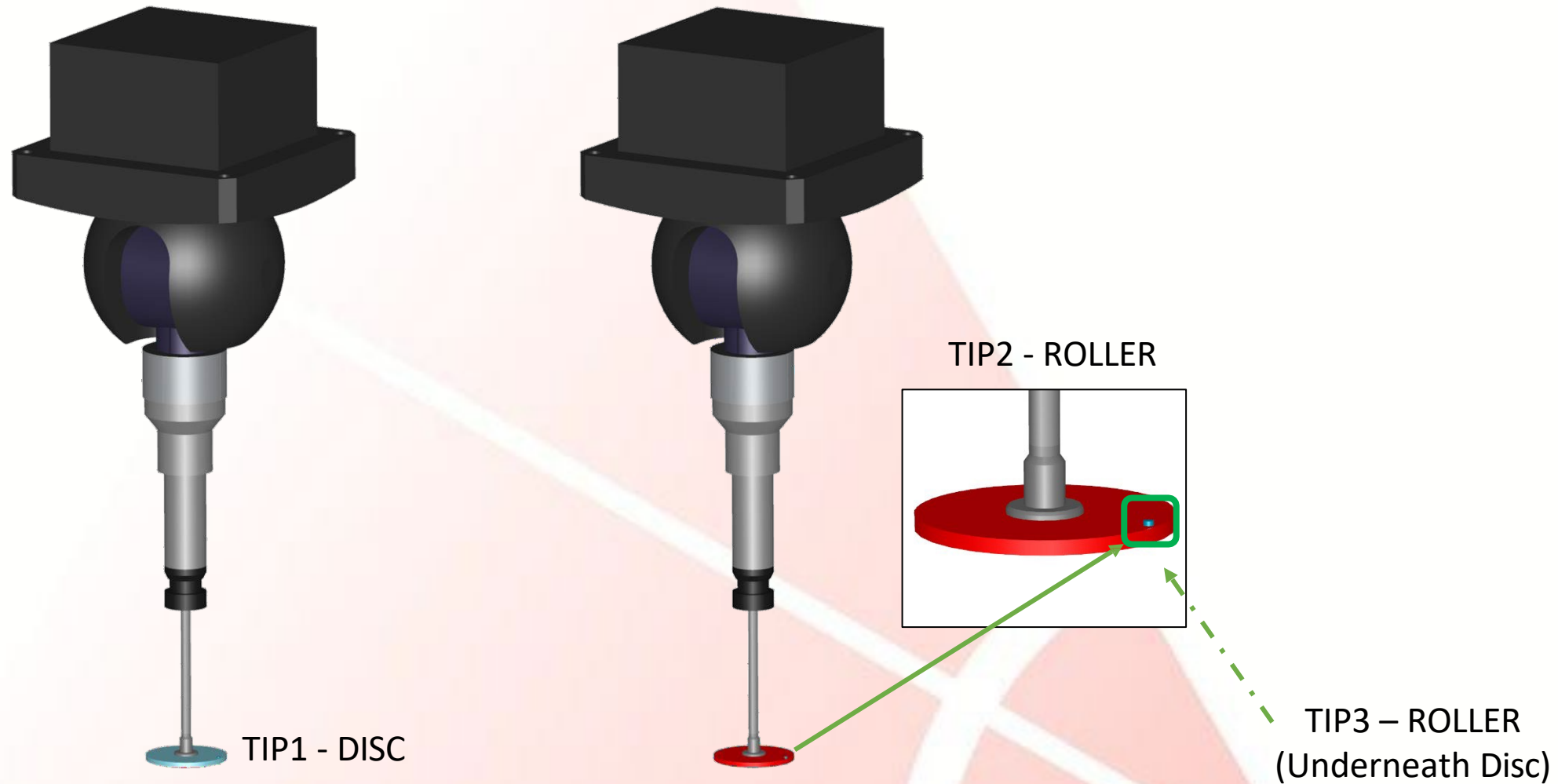




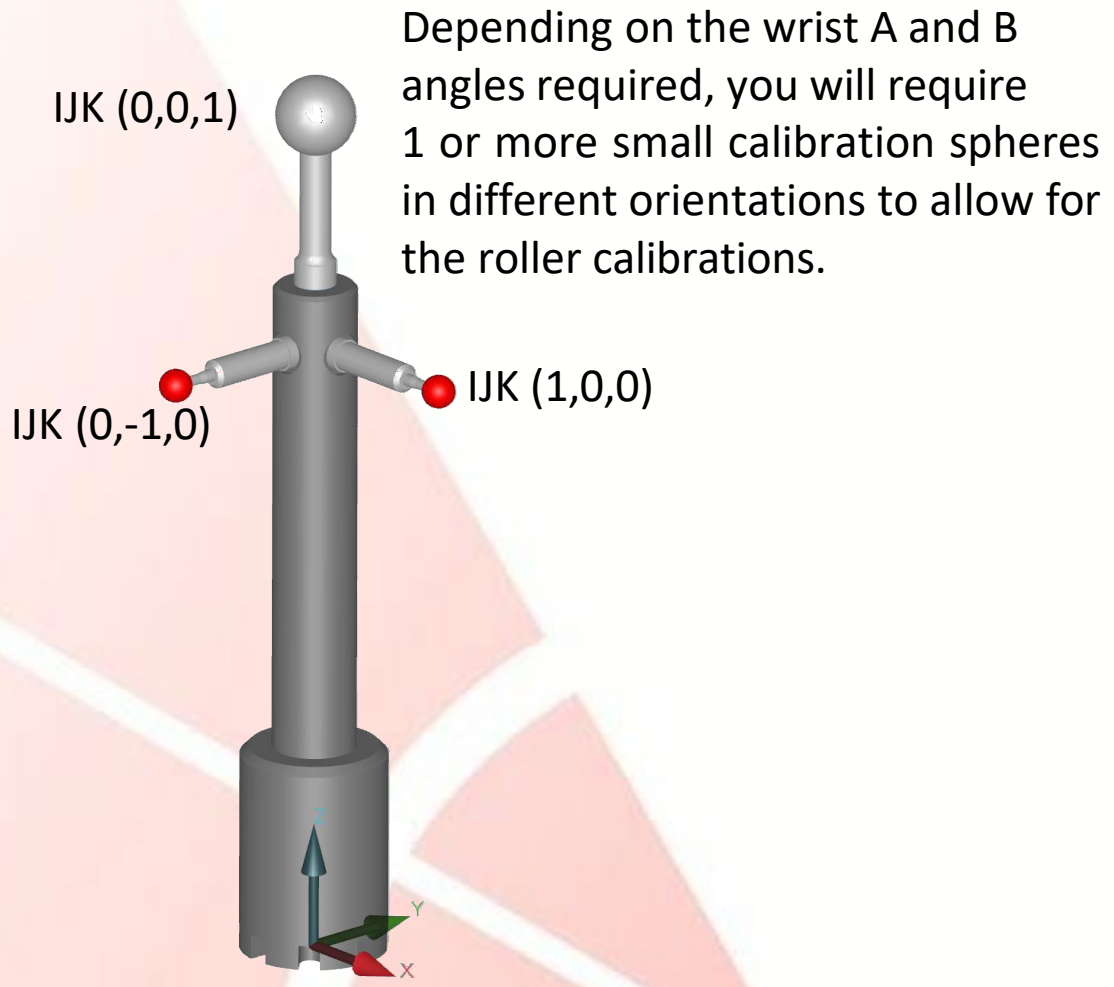
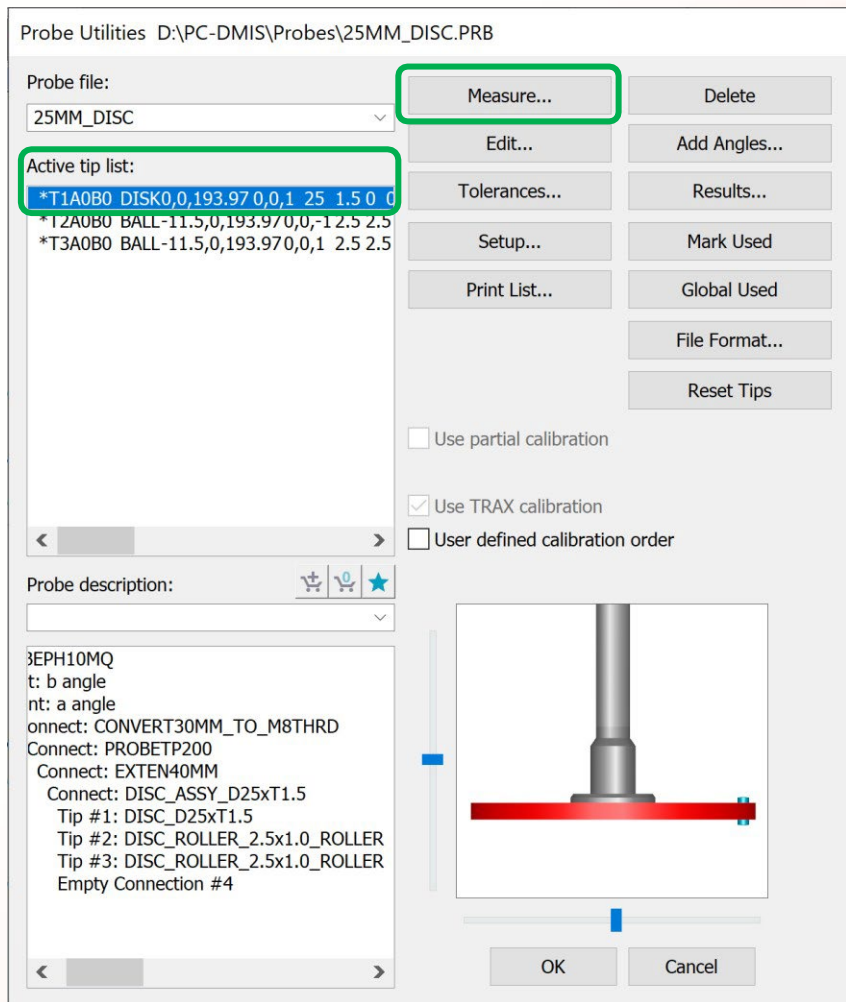
PC-DMIS

CALIBRATING CUSTOM DISC PROBES

Custom disc probes can be constructed using the Custom Probe Builder Utility that includes tips for the inbuilt rollers. This document will outline how to calibrate each tip of a custom disc probe.



After establishing each calibration sphere locations with the Master Probe (e.g. 2x20 A0B0), to calibrate the main spherical disc probe tip (shown in red on the probe dialog box), select only the T1A0B0 DISK tip and click Measure.



Use the supplied Disc Probe Calibration spreadsheet to calculate the Start and End angle for the desired probe
e.g. $\pm 3.4\text{deg}$

CALIBRATION START ANGLE CALCULATOR AND DISC/SHANK CLEARANCE VERIFICATION

USER INPUT VALUES FOR DISC STYLI						
CAL SPHERE RADIUS	EXTENSION RADIUS	DISC SPHERICAL DIAMETER	DISC ROLLER POSITION RADIUS	DISC THICKNESS/2	DIST ACROSS ROLLERS (TIP RAD*2)	ROLLER CYL RADIUS
