



MAKING MEASUREMENT

MORE ACCURATE, EFFICIENT, PRODUCTIVE

GD&T Inspection in SpatialAnalyzer

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New River Kinematics

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New River Kinematics

GD&T Inspection

Incorporating Standardized Inspection within SpatialAnalyzer

Check Pre-Eval Validator

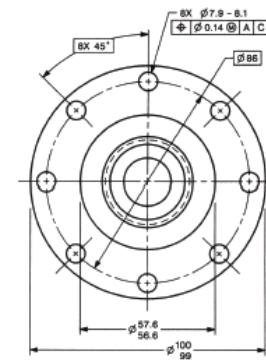
- None ASME (1994) ISO (1983)
 ASME (2009) ISO (2004)
 ISO (2012)

(If an ASME or ISO option is selected, additional validation is done before check eval according to the selection and this is also indicated in the reports.)

(The choice of None/ASME/ISO does not affect the numeric results from the GD&T evaluation. It only controls the validation done before evaluation to determine if the check can be evaluated)

Dimensioning and Tolerancing

Engineering Drawing and Related Documentation Practices



AN INTERNATIONAL STANDARD



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GD&T Inspection

	GD&T	“Regular Inspection”
Alignments	Datum Structure Check Specific	Current Position
Computation	Bounding Tol. Zone Outlier Pts = Part Error	RMS (root mean square) User controls rejection rules
Goals:	Pass/Fail at Tolerance	Is the part good and if not..., how do I fix it?



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GD&T Inspection

GD&T Inspection can be Divided into 2 Distinct Steps

1. Defining the Checks

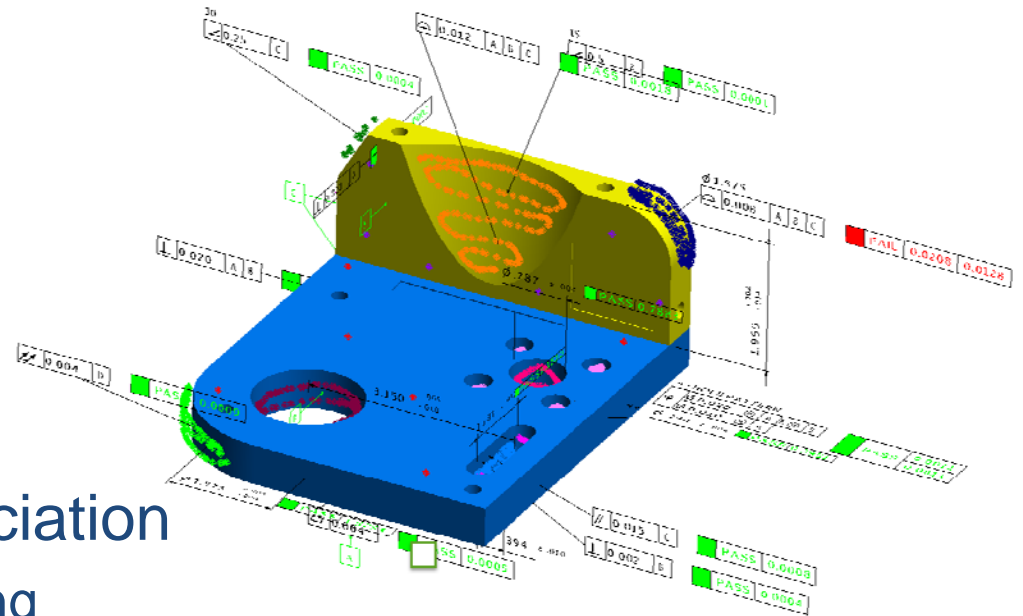
Building Annotations

- Tolerance Structure
- Nominal designation

1. Measurement Process

Data Gathering & Association

- Inspection/ inspect scripting
- Toolkit or direction Association
- or Measurement Plan (MP)

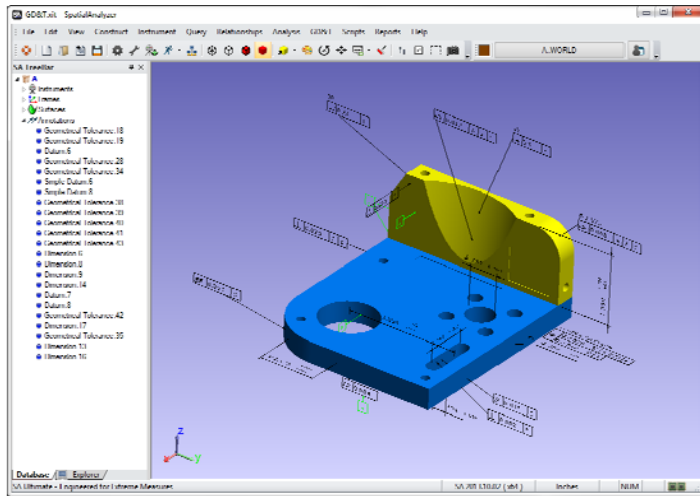
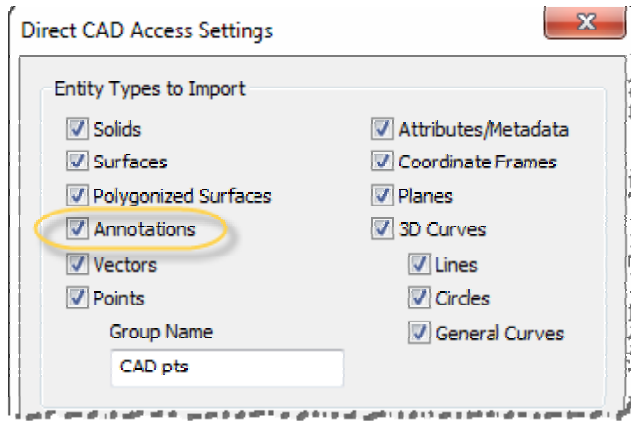


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GD&T and CAD Import



Manufacturer	Format	Version	Polygonized Surfaces	Surfaces	Annotations
Standard	PRC (PRC)	All Versions	✓	✓	✓
	IGES (IGS, IGES)	5.1, 5.2, 5.3	✓	✓	N/A
	Industry Foundation Classes (IFC, IFCZIP)	IFC2x Editions 2, 3, & 4	✓	N/A	N/A
	STEP (.STR, .STEP)	AP 203 E1/E2, AP 214, AP 242	✓	✓	✓
	Stereo Lithography (.STL)	All Versions	✓	N/A	N/A
	VDA-FS (.VDA)	v1.0 & v2.0	✓	✓	N/A
	VRML (.WRL, .VRML)	v1.0, v2.0	✓	N/A	N/A
Adobe	Adobe 3D PDF (.PRC)	All Versions	✓	✓	✓
McNeel	Rhinoceros (.3DM)	v4, v5	✓	✓	N/A
DASSAULT SYSTEMES	CATIA V4 (.MODEL, .SESSION, .DLV, .EXP)	Up to 4.2.5	✓	✓	✓
	CATIA V5 (.CATDRAWING, .CATPRODUCT, .CATPART, .CATSHAPE, .CGR)	R4 to R21, V5-6R2014	✓	✓	✓
	CATIA V6 (.3DXML)	2011 to 2013	✓	✓	✓
	SolidWorks (.SLDASM, .SLDPRN1)	Up to 2014	✓	✓	✓
	ACIS (.SAT, .SAB)	Up to v23	✓	✓	N/A
SIEMENS	NX (.PRT)	Unigraphics v11.0 to NX 9.0	✓	✓	✓
	JT (.JT)	Up to 10.0	✓	✓	✓
	Parasolid (.X.T, .X.B, .XMT, .XMT.TXT)	Up to v26	✓	✓	N/A
	Solid Edge (.ASM, .PAR, .PWD, .PSM)	V19-20, ST-ST7	✓	✓	✓
	I-DEAS (.MF1, .ARC, .JUN, .PKG)	Up to 13.x (NX 5) & NX 6	✓	✓	✓
PTC	Pro/ENGINEER (.ASM, .NEU, .PRT, .XAS, .XPR)	Up to Wildfire 5	✓	✓	✓
	Creo Elements/Pro/Parametric (.ASM, .NEU, .PRT, .XAS, .XPR)	v5.0 (Pro) v3.0 (Parametric)	✓	✓	✓
Autodesk	Inventor (.IPT, .IAM)	Up to 2015	✓	✓	N/A



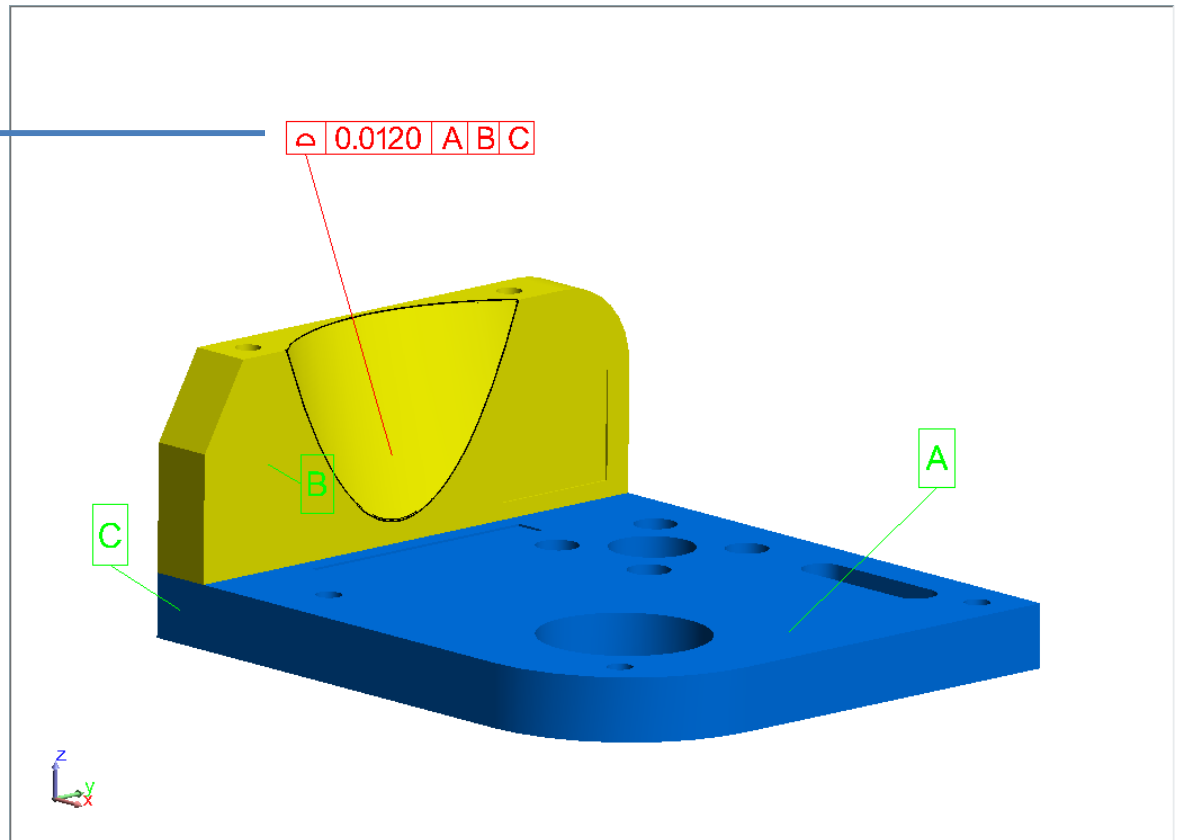
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GD&T Annotations

SA TreeBar [icon] [close]

- ▶ A
- ▶ Instruments
- ▶ Point Groups
- ▶ Frames
- ▶ Lines
- ▶ Surfaces
- ▶ Annotations
 - Geometrical Tolerance.18
 - Geometrical Tolerance.19
 - Datum.6
 - **Geometrical Tolerance.28**
 - Geometrical Tolerance.34
 - Simple Datum.6
 - Simple Datum.8
 - Geometrical Tolerance.38
 - Geometrical Tolerance.39
 - Geometrical Tolerance.40
 - Geometrical Tolerance.41
 - Geometrical Tolerance.43
 - Dimension.6
 - Dimension.8
 - Dimension.9
 - Dimension.14
 - Datum.7
 - Datum.8
 - Geometrical Tolerance.42
 - Dimension.17
 - Geometrical Tolerance.35
 - Dimension.13
 - Dimension.16

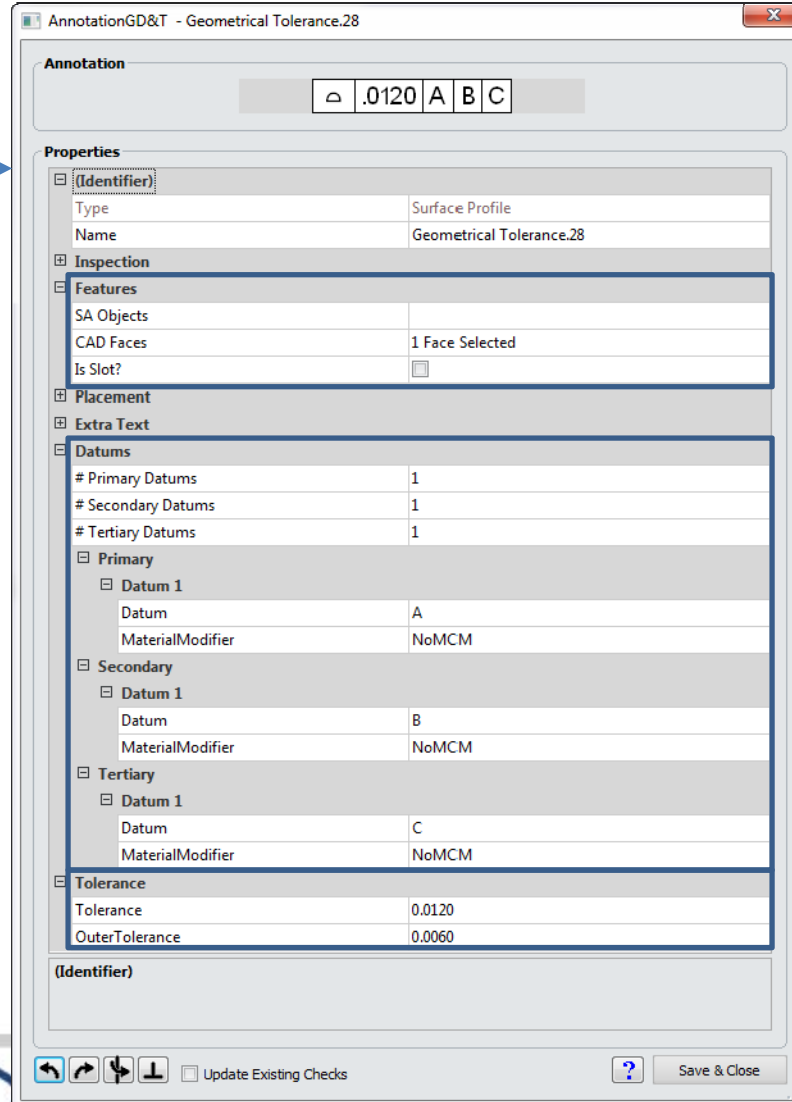
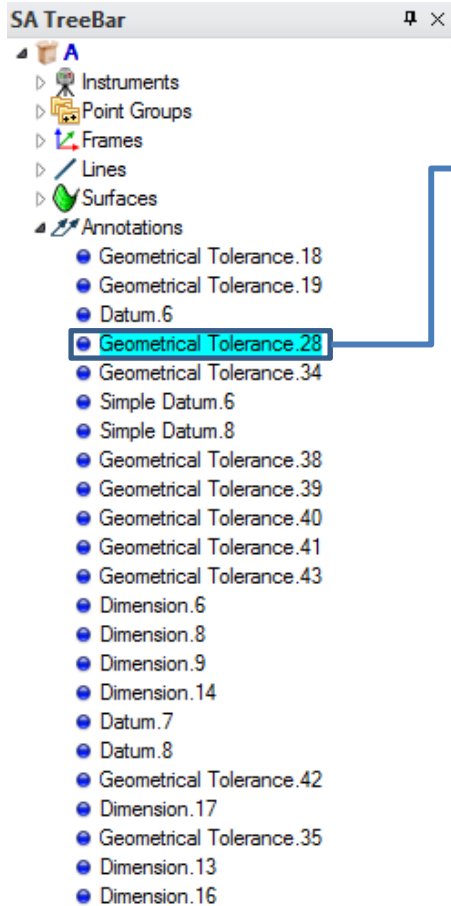


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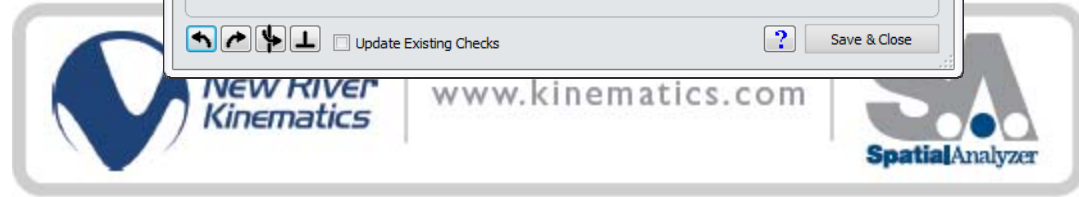
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GD&T Annotations



- SA Objects/CAD Face
- Datum Assignment
- Tolerance Definition



GD&T Annotations

SA TreeBar

- ▶ Instruments
- ▶ Point Groups
- ▶ Frames
- ▶ Lines
- ▶ Surfaces
- ▶ Annotations
 - Geometrical Tolerance.18
 - Geometrical Tolerance.19
 - Datum.6
 - Geometrical Tolerance.28
 - Geometrical Tolerance.34
 - Simple Datum.6
 - Simple Datum.8
 - Geometrical Tolerance.38
 - Geometrical Tolerance.39
 - Geometrical Tolerance.40
 - Geometrical Tolerance.41
 - Geometrical Tolerance.43
 - Dimension.6
 - Dimension.8
 - Dimension.9
 - Dimension.14
 - Datum.7
 - **Datum.8**
 - Geometrical Tolerance.42
 - Dimension.17
 - Geometrical Tolerance.35
 - Dimension.13
 - Dimension.16

Datum Annotations:

GD&T Datum - B

Properties

(Identifier)

Name B

Inspection

Features

SA Object	
CAD Feature	1 Face Selected
Is Slot?	<input type="checkbox"/>
SA Offset Object	

Placement

CAD Feature

(Identifier)

Update Existing Datums, Checks, and Annotations which use this.