4	2	25	11	0.75	2.5	0.5
DATA SOURCE	PART NUMBER		PART NUMBER	N-5000-7810		
CALCULATION INPUTS	12.5	11.5	0.75	2.5	0.5	
DISC SPHERICAL SURFACE START ANGLE ON CAL SPHERE			3.4	USE 3 LEVELS WITH +/- ANGLE \leq TO THIS VALUE		
MAX ROLLER TIP ANGLE			21.8	EDGE OF RADIUS TOUCHING SPHERE		
CALCULATED START ANGLE ON CAL SPHERE FOR ROLLERS			68.2	CHOSEN ANGLE MUST BE GREATER THAN CALCULATED ANGLE		
CHOSEN START ANGLE ON CAL SPHERE FOR ROLLERS			80.0			
CLEARANCE TO DISC			0.44	CLEARANCES MUST BE GREATER THAN 0		
CLEARANCE TO EXTENSION			4.09			

Disk Stylus Calibration Notes and Procedure

When you perform a discrete hit calibration of a disk stylus on an analog probe with the qualification sphere, you need to use the [Measure Probe dialog box](#) and specify the following:

- Five hits in the **Number of Hits** box
- Two levels in the **Number of Levels** box

These do not apply for probes that use the Renishaw scan-based calibration.

Make sure that when you define your probe, you model a disk stylus and not a ball stylus. Once you click the **Measure** button in the **Measure Probe** dialog box, PC-DMIS automatically recognizes that you have an analog probe with a disk stylus and goes through this procedure:

- *If you moved the sphere*, or if you chose the **Man + DCC** mode, PC-DMIS prompts you to take one manual hit on the very top of the qualification sphere (the north pole) with the center of the bottom of the disk stylus. If your probe configuration has an additional ball stylus attached to the bottom of the disk stylus, be sure to take the hit with that ball stylus.
- *If you didn't move the sphere*, and you chose not to use **Man + DCC** mode, PC-DMIS takes the hit on the top of the qualification tool in DCC mode.

Disk Stylus Calibration Notes and Procedure

PC-DMIS then finishes by doing the following in DCC mode:

•PC-DMIS does one of the following based on the value of the

[ProbeQualAnalogDiskUsePlaneOnBottom](#) registry entry located in the **Probe Cal** section of the PC-DMIS

Settings Editor:

- If this entry is set to 1, PC-DMIS takes four hits on top of the sphere using a circular pattern on the bottom of the disk stylus and calculates a plane from it. Measuring a plane helps ensure that the hits for calibrating the face are oriented properly to reflect the actual plane of the disk. *This is the default for the traditional calibration method using discrete hits.*
- If this entry is set to 0, PC-DMIS does not attempt to measure a plane on the bottom of the disk's face. Instead it uses the design orientation of the disk. *This is the default for the Renishaw scan-based calibration.*
- After the hits are taken on top of the sphere, it takes six hits on two levels to get a close location of the center point of the sphere.
- It uses the center point along with the vector from either the plane measurement or the design orientation to correctly position the subsequent measurement.
- For discrete hit calibration, it takes five hits (four in a circular pattern around the equator of the sphere and the fifth hit on the top, or the pole, of the sphere).
- For scan-based calibration, it takes a series of scans at two different levels (one slightly below the equator and one slightly above the equator). Each level is scanned in both clockwise and counterclockwise directions. Each direction for each level is also scanned using two different scan force offsets. This results in a total of eight scans.

Disk Stylus Calibration Notes and Procedure

PC-DMIS also provides two additional registry entries in the PC-DMIS Settings Editor in the **ProbeCal** section. You can use these to affect the location of the hits on the bottom of the disk stylus during calibration. These registry entries are:

- [ProbeQualAnalogDiskBottomHitsDistanceFromEdge](#)
- [ProbeQualAnalogDiskPlaneStartAngle](#)

For more information on these registry entries, see the "[ProbeCal](#)" section of the PC-DMIS Settings Editor documentation.

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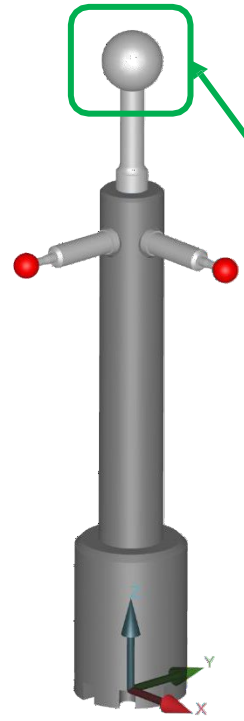
Set the Measure Probe dialog box as shown below.

Enter the start and end angle with 3 levels based on the values from the spreadsheet.

Only use DCC only

For non hexagon analog scanning bodies, you can use any number divisible by the number of levels. For Hexagon Analog Bodies, use 5 hits and 2 levels.

IJK (0,0,1)



Measure Probe

Number of hits: Manual DCC

Prehit / Retract:

Move speed (mm/sec): Man+DCC

Touch speed (mm/sec): DCC+DCC

Type of operation

Calibrate tips

Calibrate the unit

Qualification check

Home the unit Calibrate ScanRDV

Calibration mode

Default mode

User defined

Number of levels:

Start Angle:

End Angle:

Wrist calibration

Start:	End:	Increment:
A: -140.0	140.0	10.0
B: -180.0	180.0	10.0
C: -180.0	180.0	10.0

Shank qual Number shank hits:

Shank offset:

Parameter sets

Name: Save Delete

Tool mounted on rotary table

Reset tips to Theo at start of calibration

List of available tools:

TIGO SPHERE 0,0,1 24.994 0

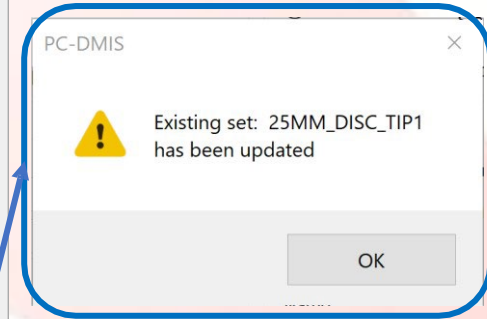
Add Tool... Edit Tool... Delete Tool

Tips to use if none explicitly selected

All Abort execution

Used in Routine

Measure Cancel



Save these settings as a parameter set specific to this tip for later use in an autocalibration routine.

Qualification Tool Moved

Has the qualification tool been moved, or has the Machine zero point changed?

No

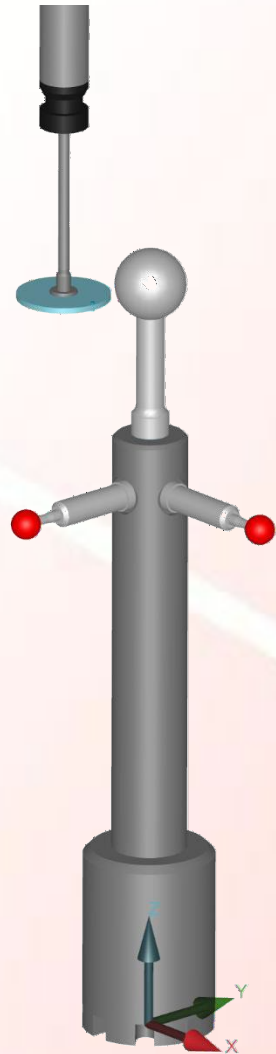
Yes (Manual hit to locate tool)

Yes (DCC hits to locate tool)