Save & Close

- SA Objects/CAD Face

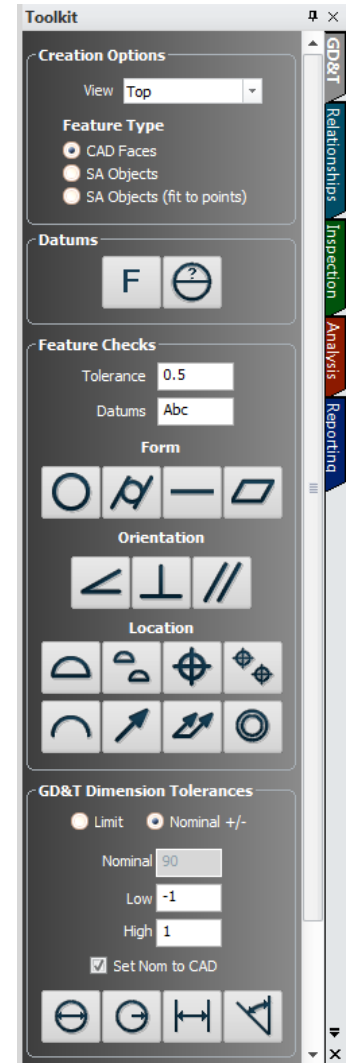
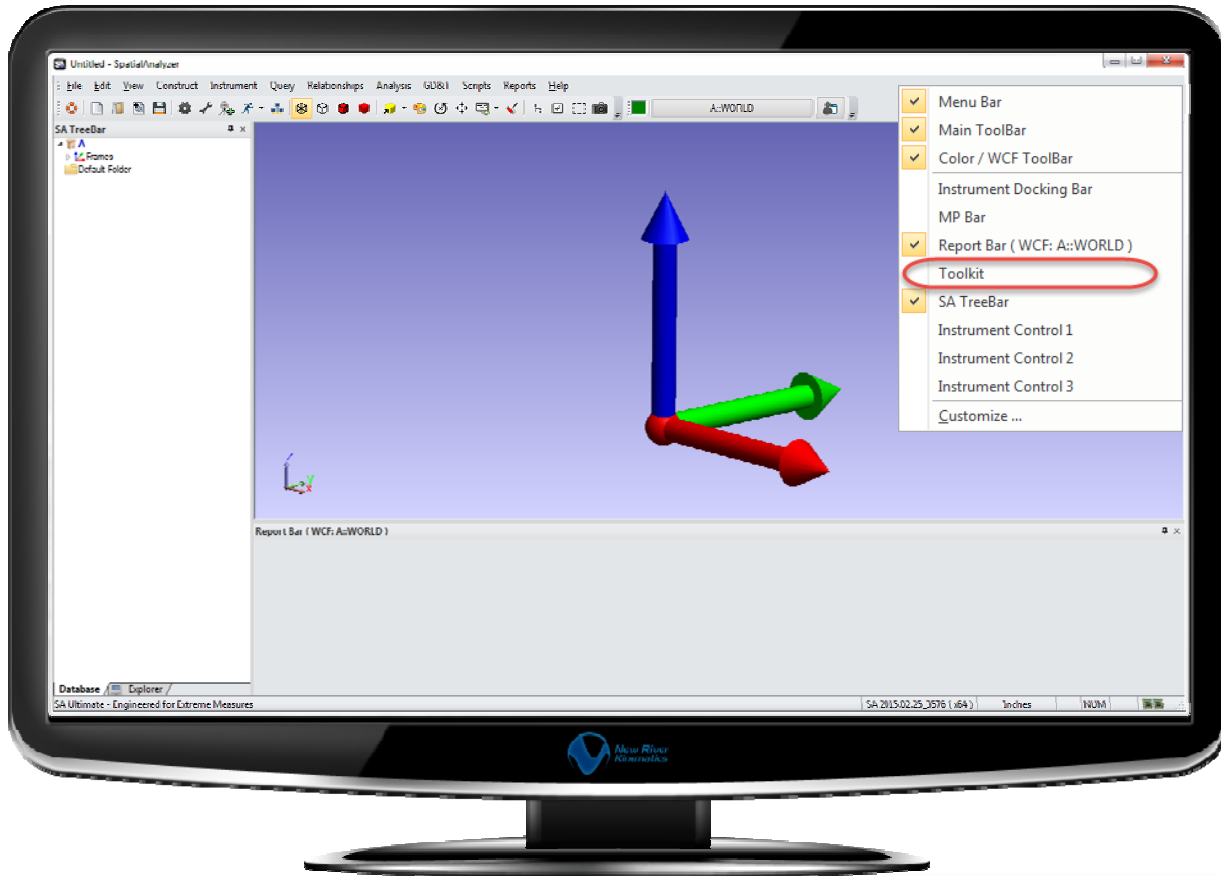


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Building Annotations

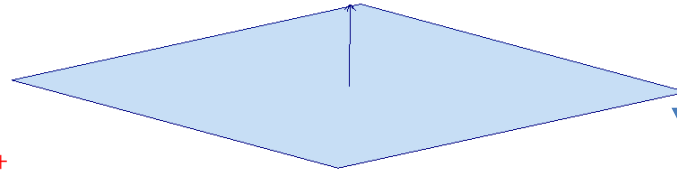
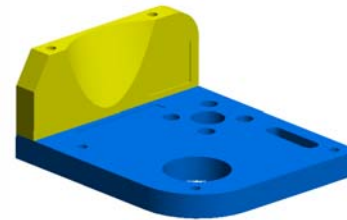
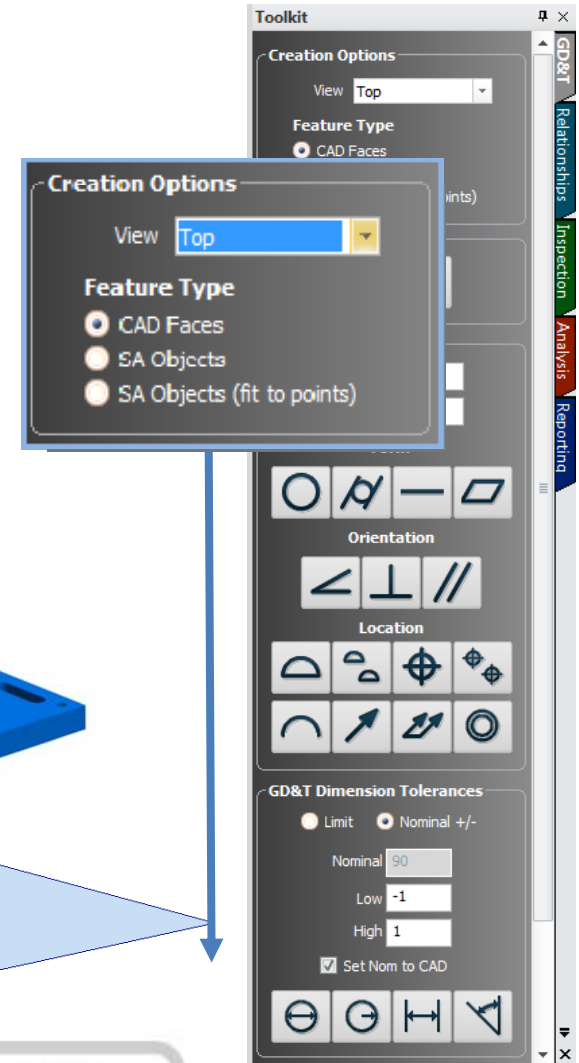
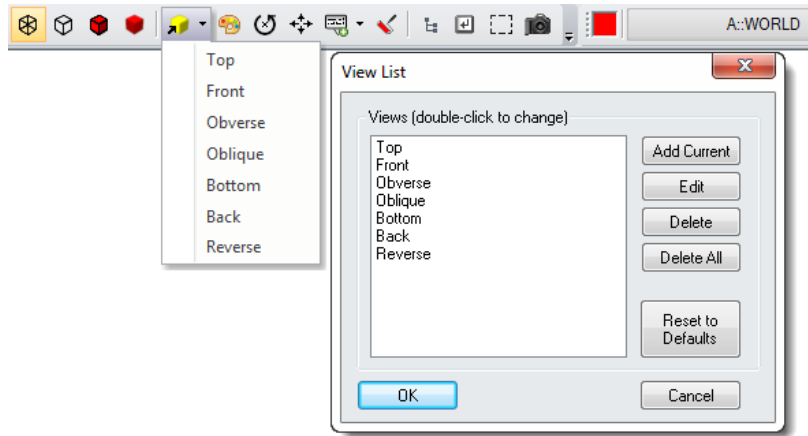


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GD&T Annotations

- Annotation View Orientation:

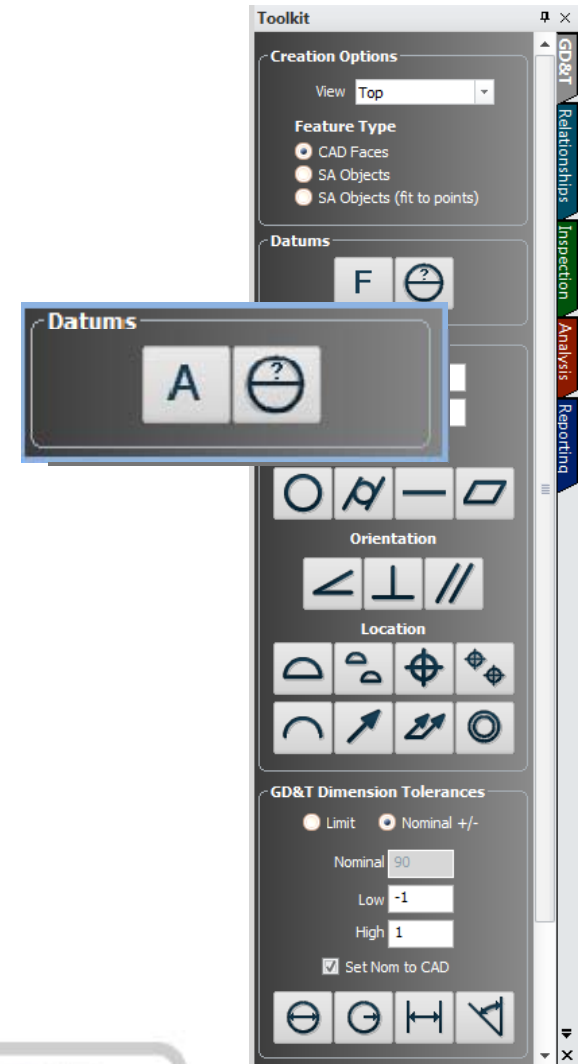
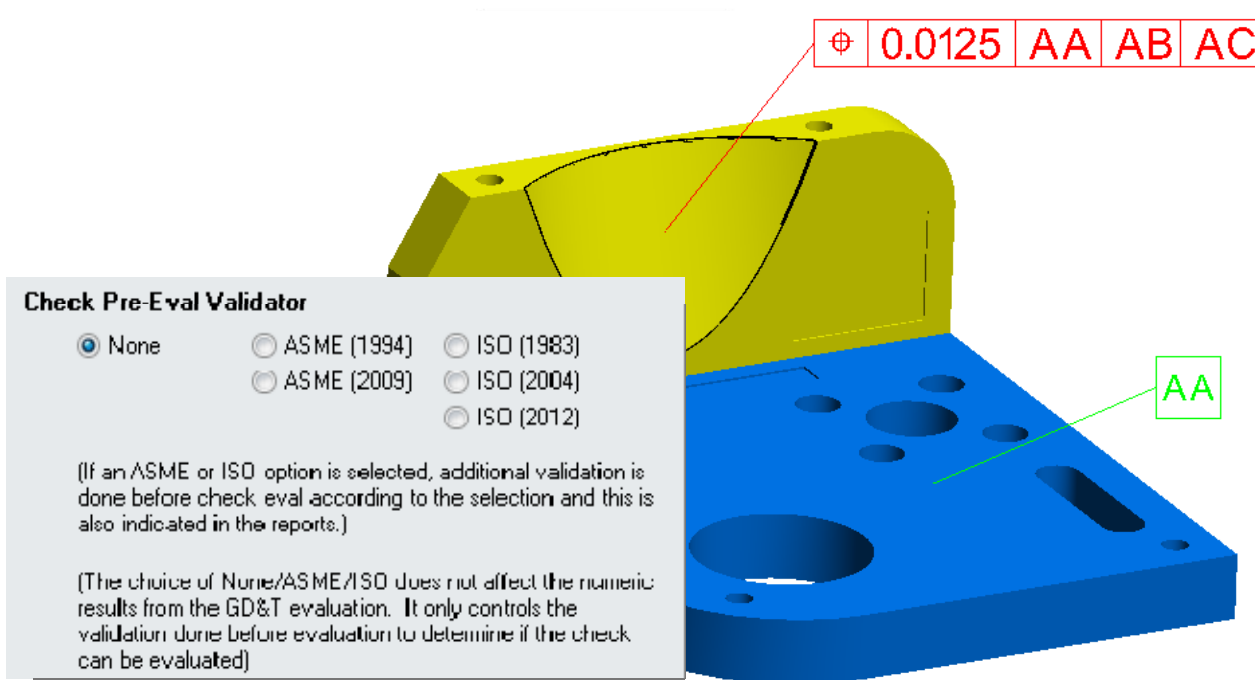


- CAD Faces vs. SA Objects
SA Objects (Fit to Points)

GD&T Annotations

Datum and Datum Target Designations

- (Hold down A-Z to pick a letter)
- Click-point defines leader line anchor point



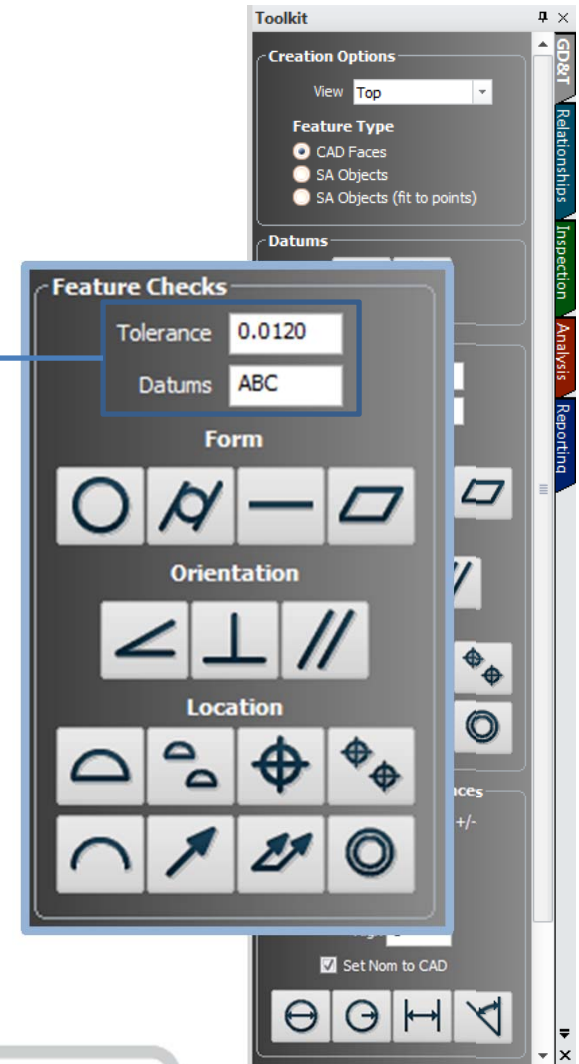
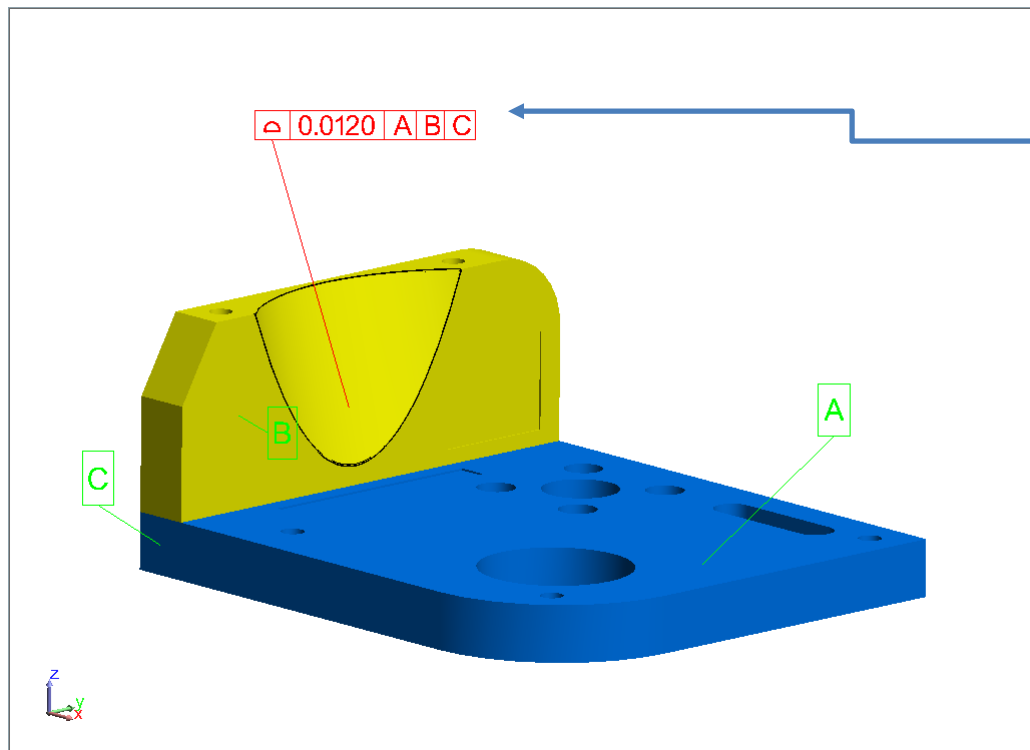
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GD&T Annotations