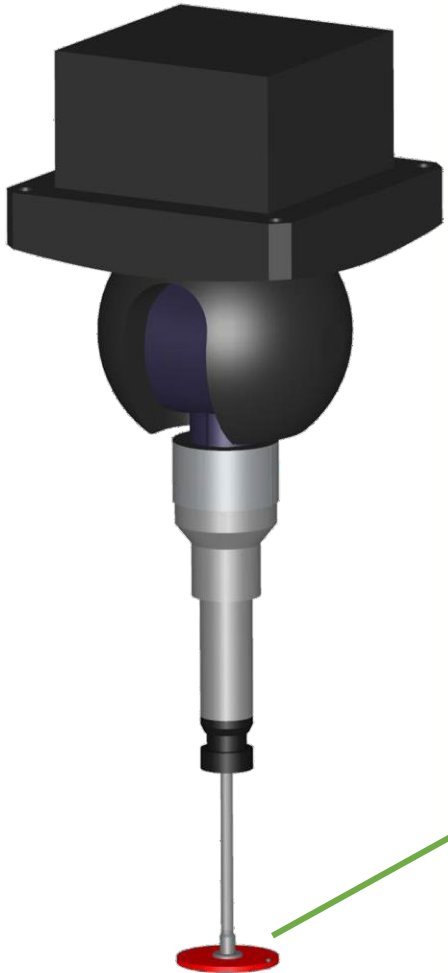
OK

Answer "No" for has the qualification tool moved

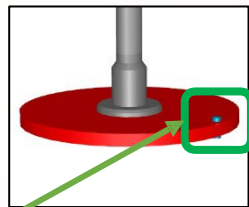
PC-DMIS will now automatically measure the datum sphere using 3 levels at -3.4deg, 0deg (equator) and +3.4deg, 12 hits per level. For Hexagon Analog Bodies, use 5 hits and 2 levels.



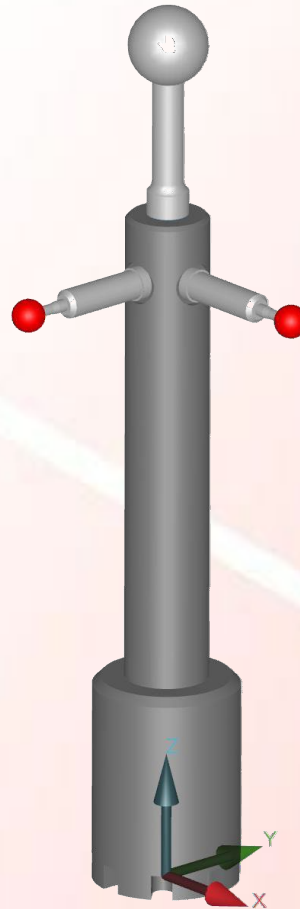
To calibrate the roller tips, we need to use a small calibration sphere that will not cause interferences with the probe body. Select the T2A0B0 Tip and click Measure.



TIP2 - ROLLER



IJK (0,-1,0)



Probe Utilities D:\PC-DMIS\Probes\25MM_DISC.PRB

Probe file: 25MM_DISC

Active tip list:

- *T2A0B0 BALL-11.5,0,193.970,0,-12.5 2.5
- *T3A0B0 BALL-11.5,0,193.970,0,1 2.5 2.5
- T1A0B0 DISK0,0,193.97 0,0,1 25 1.5 0 0

Buttons: Measure... (highlighted), Delete, Edit..., Add Angles..., Tolerances..., Results..., Setup..., Mark Used, Print List..., Global Used, File Format..., Reset Tips

Options: Use partial calibration, Use TRAX calibration, User defined calibration order

Probe description:

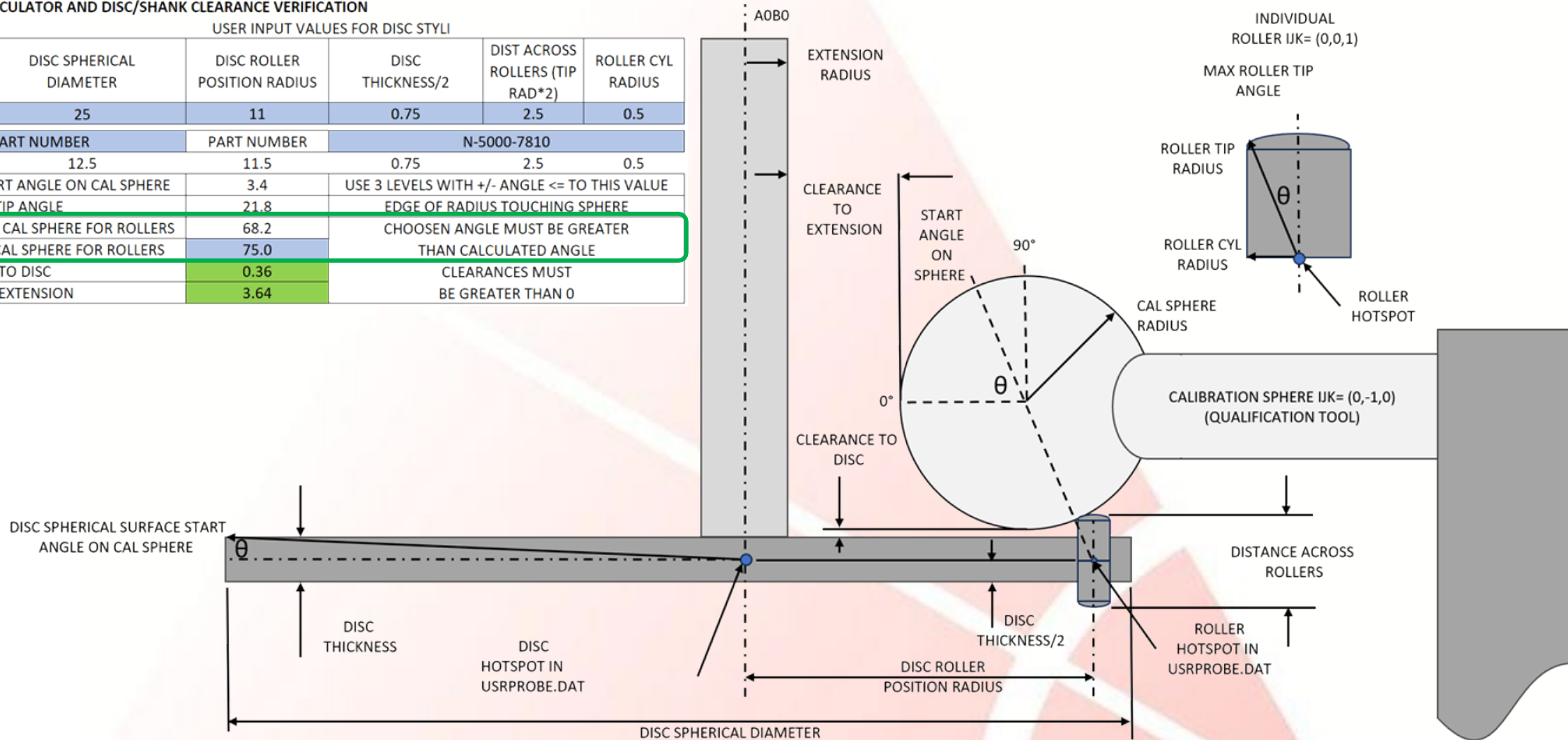
- PROBEPH10MQ
- Joint: b angle
- Joint: a angle
- Connect: CONVERT30MM_TO_M8THRD
- Connect: PROBETP200
- Connect: EXTEN40MM
- Connect: DISC_ASSY_D25xT1.5
- Tip #1: DISC_D25xT1.5
- Tip #2: DISC_ROLLER_2.5x1.0_ROL
- Tip #3: DISC_ROLLER_2.5x1.0_ROL
- Empty Connection #4