Feature Checks Designation:



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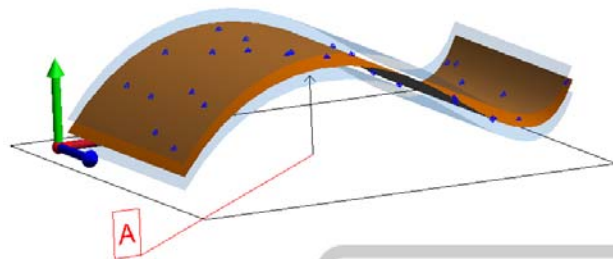
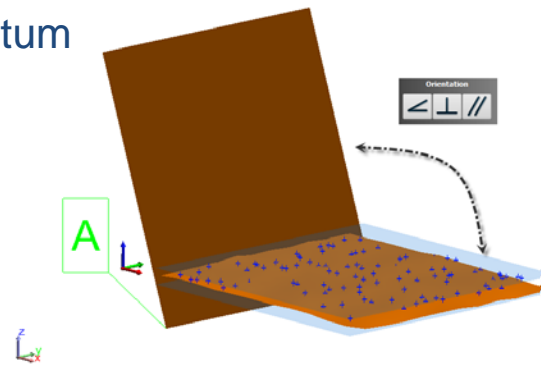
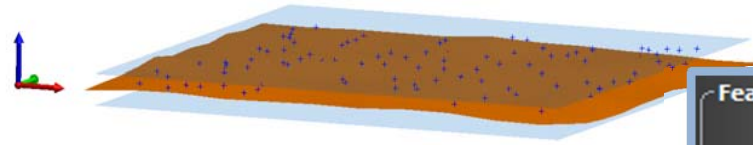
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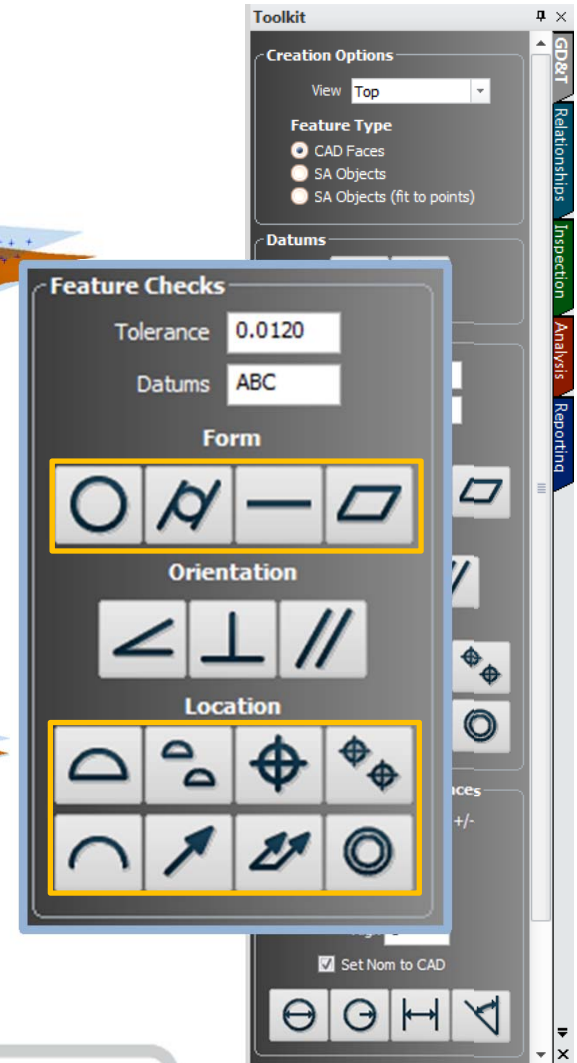
Feature Checks Designation:

- Form Checks
 - Datum Independent
- Orientation Checks
 - Depend on 1 Datum
- Location Checks
 - Can Include 1-3 Datums
 - Can Include 1-2 Tiers



4 - HOLE PATTERN

⌀	⌀0.0200 ^(M)	A	E ^(M)	B
	⌀0.0100 ^(M)	A		

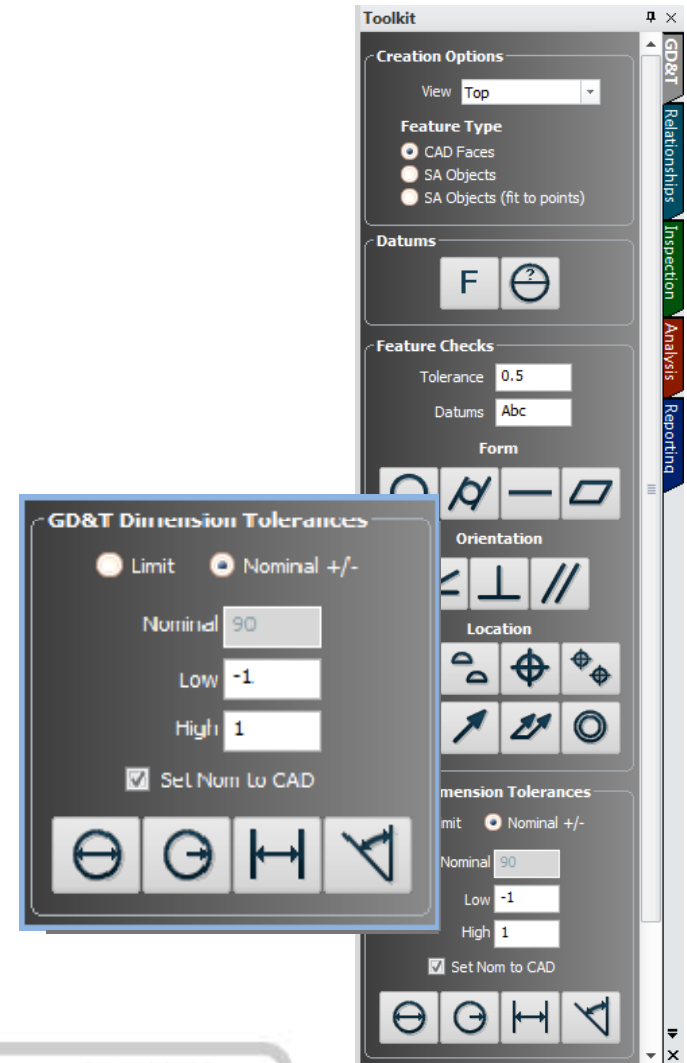


GD&T Annotations

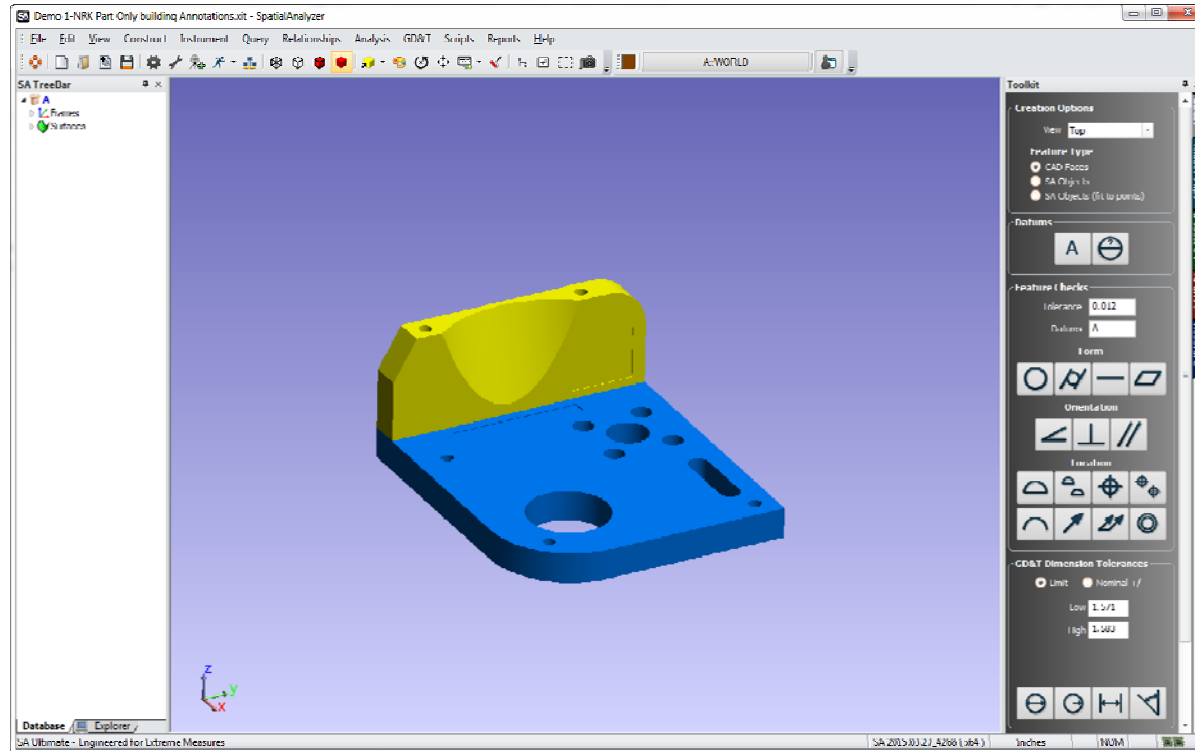
- Dimensional Tolerances
 - Datum Independent

————— $\varnothing 1.5710-1.5830$
 $\varnothing 1.5750 \begin{matrix} 0.0080 \\ -0.0040 \end{matrix}$

- Required for Material Modifiers
 - MMC, LMC



Building Annotations Demo



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GD&T Inspection

GD&T Inspection can be Divided into 2 Distinct Steps

1. Defining the Checks

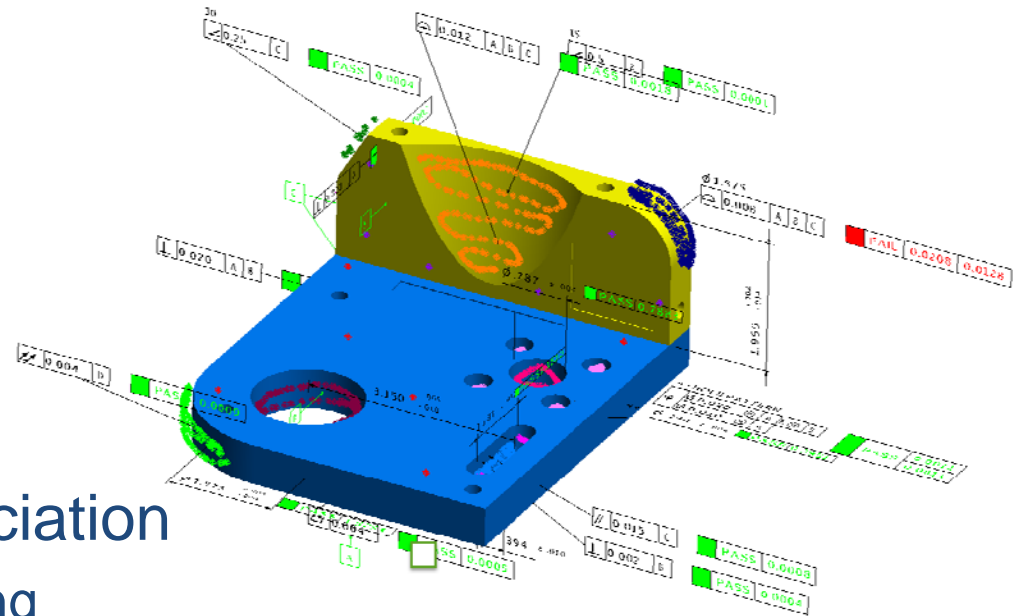
Building Annotations

- Tolerance Structure
- Nominal designation

1. Measurement Process

Data Gathering & Association

- Inspection/ inspect scripting
- Toolkit or direction Association
- or Measurement Plan (MP)

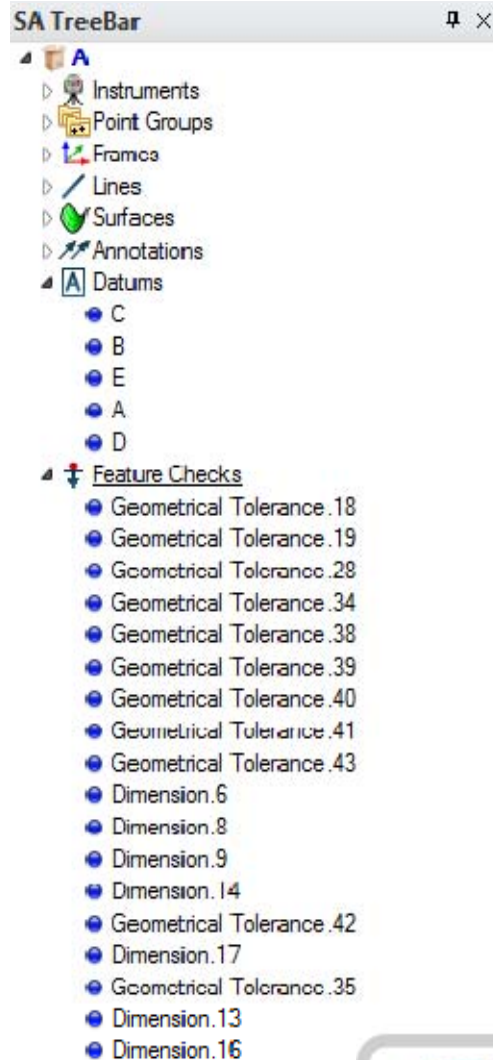


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Building Feature Checks



- Tree Structure
 - Annotations
 - Tolerance & check definition
 - Datums & Feature Checks
 1. Link points to annotations
 2. Point offset & evaluation control
 3. Contain guided inspection controls



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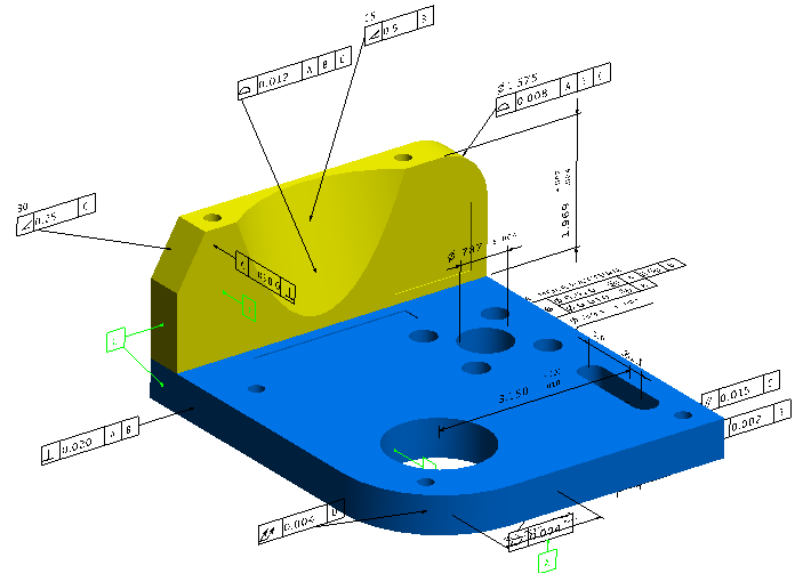
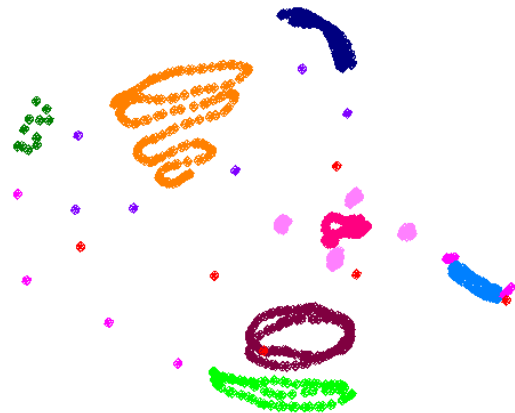
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Building Feature Checks

SA TreeBar

- ▶ A
 - ▶ Instruments
 - ▶ Point Groups
 - ▶ Frames
 - ▶ Lines
 - ▶ Surfaces
 - ▶ Annotations
 - ▶ A Datums
 - C (4 meas)
 - B (6 meas)
 - E (74 meas)
 - A (6 meas)
 - D (131 meas)
 - ▶ Feature Checks
 - Geometrical Tolerance.18 (11 meas)
 - Geometrical Tolerance.19 (153 meas)
 - Geometrical Tolerance.28 (153 meas)
 - Geometrical Tolerance.34 (123 meas)
 - Geometrical Tolerance.38 (6 meas)
 - Geometrical Tolerance.39 (60 meas)
 - Geometrical Tolerance.40 (78 meas)
 - Geometrical Tolerance.41 (60 meas)
 - Geometrical Tolerance.43 (4 meas)
 - Dimension.6 (74 meas)
 - Dimension.8 (60 meas)
 - Dimension.9 (6 meas)
 - Dimension.14 (131 meas)
 - Geometrical Tolerance.42 (6 meas) (PASS)
 - Dimension.17 (11 meas)
 - Geometrical Tolerance.35 (188 meas)
 - Dimension.13 (131 meas)
 - Dimension.16 (188 meas)



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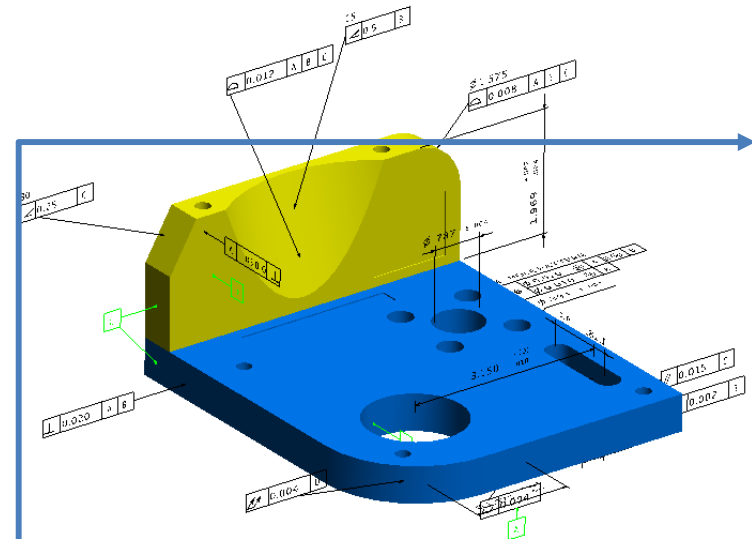
GD&T Inspection

Direct Point Association

SA TreeBar

- ▶ Instruments
- ▶ Point Groups
- ▶ Frames
- ▶ Lines
- ▶ Surfaces
- ▶ Annotations
- ▶ **Datums**
 - C
 - B
 - E
 - A
 - D
- ▶ **Feature Checks**
 - Geometrical Tolerance.18
 - Geometrical Tolerance.19
 - Geometrical Tolerance.28
 - Geometrical Tolerance.34
 - Geometrical Tolerance.38
 - Geometrical Tolerance.39
 - Geometrical Tolerance.40
 - Geometrical Tolerance.41
 - Geometrical Tolerance.42
 - Dimension.6
 - Dimension.8
 - Dimension.9
 - Dimension.14
 - Geometrical Tolerance.42
 - Dimension.17
 - Geometrical Tolerance.35
 - Dimension.13
 - Dimension.16

- Associate Points
- Associate Clouds
- Clear Point/Cloud Associations
- Delete Associated Points/Clouds
- Trap Measurements from an Instrument
- Stop Trapping Measurements
- Inspection
- Properties
- Tolerance
- Delete
- Highlight
- Include in Composite Quick Reports
- Generate Quick Report
- Add to Active SA Report
- Report Options
- Change Order In List



Toolkit

Instrument Alignment

Repeat Last New

Measurement Trapping

◀ ■ ▶

Task

- Dimension.6
- Dimension.8
- Dimension.9
- Dimension.14
- Geometrical Tolerance.42
- Dimension.17
- Geometrical Tolerance.35
- Dimension.13
- Dimension.16
- A C
- A B
- A E
- A A
- A D

Sweep

Delete Points

Clear Assoc.

GD&T Relationships Inspection Analysis Reporting

GD&T Inspection

- SA TreeBar
- ▶ Instruments
 - ▶ Point Groups
 - ▶ Frames
 - ▶ Lines
 - ▶ Surfaces
 - ▶ Annotations
 - ▶ **A** Datums
 - C
 - B
 - E
 - A
 - D
 - ▶ **+** Feature Checks
 - Geometrical Tolerance.18
 - Geometrical Tolerance.19
 - Geometrical Tolerance.28
 - Geometrical Tolerance.34
 - Geometrical Tolerance.38
 - Geometrical Tolerance.39
 - Geometrical Tolerance.40
 - Geometrical Tolerance.41
 - Geometrical Tolerance.43
 - Dimension.6
 - Dimension.8
 - Dimension.9
 - Dimension.14
 - Geometrical Tolerance.42
 - Dimension.17
 - Geometrical Tolerance.35
 - Dimension.13
 - Dimension.16

Proceed with inspection design of Datum A

Inspection Design Options

Save View for Inspection

Create Nominal Points by clicking on the feature (6 Nom. Pts.)

Group Name: DatumA-InspNomPts Point Name: DatumA-InspNomPt6

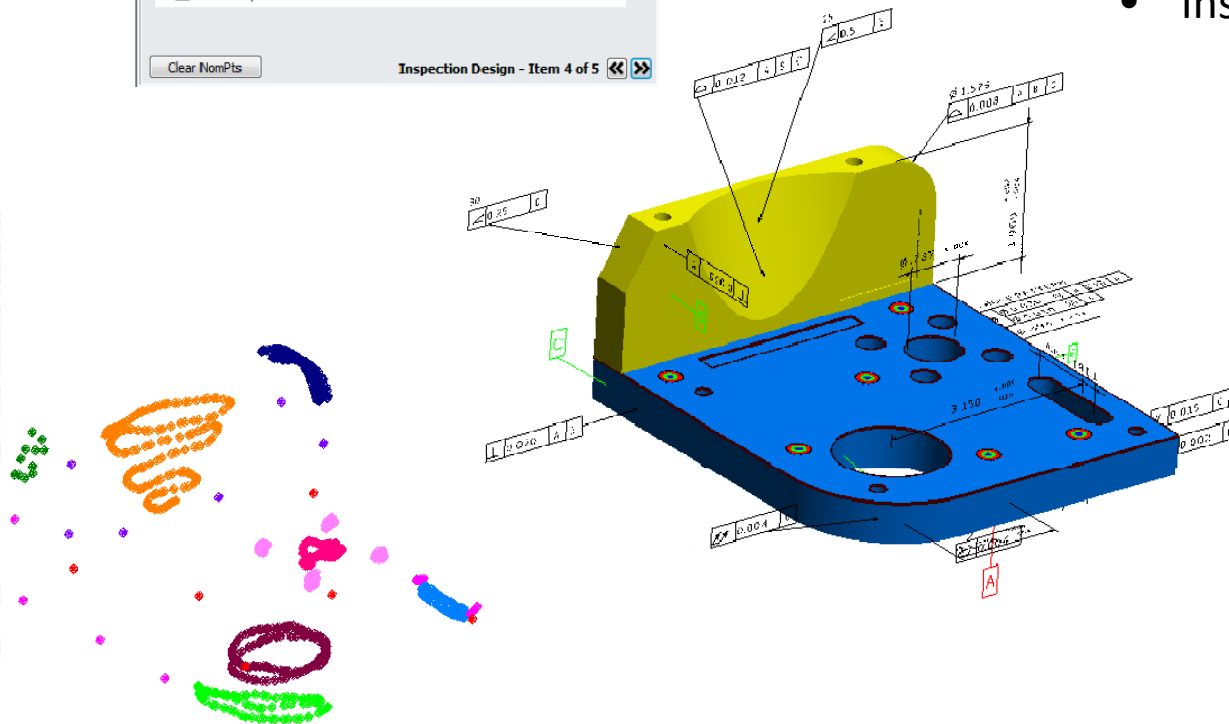
Measurement Profile Name: _____

Enable Inspection Automatic Measurement

Clear NomPts Inspection Design - Item 4 of 5

Guided Inspection

- Design
- Rehearse
- Inspect

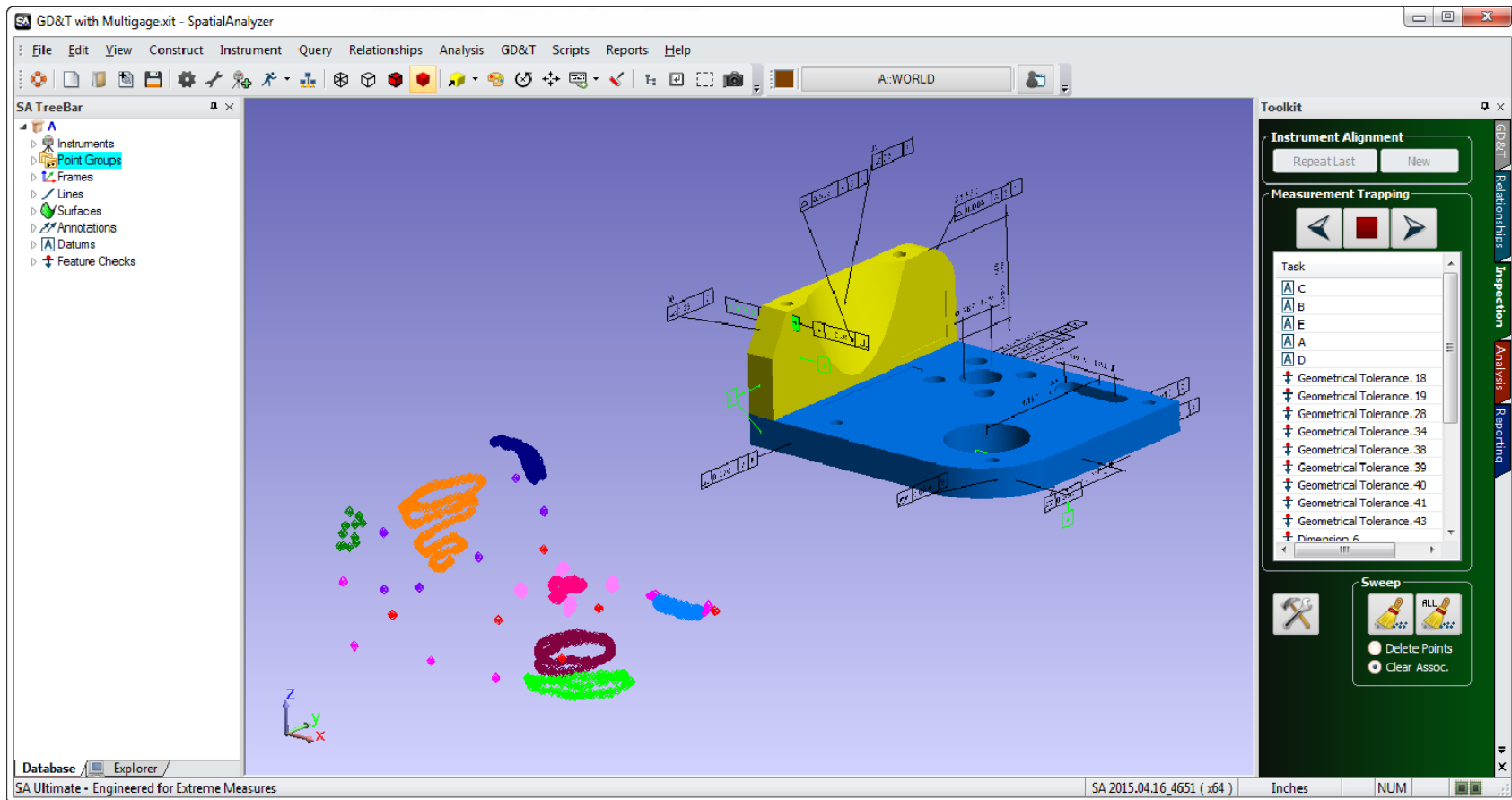


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Demo- Basic Fit & Link



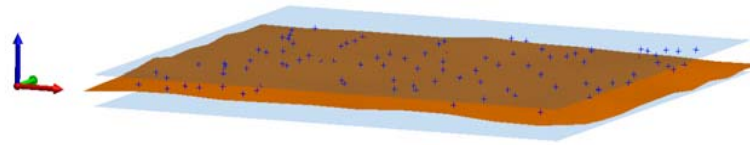
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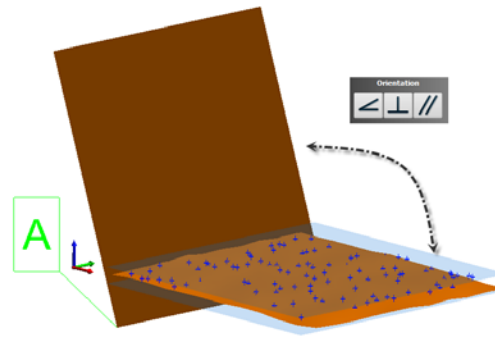
Check Details

Feature Checks come in 3 Categories:

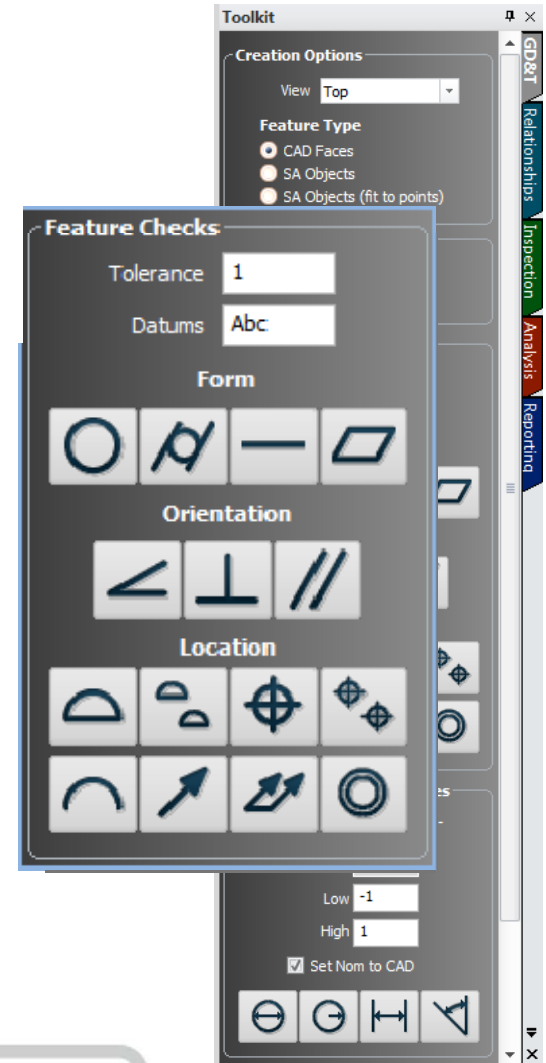
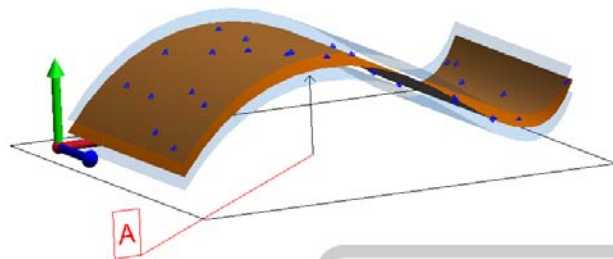
– Form Checks



– Orientation Checks



– Location Checks



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Flatness

Flatness Evaluation Process within SA:

1. Two parallel planes are built bounding the extents of the data.
2. These planes are allowed to freely rotate to establish the minimum distance between them while still containing the data.

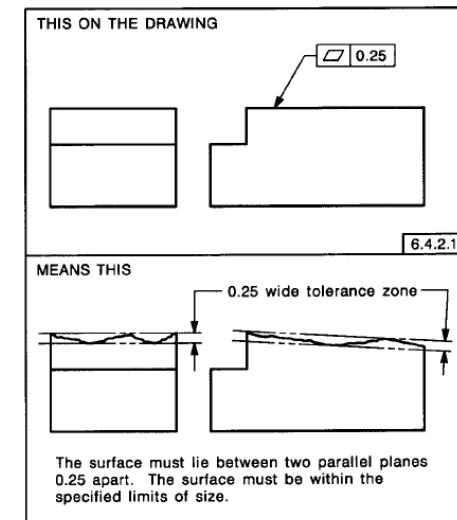
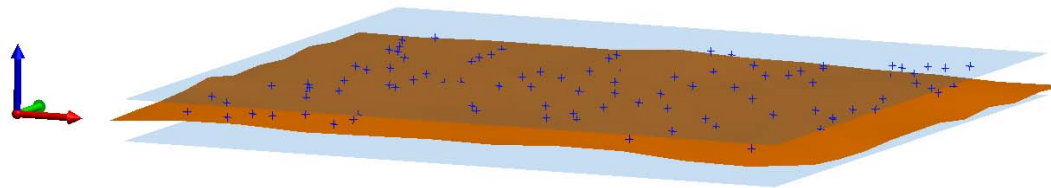
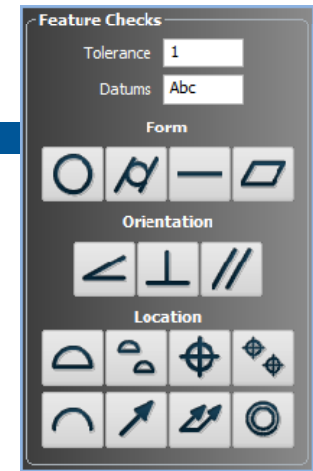


FIG. 6-7 SPECIFYING FLATNESS



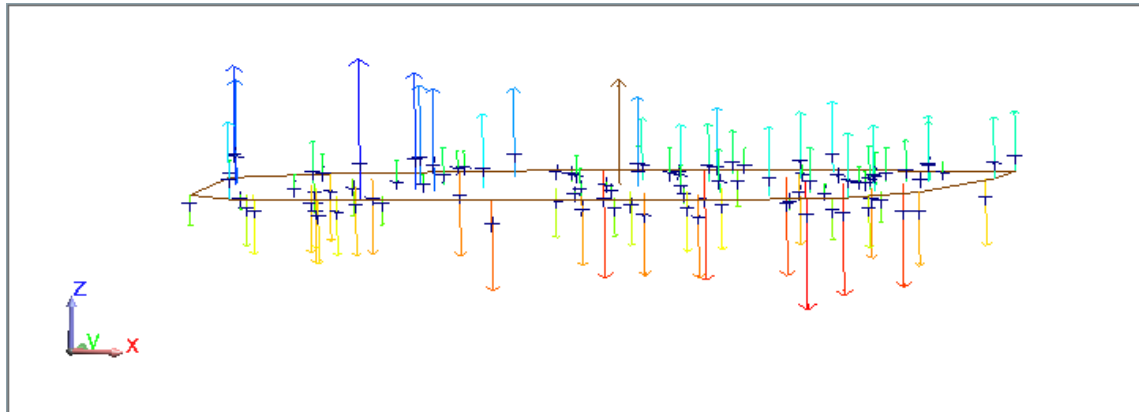
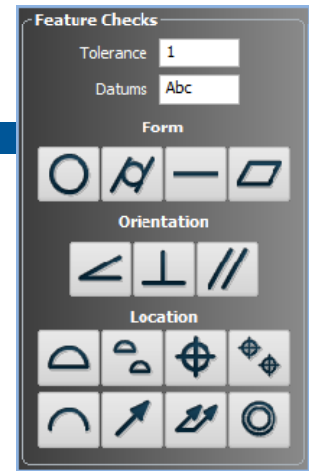
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Flatness

Standard Inspection (RMS):



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Flatness

Flatness Evaluation Process within SA:

1. Two parallel planes are built bounding the extents of the data.
2. These planes are allowed to freely rotate to establish the minimum distance between them while still containing the data.