Buttons: OK, Cancel

To calibrate the roller tips, we need to use a small calibration sphere that will not cause interferences with the probe body. The spreadsheet outlines the clearances and start/end angles to use in the measure probe dialog window.

CALIBRATION START ANGLE CALCULATOR AND DISC/SHANK CLEARANCE VERIFICATION

USER INPUT VALUES FOR DISC STYLI						
CAL SPHERE RADIUS	EXTENSION RADIUS	DISC SPHERICAL DIAMETER	DISC ROLLER POSITION RADIUS	DISC THICKNESS/2	DIST ACROSS ROLLERS (TIP RAD*2)	ROLLER CYL RADIUS
4	2	25	11	0.75	2.5	0.5
DATA SOURCE	PART NUMBER		PART NUMBER	N-5000-7810		
CALCULATION INPUTS		12.5	11.5	0.75	2.5	0.5
DISC SPHERICAL SURFACE START ANGLE ON CAL SPHERE			3.4	USE 3 LEVELS WITH +/- ANGLE <= TO THIS VALUE		
MAX ROLLER TIP ANGLE			21.8	EDGE OF RADIUS TOUCHING SPHERE		
CALCULATED START ANGLE ON CAL SPHERE FOR ROLLERS			68.2	CHOSEN ANGLE MUST BE GREATER THAN CALCULATED ANGLE		
CHOSEN START ANGLE ON CAL SPHERE FOR ROLLERS			75.0			
CLEARANCE TO DISC			0.36	CLEARANCES MUST BE GREATER THAN 0		
CLEARANCE TO EXTENSION			3.64			



Set the Measure Probe dialog box as shown below.
 Enter the start and end angle based on the values from the spreadsheet with 4 levels and total number of hits 25.

IJK
(0,-1,0)

Measure Probe

Number of hits: 25
 Prehit / Retract: 1
 Move speed (mm/sec): 100
 Touch speed (mm/sec): 2

Type of operation
 Calibrate tips
 Calibrate the unit
 Qualification check
 Home the unit

Calibration mode
 Default mode
 User defined

Number of levels: 4
 Start Angle: 75
 End Angle: 90

Wrist calibration
 Start: End: Increment:
 A: -140.0 140.0 10.0
 B: -180.0 180.0 10.0
 C: -180.0 180.0 10.0

Parameter sets
 Name: 25MM_DISC_ROLLER_TIP2

Measure

Only use MAN+ DCC only to avoid crashes

PC-DMIS

Existing set: 25MM_DISC_ROLLER_TIP2 has been updated

OK

Save these settings as a parameter set specific to this tip for later use in an autocalibration routine.

Qualification Tool Moved

Has the qualification tool been moved, or has the Machine zero point changed?

For a small position change where the last known position is still very close to the current position, it may be possible to locate the tool in DCC mode without needing a Manual hit.

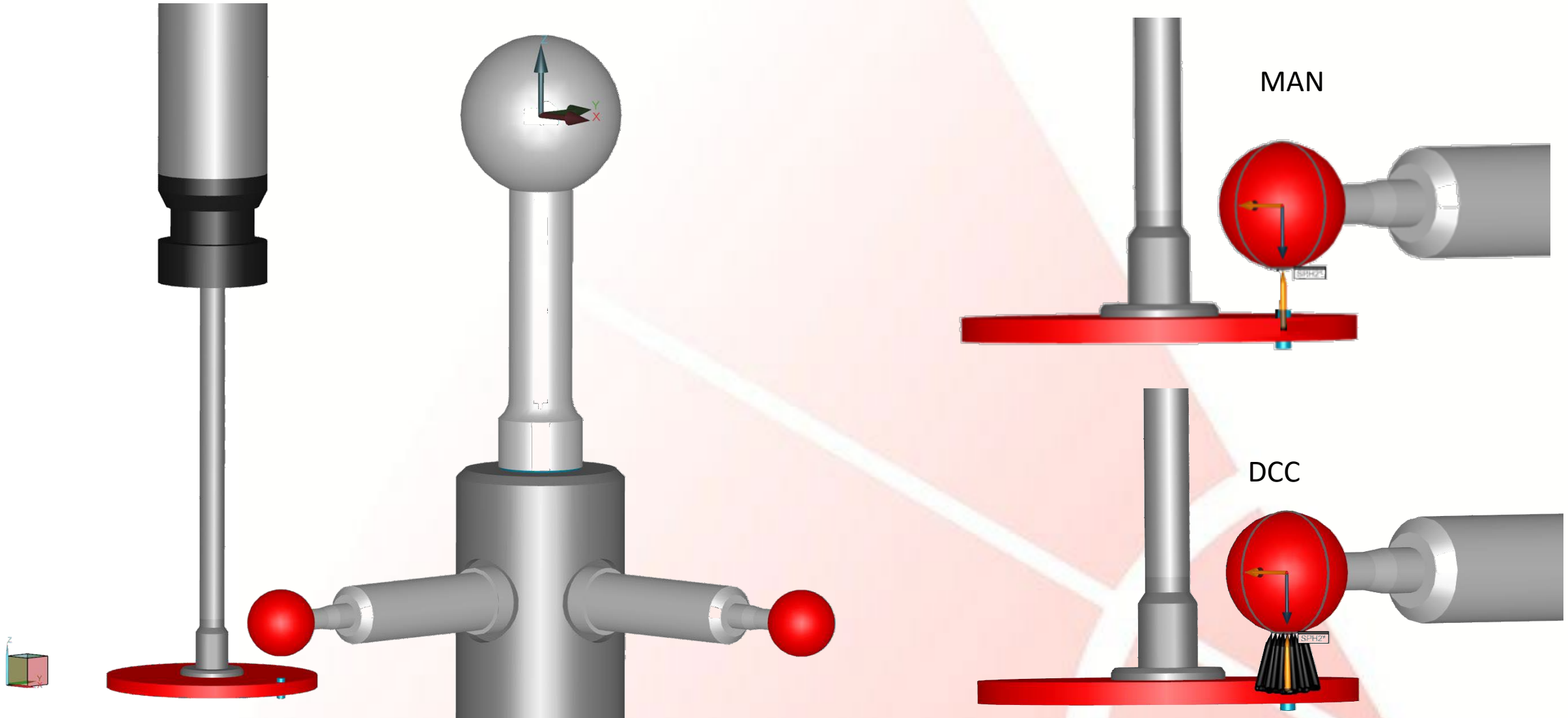
For a newly defined tool or a significant position change, a Manual hit will be needed to locate it.

No
 Yes (Manual hit to locate tool)
 Yes (DCC hits to locate tool)

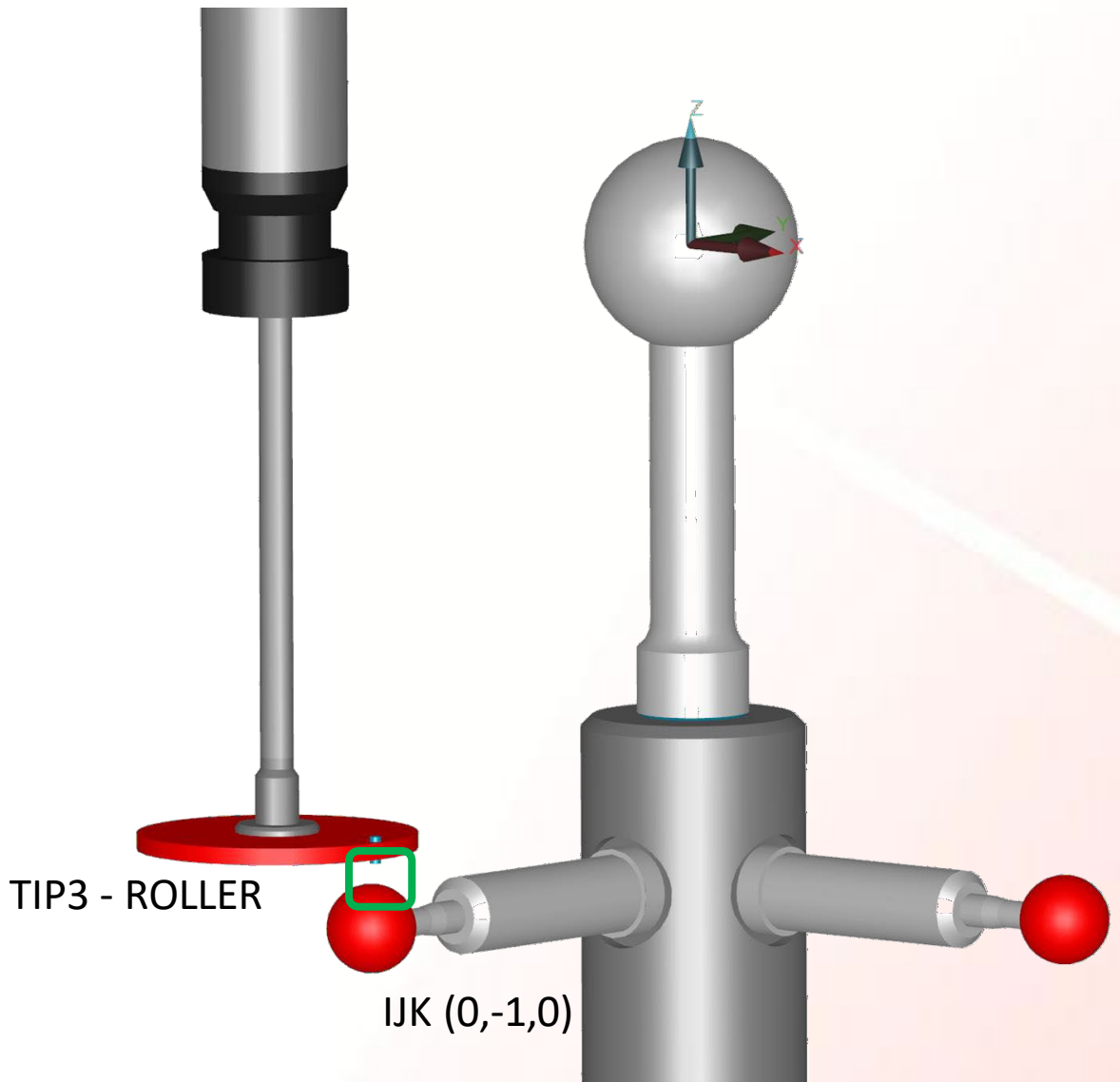
OK

Answer "No" for has the qualification tool moved

MAN + DCC –MAN hit on sphere with the roller, if you use DCC+DCC, it will try to take a hit on the top of the sphere and crash
- DCC is the calibration of the roller tip using 25 points over 3 levels between 75 to 90 degs on the sphere



To calibrate the roller tips, we need to use a small calibration sphere that will not cause interferences with the probe body. Select the T3A0B0 Tip and click Measure.