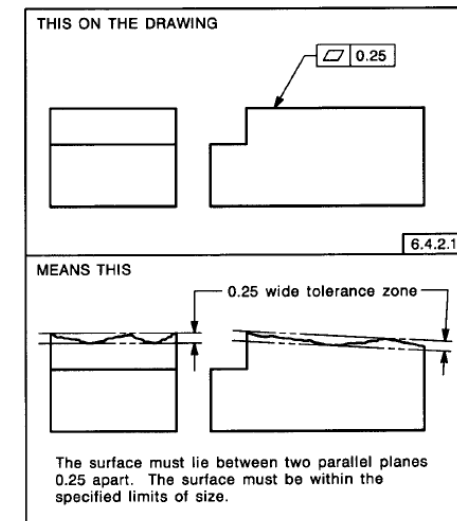
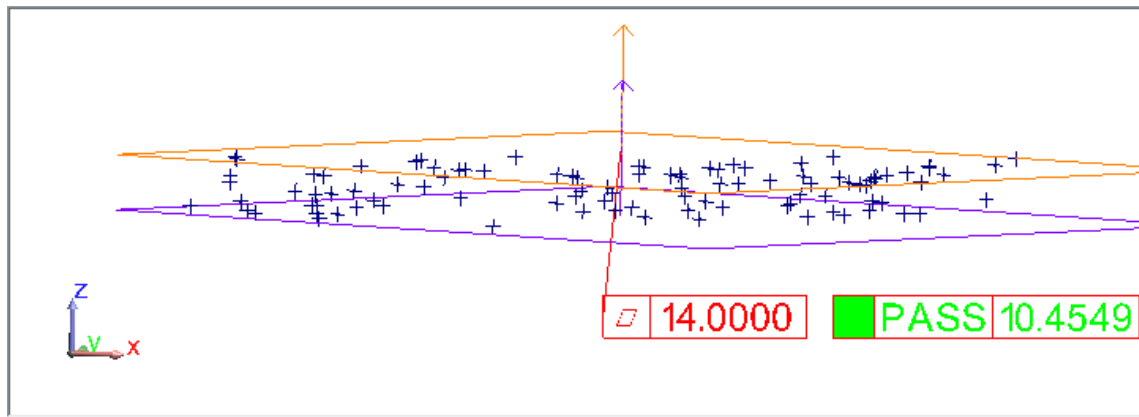
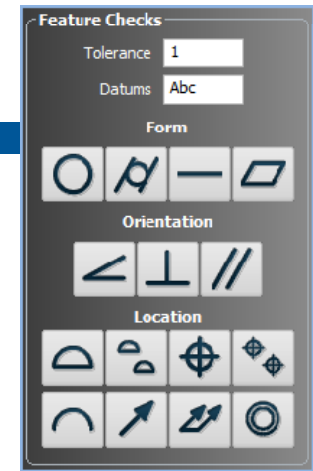
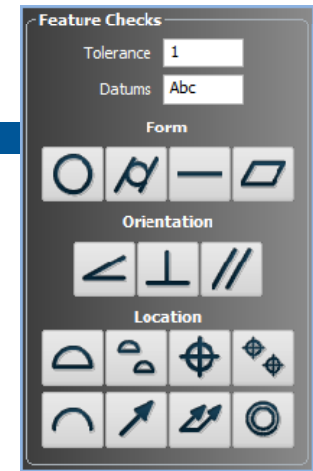


FIG. 6-7 SPECIFYING FLATNESS

Cylindricity



Cylindricity Evaluation Process within SA:

1. Two coaxial cylinders are built bounding the extents of the data.
2. The cylinders are allowed to freely rotate to establish the minimum distance between them while still containing the data.

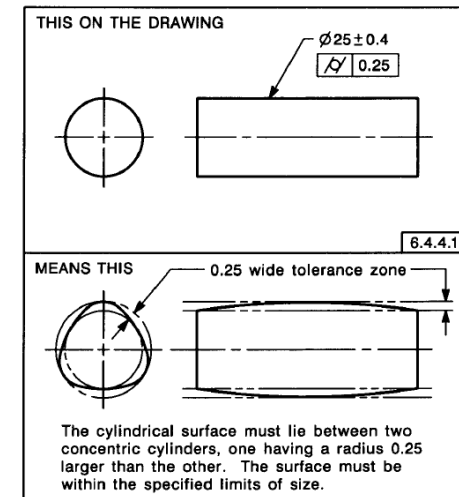
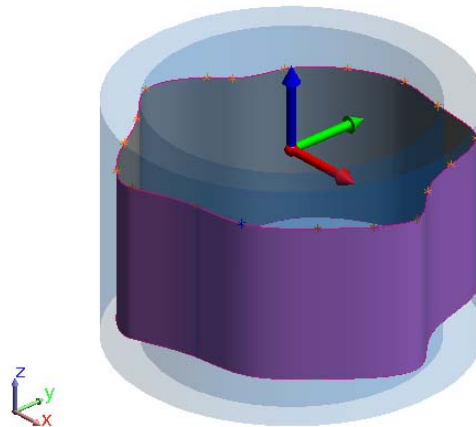


FIG. 6-10 SPECIFYING CYLINDRICITY



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Orientation Checks

Feature Checks

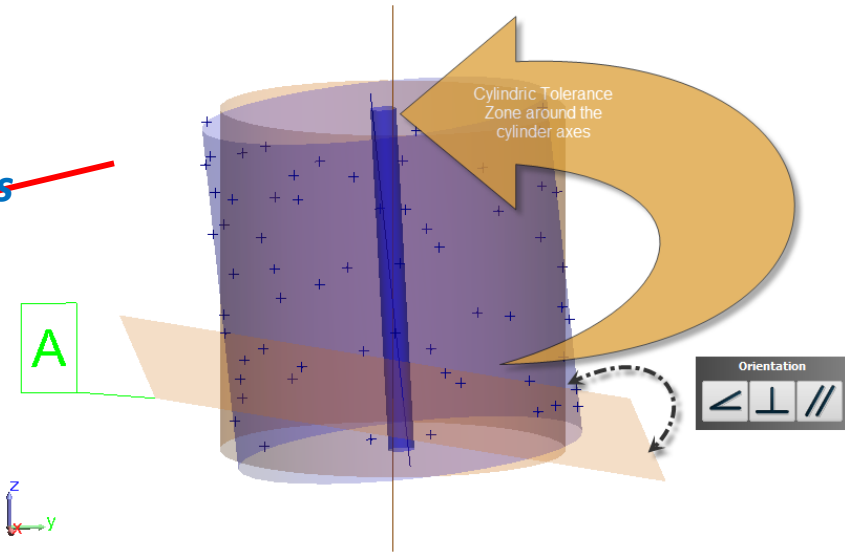
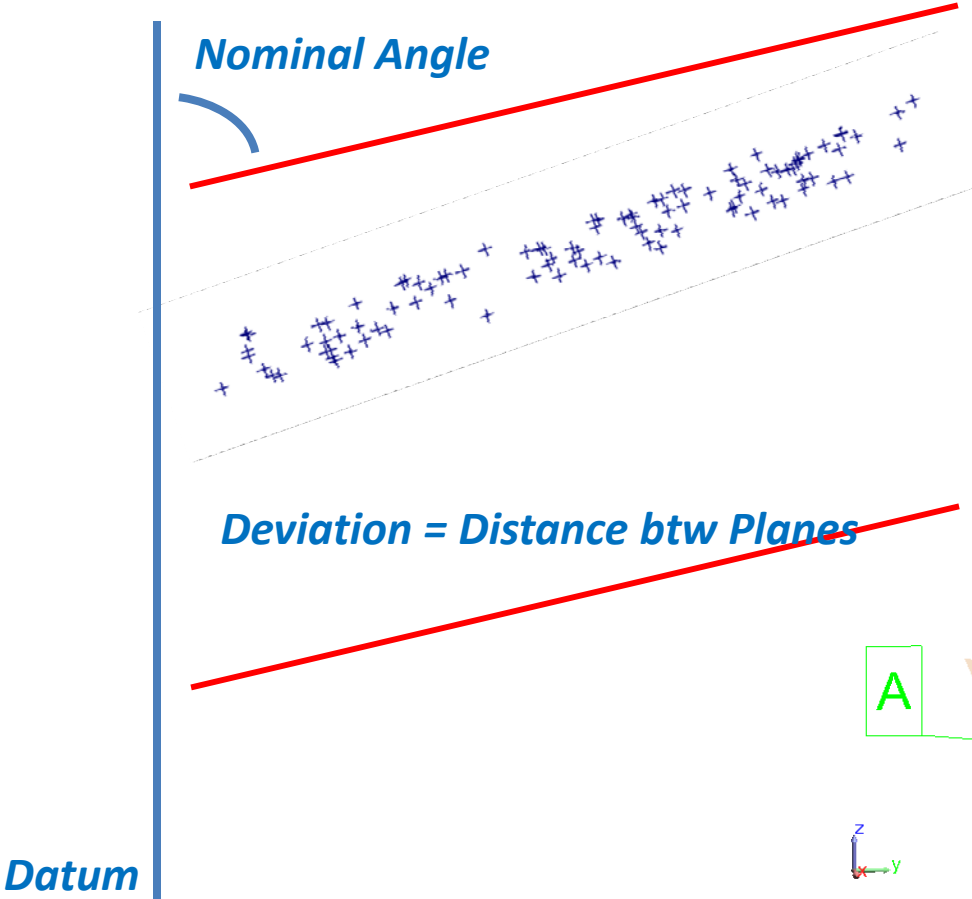
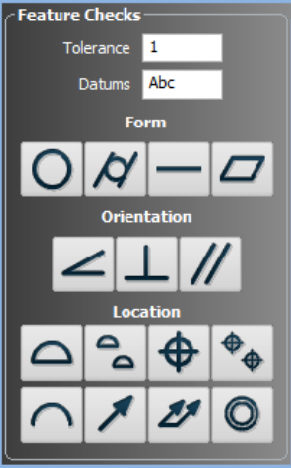
Tolerance: 1

Datums: Abc

Form

Orientation

Location



Surface Profile

Surface Profile Evaluation Process within SA:

1. An inner and outer tolerance boundary is established
2. The profile is allowed to rotate based on the datum constraints to minimize the deviations
3. The extent of the max and min deviation is used to establish the measured profile deviation

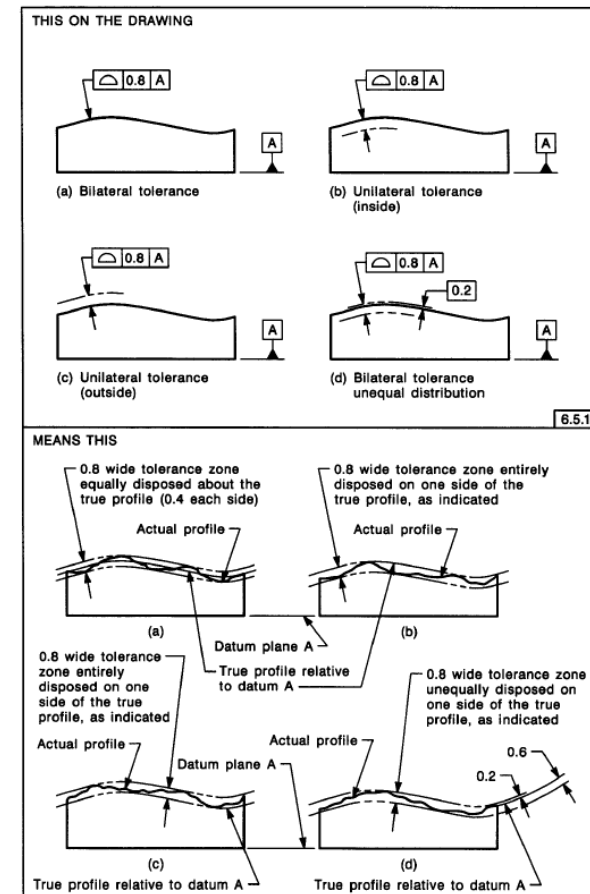
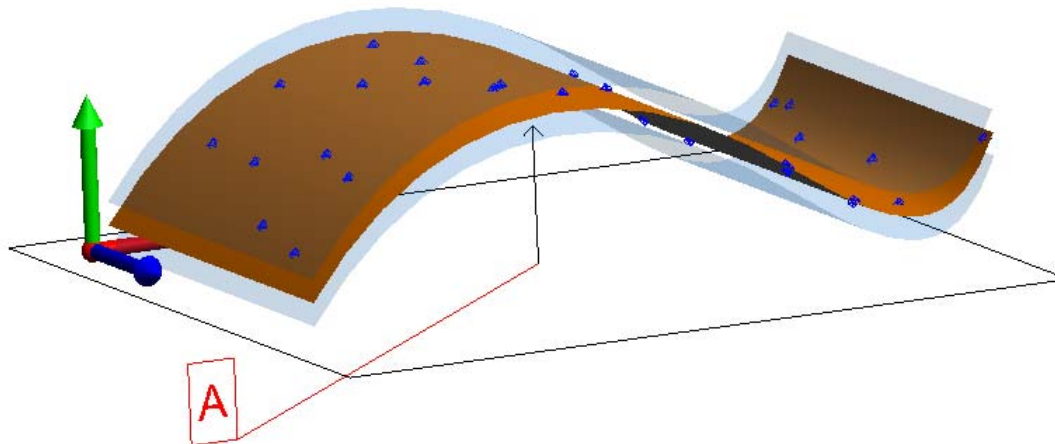


FIG. 6-11 APPLICATION OF PROFILE OF A SURFACE TOLERANCE TO A BASIC CONTOUR

GD&T Annotations

Feature Checks Categories:

GD&T Options

Use High Points for Feature Alignment
(if checked, 3 high points which also enclose the center of gravity of the points are used; if unchecked, best-fit geometry is used (least squares))

Distance Between Checks Use

Centroid Min/Max

Check Pre-Eval Validator

None ASME (1994) ISO (1983)
 ASME (2009) ISO (2004)
 ISO (2012)

Cross Section Criteria

0.0394 Inches

For checks which split the data up into cross-sections, this criteria is used to group the data. Points which are within this distance of each other along the primary axis are grouped together in the same cross section.

Feature Checks

Tolerance 1
Datums Abc

Form

Circle Line

Orientation

Angle Perpendicular Parallel

Location

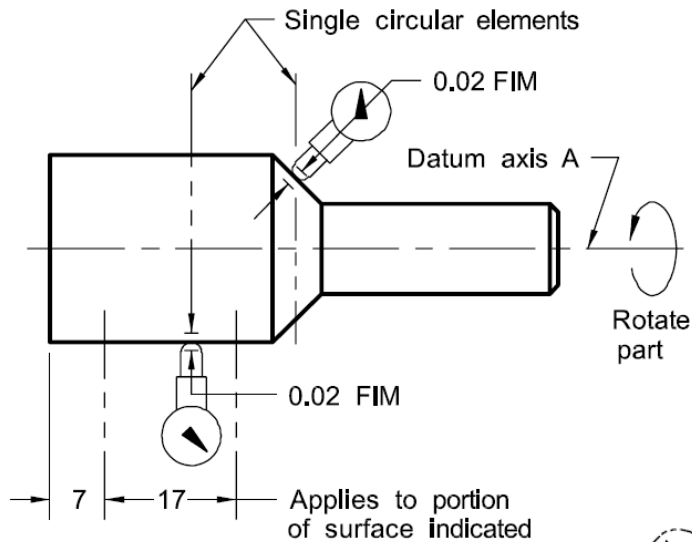
Arc Arrow Center Point

Rotate part

Status Bar: - 0.2500 **PASS** 0.0004

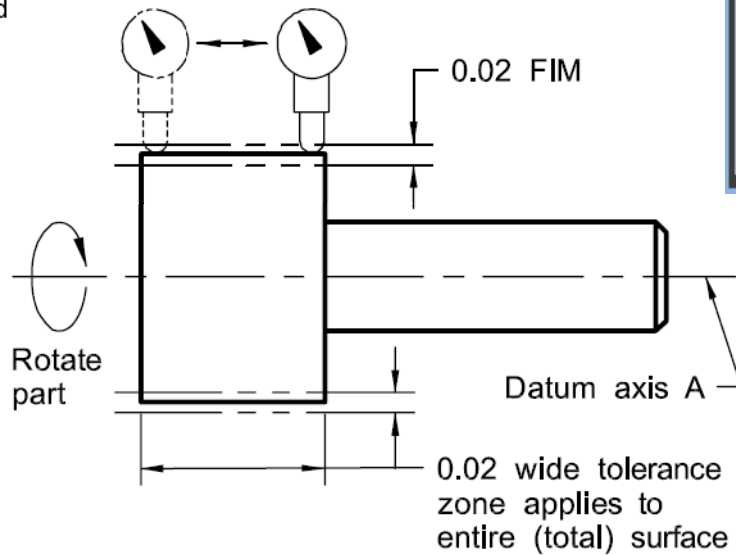
GD&T Annotations

Cross Section Checks:



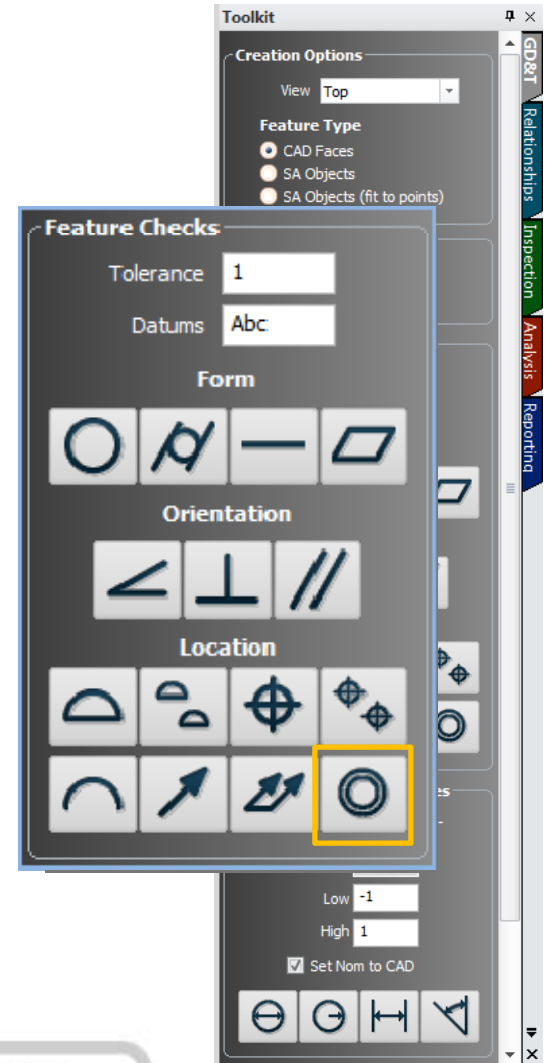
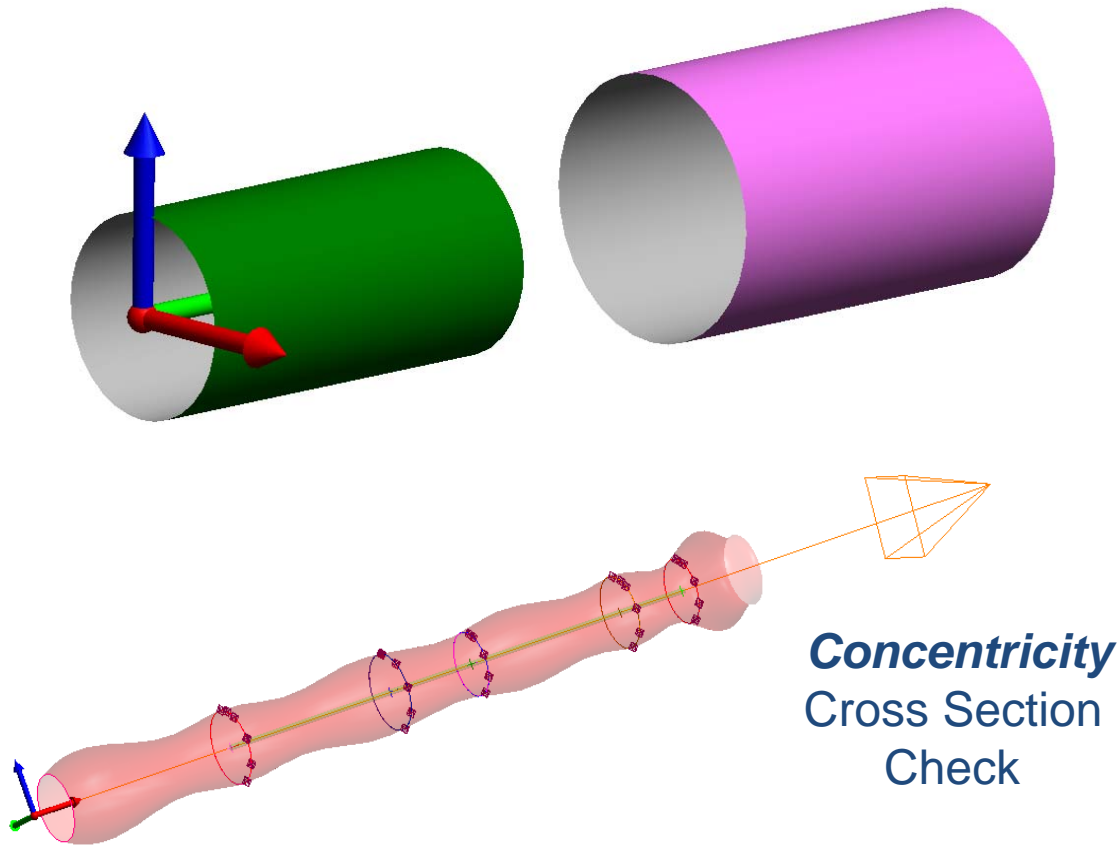
Runout Cross Section Check

Total Runout Surface Check



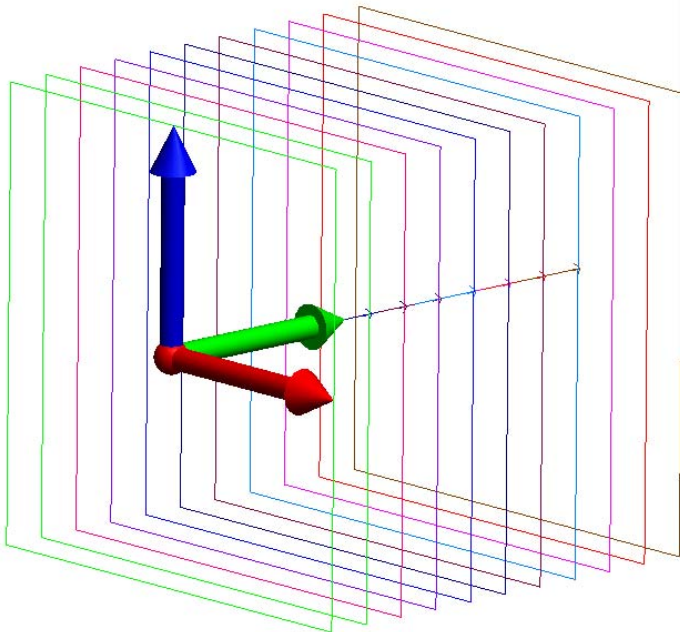
Concentricity

Cross Section Checks:



GD&T Annotations

Cross Section Checks



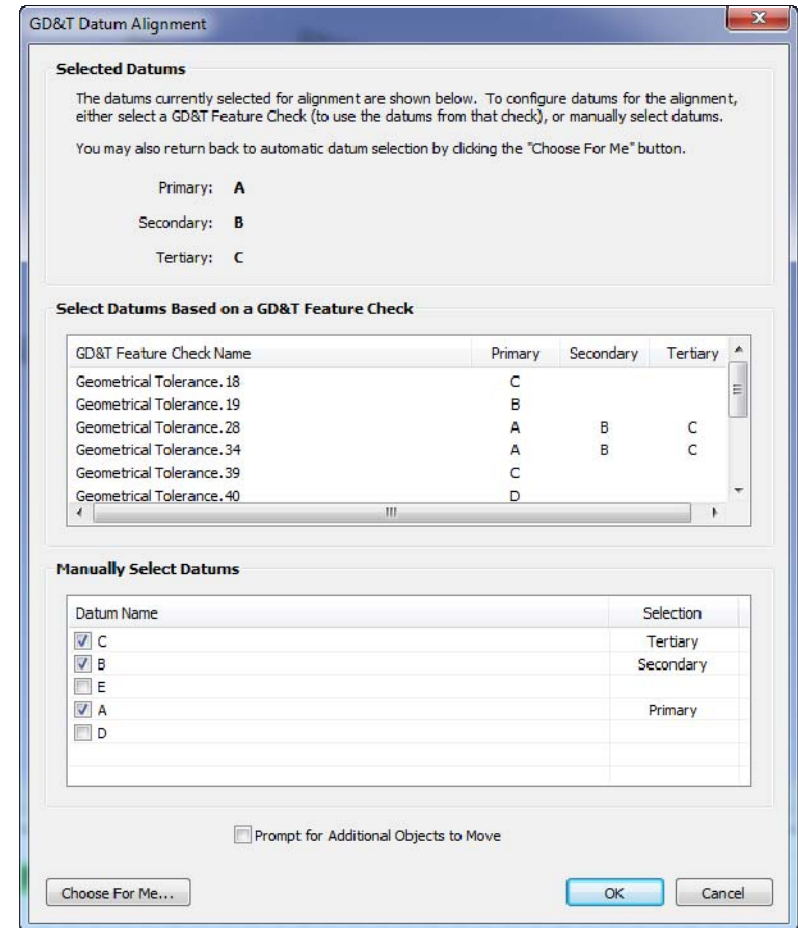
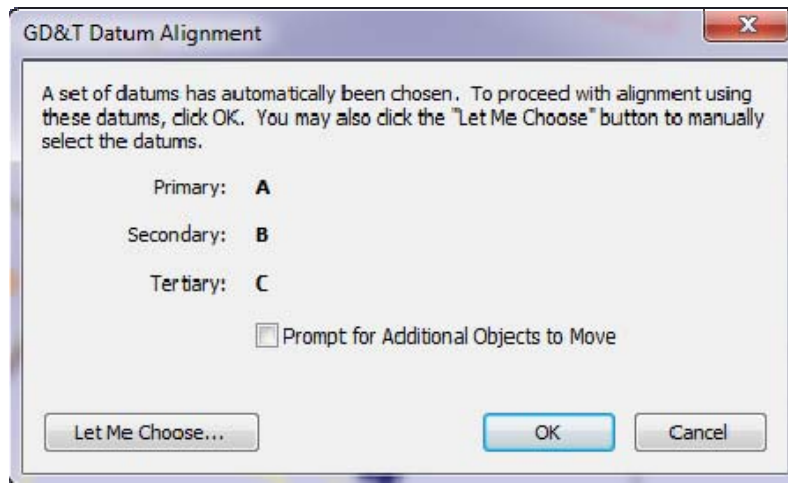
The screenshot shows the 'Make Geometry Crossing Triggers' dialog box. It has three sections: 'Add Planes', 'Add Cylinders', and 'Add Spheres'. Each section has 'Select' and 'Draw In SA' options. The 'Cross Sampling' section has 'Closest Pt.' and 'Interpolate' options. Below these is a table with columns 'Type', 'Sample', and 'Name'. The 'Output Point Grouping' section has a checked option 'Group Separately (Append Trigger Name)'. There are 'Delete Selected' and 'Delete ALL' buttons on the right, and an 'OK' button at the bottom right.

Type	Sample	Name
Plane_Cartesian	Interpolate	Cartesian Y 0.000000 in
Plane_Cartesian	Interpolate	Cartesian Y 2.000000 in
Plane_Cartesian	Interpolate	Cartesian Y 4.000000 in
Plane_Cartesian	Interpolate	Cartesian Y 6.000000 in
Plane_Cartesian	Interpolate	Cartesian Y 8.000000 in
Plane_Cartesian	Interpolate	Cartesian Y 10.000000 in
Plane_Cartesian	Interpolate	Cartesian Y 12.000000 in
Plane_Cartesian	Interpolate	Cartesian Y 14.000000 in
Plane_Cartesian	Interpolate	Cartesian Y 16.000000 in
Plane_Cartesian	Interpolate	Cartesian Y 18.000000 in
Plane_Cartesian	Interpolate	Cartesian Y 20.000000 in

Datum Alignment

Right- Click Datum Category

- Select “Align”



Building Feature Checks

- Cylinder Evaluation Method
- Probe Compensation

Datum

Name: A

Associated Measurements: 17

Measured Indirectly

View

No View Set

Set Clear Switch To

Cloud Thinning

Use Global Defaults

Settings

Nominal Pts

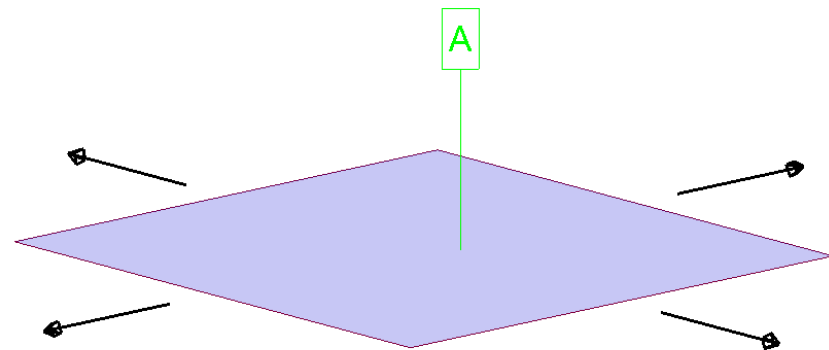
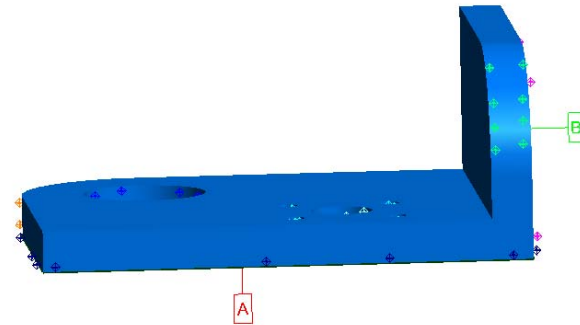
None Select

Toggle Highlight

Measurement Trapping & Advancing

Desired Measurement Count 0

Save & Close Cancel



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Kinematics

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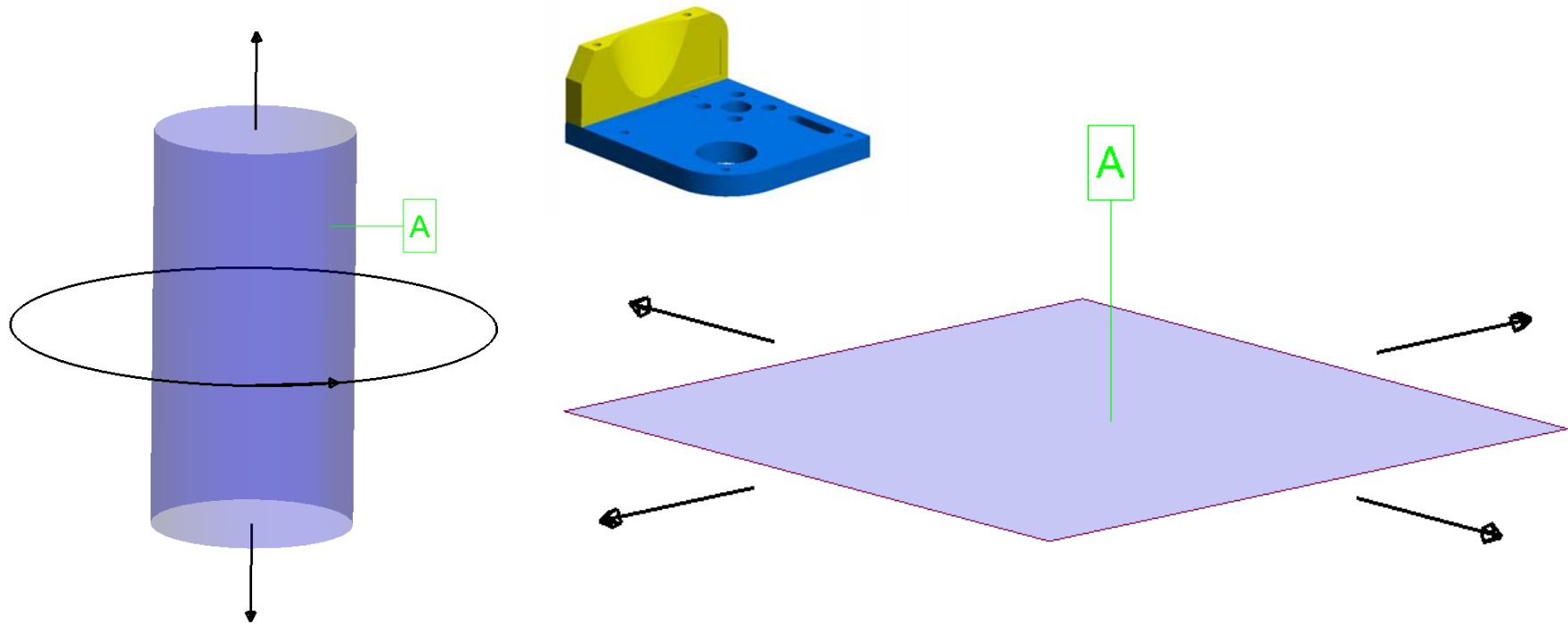


Datum Alignment



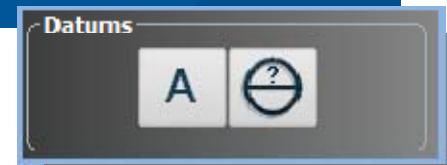
Datums and Degrees of Freedom

- Geometry Type is the Key

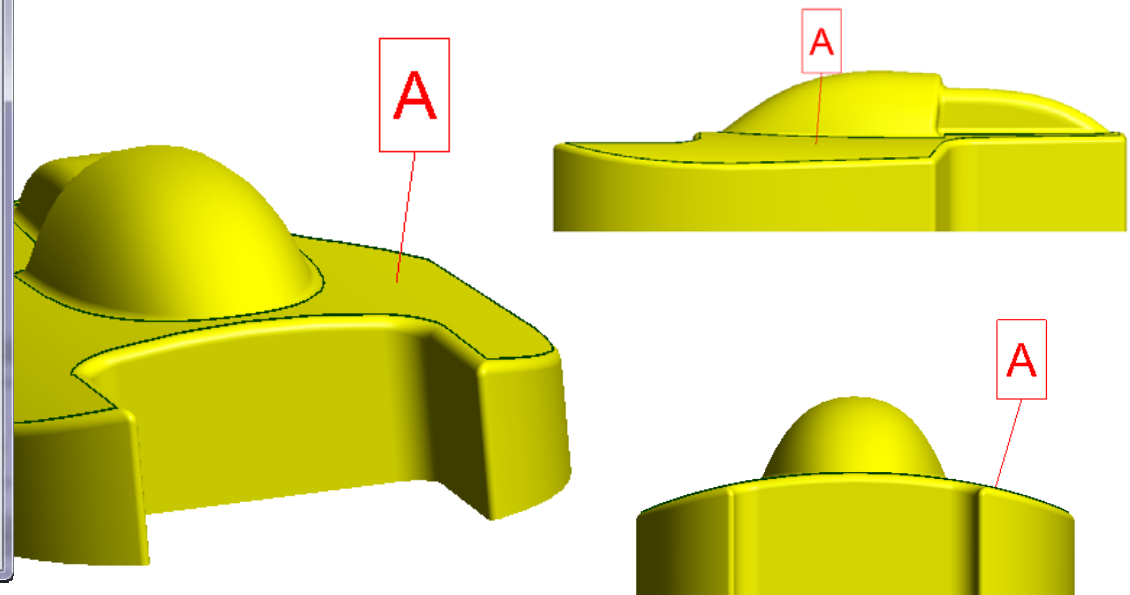
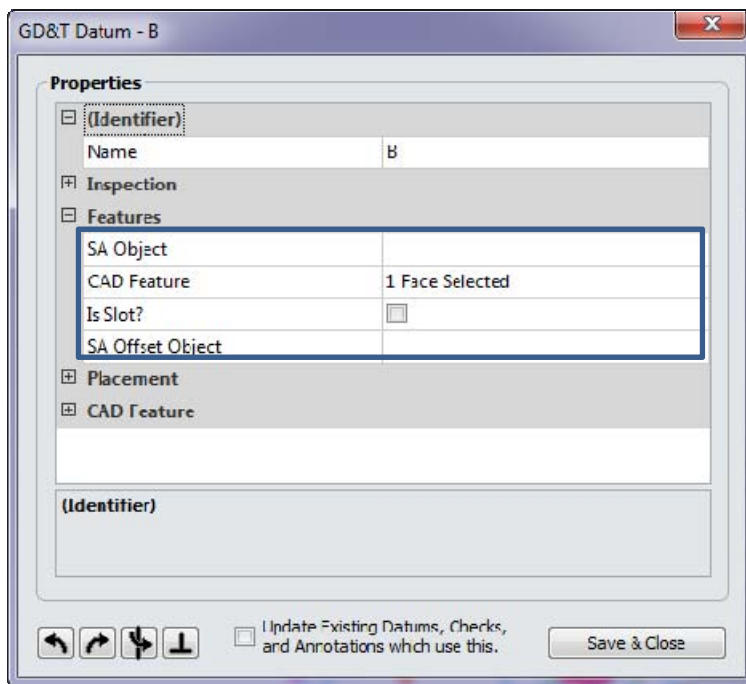