Probe Utilities D:\PC-DMIS\Probes\25MM_DISC.PR

Probe file: 25MM_DISC Measure... Delete

Active tip list:

*T2A0B0 BALL-11.5,0,193.970,0,-12.5,2.5
*T3A0B0 BALL-11.5,0,193.970,0,1 2.5 2.5
T1A0B0 DISK0,0,193.970,0,1 25 1.50 0

Edit... Add Angles...

Tolerances... Results...

Setup... Mark Used

Print List... Global Used

File Format...

Reset Tips

Use partial calibration

Use TRAX calibration

User defined calibration order

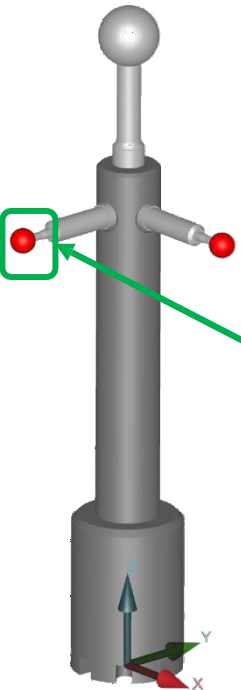
Probe description: 🛒 🛒 ★

PROBEPH10MQ
Joint: b angle
Joint: a angle
Connect: CONVERT30MM_TO_M8THRD
Connect: PROBETP200
Connect: EXTEN40MM
Connect: DISC_ASSY_D25xT1.5
Tip #1: DISC_D25xT1.5
Tip #2: DISC_ROLLER_2.5x1.0_ROL
Tip #3: DISC_ROLLER_2.5x1.0_ROL
Empty Connection #4

OK Cancel

Set the Measure Probe dialog box as shown below.
 Enter the start and end angle based on the values from the spreadsheet with 4 levels and total number of hits 25.

IJK (0,-1,0)



Measure Probe

Number of hits: 25

Prehit / Retract: 1

Move speed (mm/sec): 100

Touch speed (mm/sec): 2

Type of operation

Calibrate tips

Calibrate the unit

Qualification check

Home the unit

Calibrate ScanRDV

Calibration mode

Default mode

User defined

Number of levels: 4

Start Angle: -75

End Angle: -90

Wrist calibration

	Start:	End:	Increment:
A:	-140.0	140.0	10.0
B:	-180.0	180.0	10.0
C:	-180.0	180.0	10.0

Shank qual Number shank hits: 4

Shank offset: 5

Parameter sets

Name: 25MM_DISC_ROLLER_TIP3

Save

Delete

List of available tools:

DISC_ROLLER_0,-1,0 SPHERE 0,-1,0 8 0

Add Tool...

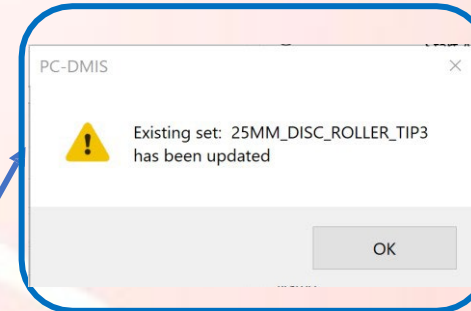
Edit Tool...

Delete Tool

Measure

Cancel

Only use MAN+ DCC only to avoid crashes



Save these settings as a parameter set specific to this tip for later use in an autocalibration routine.

Qualification Tool Moved

Has the qualification tool been moved, or has the Machine zero point changed?

For a small position change where the last known position is still very close to the current position, it may be possible to locate the tool in DCC mode without needing a Manual hit.

For a newly defined tool or a significant position change, a Manual hit will be needed to locate it.

No

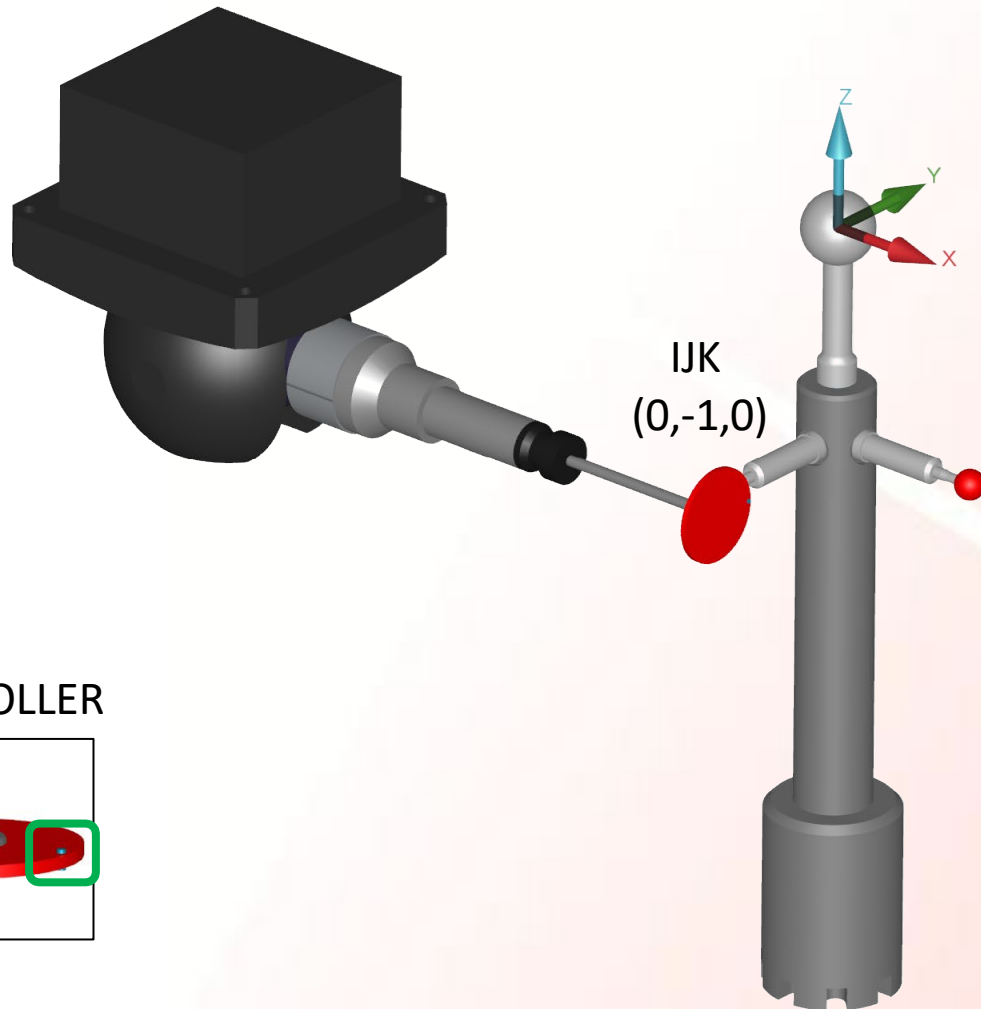
Yes (Manual hit to locate tool)

Yes (DCC hits to locate tool)

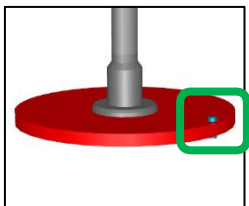
OK

Answer "No" for has the qualification tool moved

To calibrate the roller tips, we need to use a small calibration sphere that will not cause interferences with the probe body. Select the T2A90B90 Tip and click Measure.