Datum Alignment

The number of datums specified and the feature type selected controls the degrees of freedom for the check:



- SA Objects/CAD Face
- SA Offset object

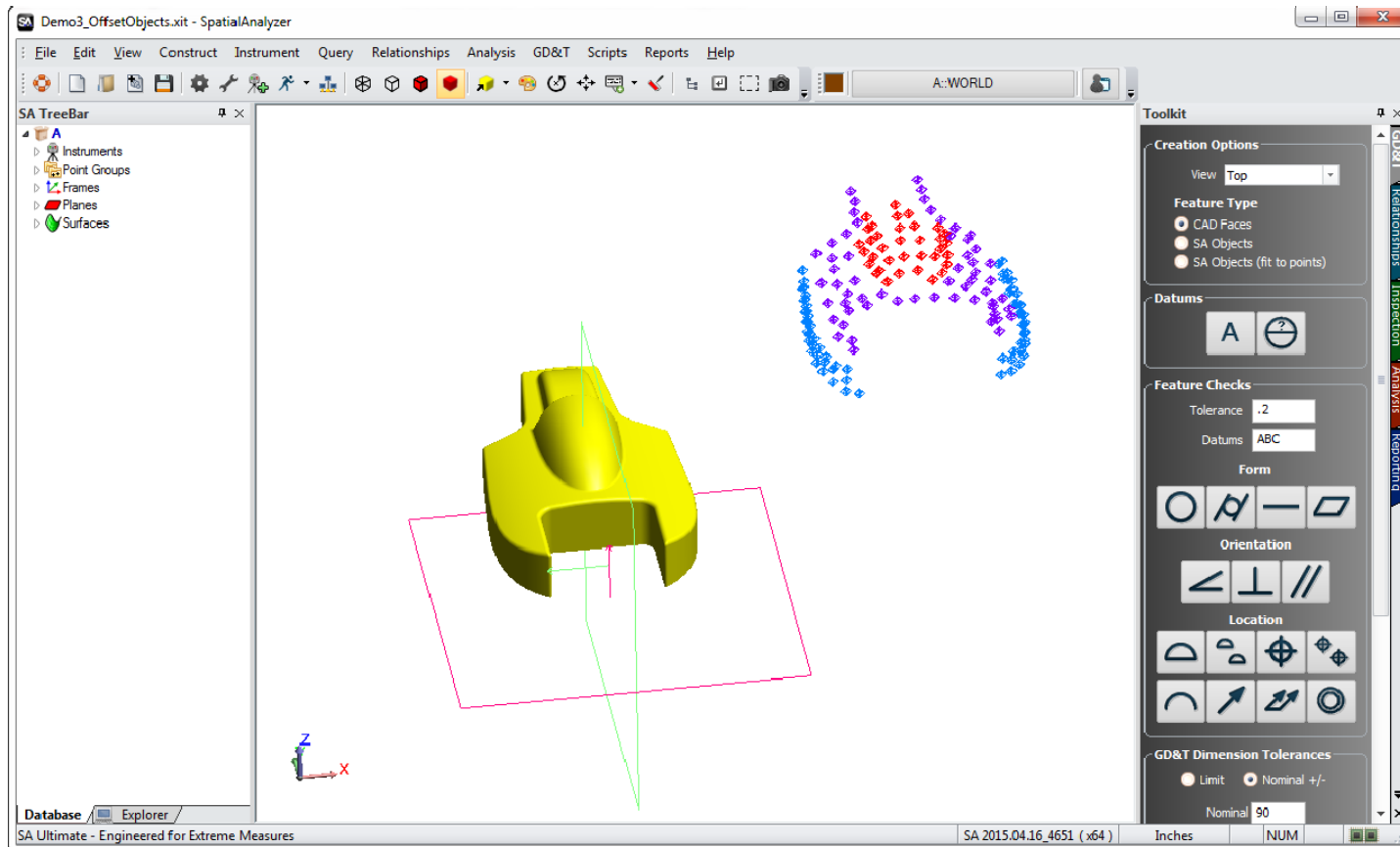


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Demo- Basic Fit & Link



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Building Feature Checks

SA TreeBar

- ▶ Instruments
- ▶ Point Groups
- ▶ Frames
- ▶ Lines
- ▶ Surfaces
- ▶ Annotations
- ▶ **A** Datums
 - C
 - R
 - E
 - A
 - D
- ▶ **+** Feature Checks
 - Geometrical Tolerance.18
 - Geometrical Tolerance.19
 - Geometrical Tolerance.28
 - Geometrical Tolerance.34
 - Geometrical Tolerance.38
 - Geometrical Tolerance.39
 - Geometrical Tolerance.40
 - Geometrical Tolerance.41
 - Geometrical Tolerance.43
 - Dimension.6
 - Dimension.8
 - Dimension.9
 - Dimension.14
 - Geometrical Tolerance.42
 - Dimension.17
 - Geometrical Tolerance.35
 - Dimension.13
 - Dimension.16

Feature Check

Name: Geometrical Tolerance.19
Associated Measurements: 153

View
View is Set for Check
[Set] [Clear] [Switch To]

Cloud Thinning
 Use Global Defaults [Settings]

Datum Alignment
 Enable Datum Alignment
Un-check for manual alignment

Nominal Pts
None [Select] [Toggle Highlight]

Measurement Trapping & Advancing
Desired Measurement Count: 0

Cylinder Evaluation Method

Choose for me (Automatic)
 Full Cylinder Eval (Fit meas. to cyl.)
Auto: >= 10 pts
 Trans-Axis Center Pos. Meas. (e.g. SMR resting on hole)
Auto: 1 pt
 Enable Pin Nest Detect & Comp (used when offset1 > offset2 and at least 3 Meas.)
 Enable Actual Diameter Override
Value: _____ in [?]

Center and Surface Axis Meas. (e.g. SMR on hole w/spacer)
Auto: 2 pts
 Center & Diam. at Nom. Direction (e.g. 3 or more meas. projected to nominal plane)
Auto: 3-9 pts

Cylinder Type: HOLE
[Set to HOLE] [Set to PIN]

[Save & Close] [Cancel]

Inspection Controls

Evaluation Method

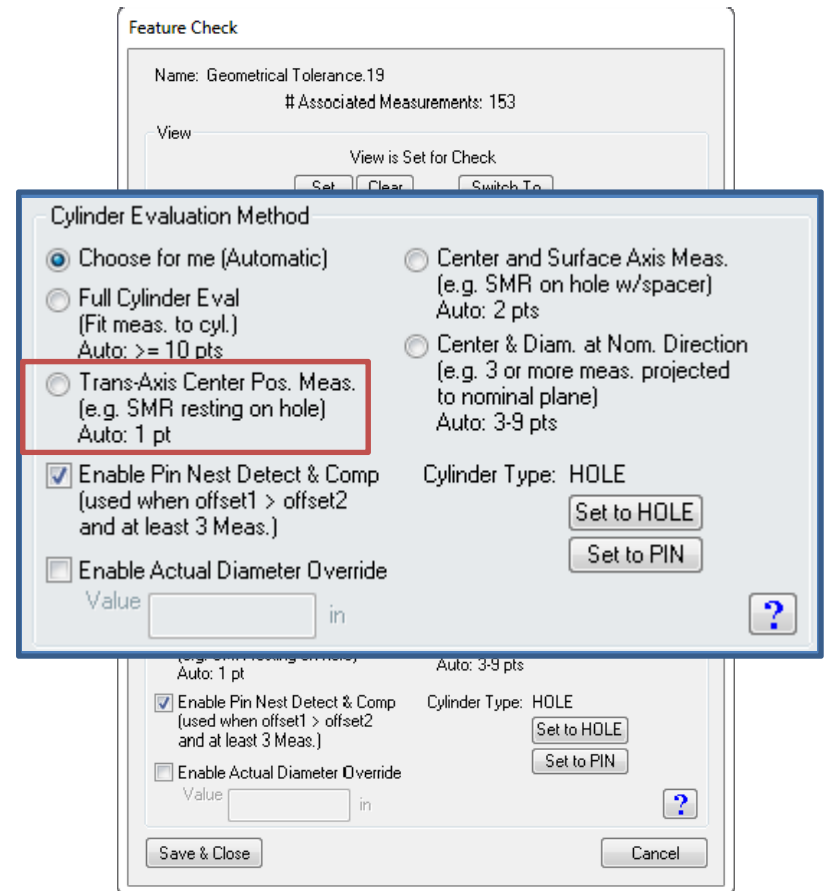
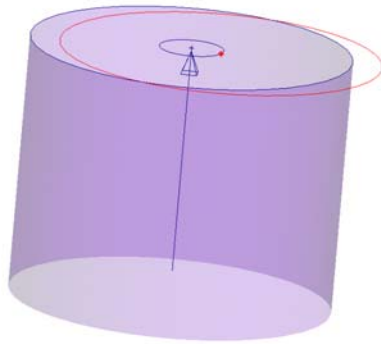


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Building Feature Checks

- Cylinder Evaluation Method

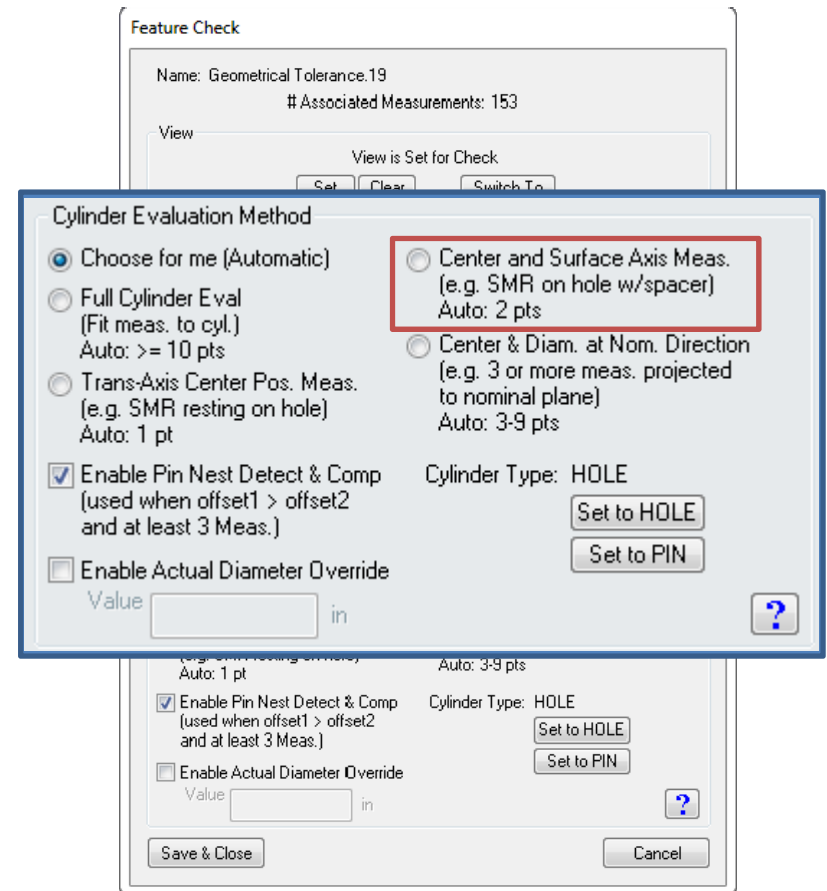
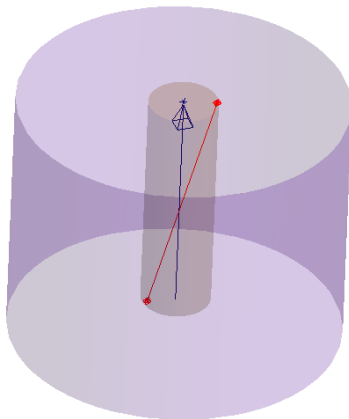
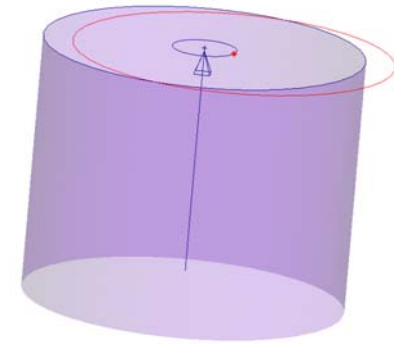


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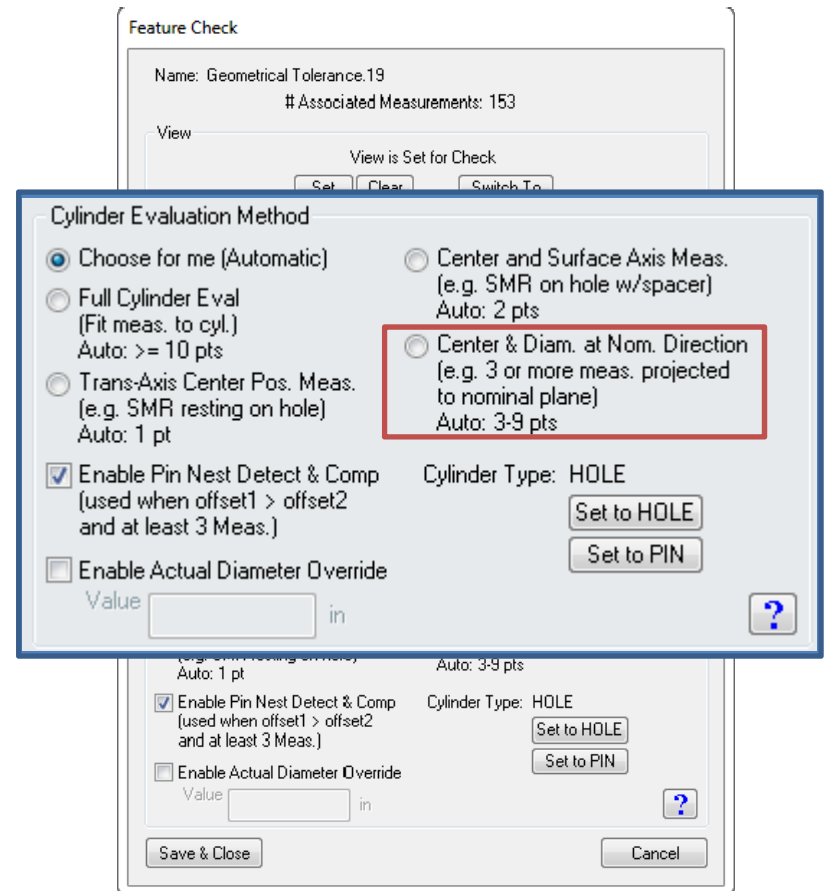
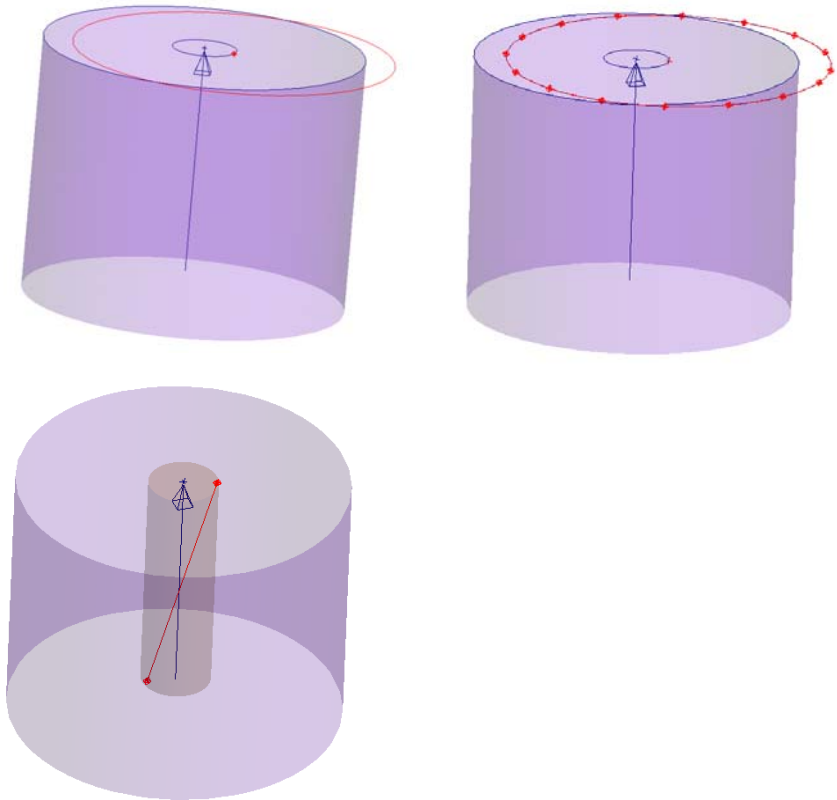
Building Feature Checks