TIP2 - ROLLER



Probe Utilities D:\PC-DMIS\Probes\25MM_DISC.PRB

Probe file: 25MM_DISC

Active tip list:

- *T1A90B90 DISK-158.97,0,35 -1,0,0,25 1.
- *T2A90B0 BALL-11.5,0,193.97,0,0,-1,2.5,2.5
- *T2A90B90 BALL-158.97,-11.5,35 1,0,0 2.**
- *T3A90B0 BALL-11.5,0,195.97,0,0,1 2.5 2.5
- *T3A90B90 BALL-158.97,-11.5,35 -1,0,0,2.
- T1A0B0 DISK0,0,193.97,0,0,1 25 1.5 0 0

Buttons: Measure... (highlighted), Edit..., Tolerances..., Setup..., Print List..., Delete, Add Angles..., Results..., Mark Used, Global Used, File Format..., Reset Tips

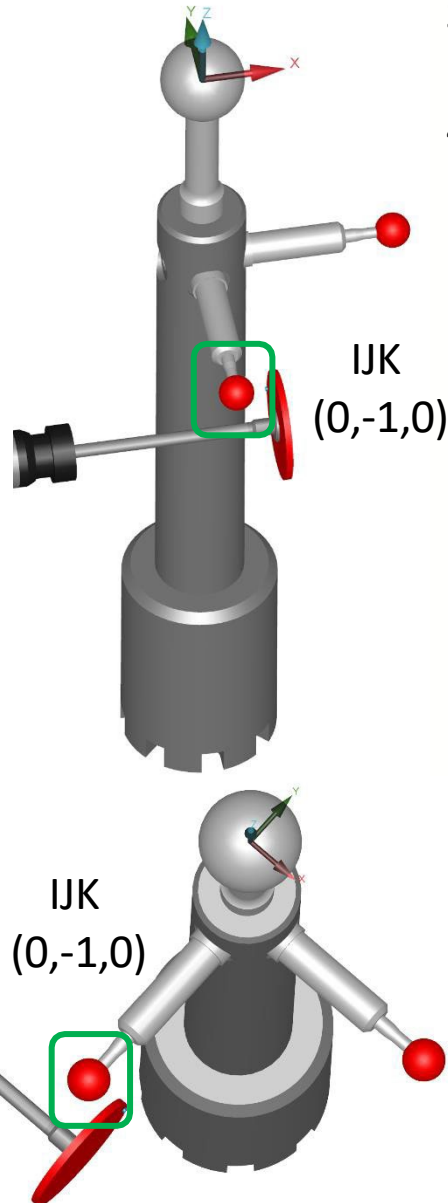
Options: Use partial calibration, Use TRAX calibration, User defined calibration order

Probe description:

PROBEPH10MQ
Joint: b angle
Joint: a angle
Connect: CONVERT30MM_TO_M8THRD
Connect: PROBETP200
Connect: EXTEN40MM
Connect: DISC_ASSY_D25xT1.5
Tip #1: DISC_D25xT1.5
Tip #2: DISC_ROLLER_2.5x1.0_ROL
Tip #3: DISC_ROLLER_2.5x1.0_ROL
Empty Connection #4

OK Cancel

Set the Measure Probe dialog box as shown below.
 Enter the start and end angle based on the values from the spreadsheet with
 4 levels and total number of hits 25.



Measure Probe

Number of hits: Manual
 Prehit / Retract: DCC
 Move speed (mm/sec): Man+DCC
 Touch speed (mm/sec): DCC+DCC

Type of operation
 Calibrate tips
 Calibrate the unit
 Qualification check
 Home the unit Calibrate ScanRDV

Calibration mode
 Default mode User defined

Number of levels:
 Start Angle:
 End Angle:

Wrist calibration

	Start:	End:	Increment:
A:	-140.0	140.0	10.0
B:	-180.0	180.0	10.0
C:	-180.0	180.0	10.0

Shank qual Number shank hits:
 Shank offset:

Parameter sets
 Name: Save

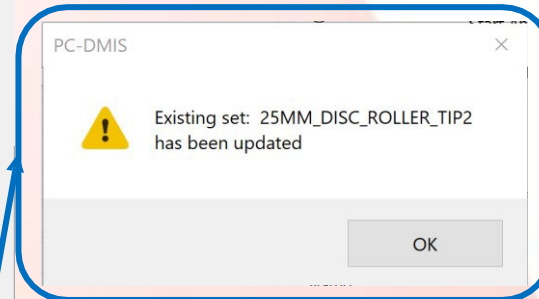
Tool mounted on rotary table Reset tips to Theo at start of calibration

List of available tools:
 DISC_ROLLER_0,-1,0 SPHERE 0,-1,0 8 0

Add Tool... Edit Tool...
 Delete Tool

Tips to use if none explicitly selected
 All Abort execution
 Used in Routine

Only use MAN+ DCC
 only to avoid crashes



Save these settings as a
 parameter set specific to
 this tip for later use in an
 autocalibration routine.

Qualification Tool Moved

Has the qualification tool been moved, or has the Machine zero point changed?

For a small position change where the last known position is still very close to the current position, it may be possible to locate the tool in DCC mode without needing a Manual hit.

For a newly defined tool or a significant position change, a Manual hit will be needed to locate it.

No
 Yes (Manual hit to locate tool)
 Yes (DCC hits to locate tool)

Answer "No" for has the
 qualification tool moved