- Cylinder Evaluation Method



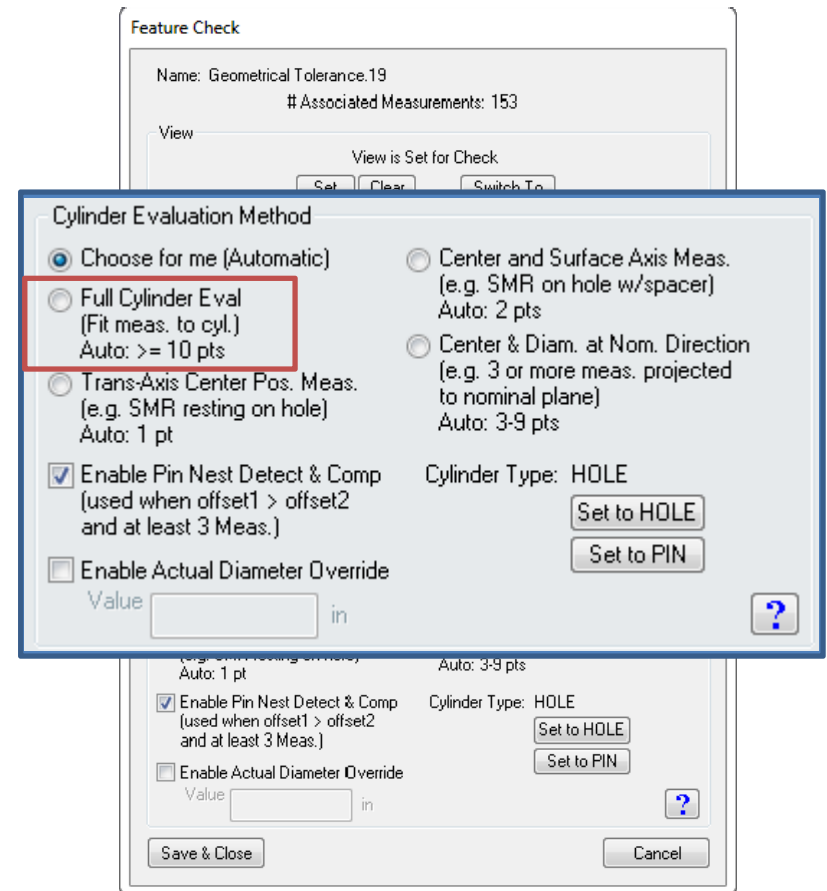
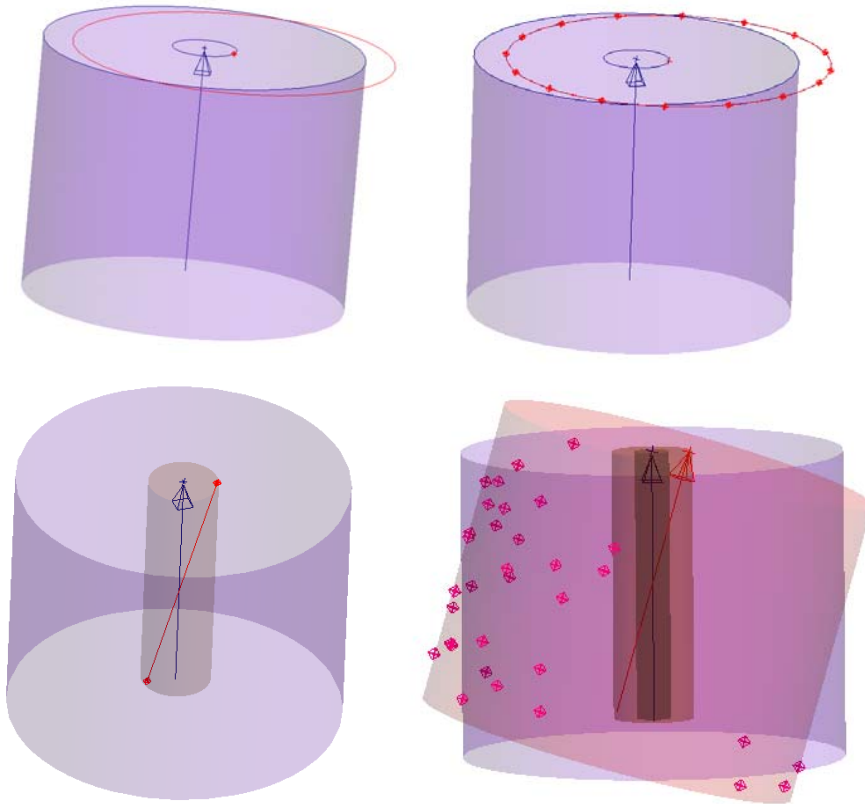
Building Feature Checks

- Cylinder Evaluation Method



Building Feature Checks

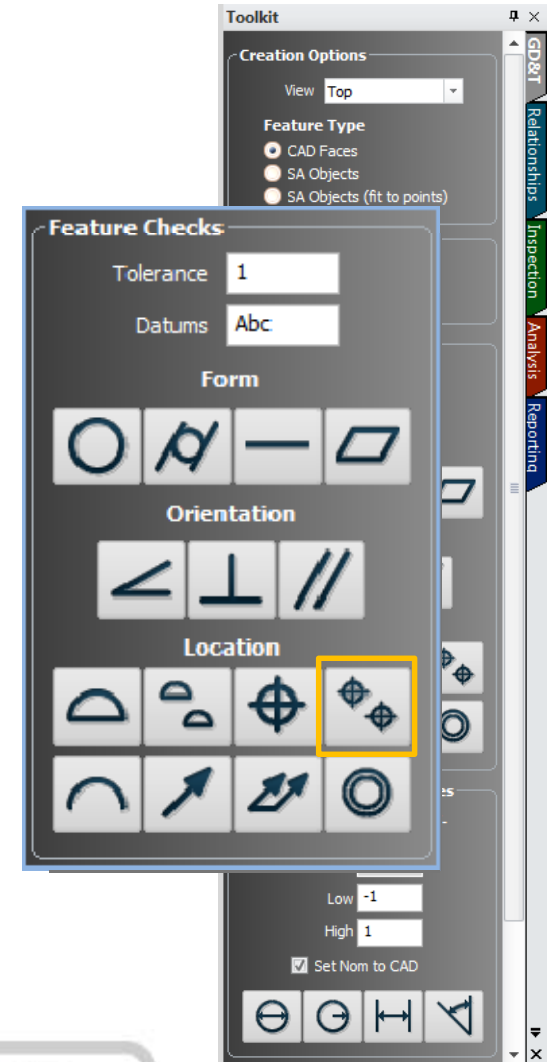
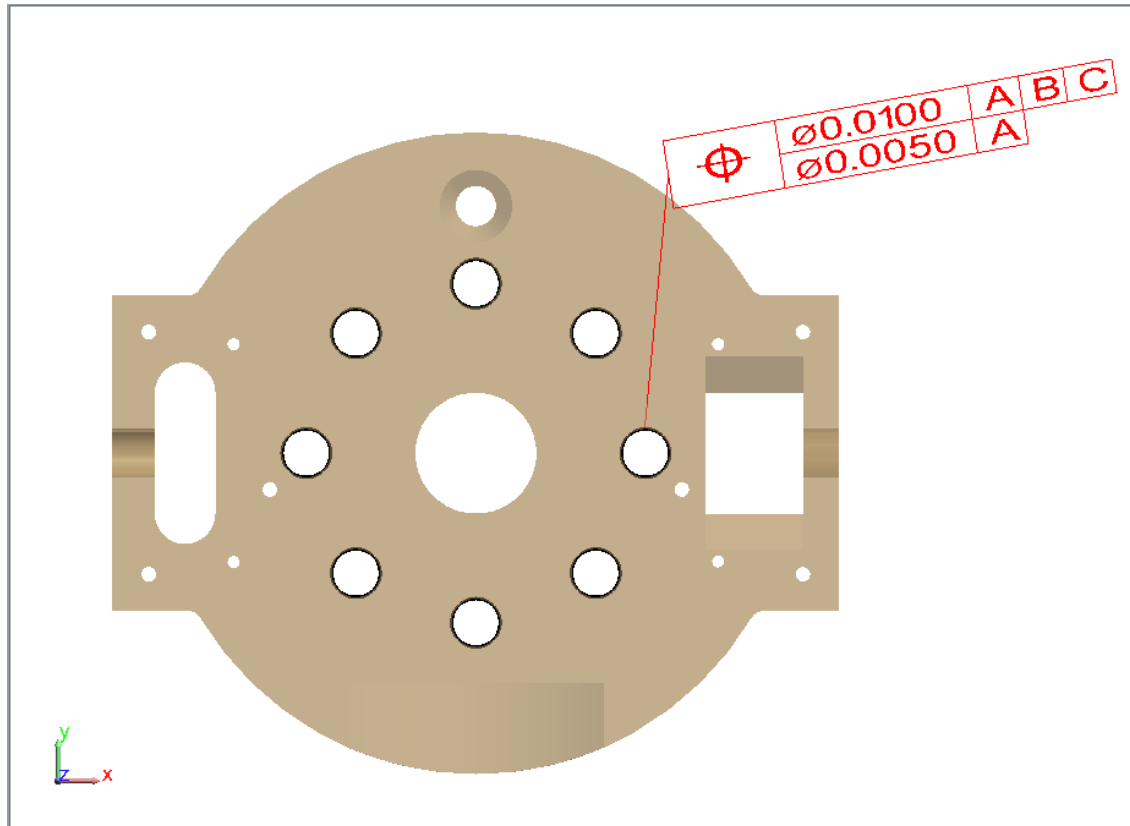
- Cylinder Evaluation Method



Composite True Position

Composite Checks:

ϕ	$\phi 0.0100$	A	B	C
ϕ	$\phi 0.0050$	A		



GD&T Inspection

Automatic Point Association

The screenshot displays a CAD software interface with a menu bar including Query, Relationships, Analysis, GD&T, Scripts, Reports, and Help. The GD&T menu is open, showing options such as 'Show GD&T Annotation Toolbar', 'Make GD&T Feature Check From Selected CAD Annotations', 'Make GD&T Feature Checks From ALL CAD Annotations', 'Make Annotation For GD&T Datum', 'Make Annotation For GD&T Feature Check', 'Make Annotation For NRK Feature Check', 'Make NRK Feature Check from Hole', 'Feature Inspection Auto Filter', and 'Evaluate all Feature Checks'. The 'Feature Inspection Auto Filter' option is highlighted.

Overlaid on the interface are two dialog boxes. The 'Inspection Auto Filter - Settings' dialog box has 'Face Offsets' with 'Surface Offset' and 'Edge Offset' both set to 0.635 Millimeters. The 'Cloud Thinning' dialog box is open, showing 'Preferred Mode' with 'Use Every Nth Point' selected and 'Increment By' set to 5. The 'Limits' section shows 'Min Num Pts' at 100 and 'Max Num Pts' at 20000, with 'No Limits' unchecked. The 'OK' button is highlighted.

The background shows a 3D model of a mechanical part with various GD&T annotations. These include a datum feature control frame 'A | R | C', a feature control frame '0.5 | R', a circular feature control frame '0.2 | 3 | C', a circular feature control frame '0.1', and a feature control frame '0.05 | B'. Dimensions shown include $\phi 40$, $\phi 20 \pm 0.2$, 3.0 ± 0.05 , and 5.0 ± 0.1 . The model is rendered with a color gradient from blue to red, indicating different inspection features or tolerances.

- Proximity Filter
- Based on Initial Alignment

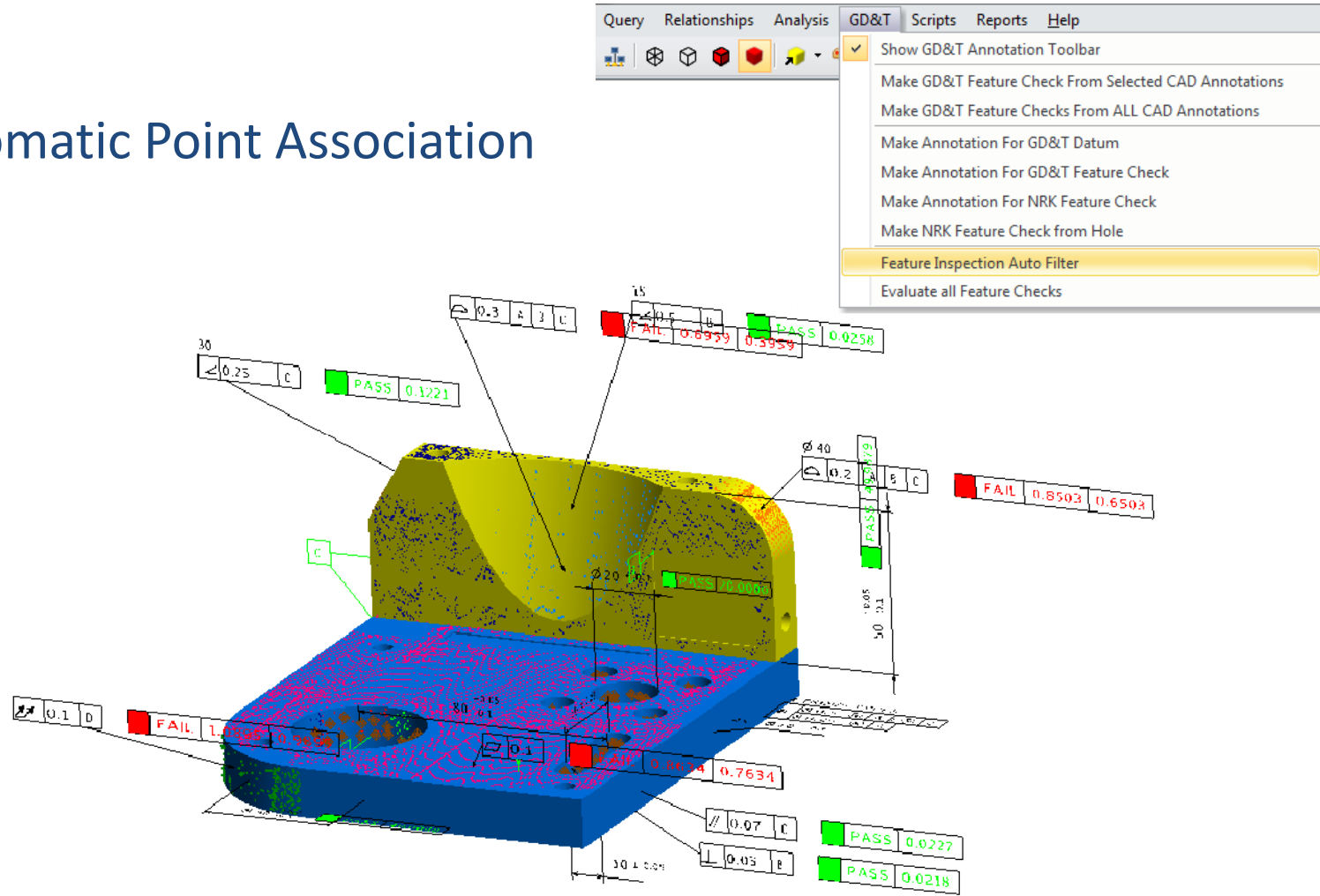


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GD&T Inspection

Automatic Point Association

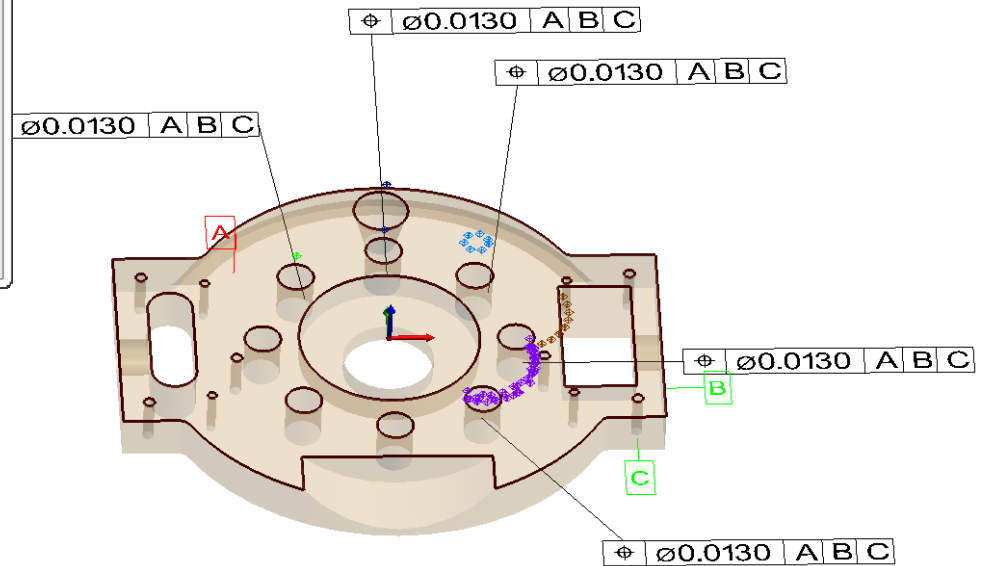
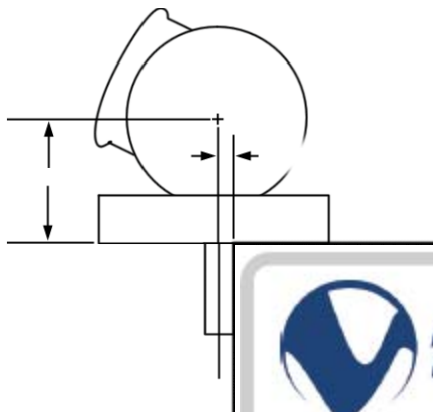
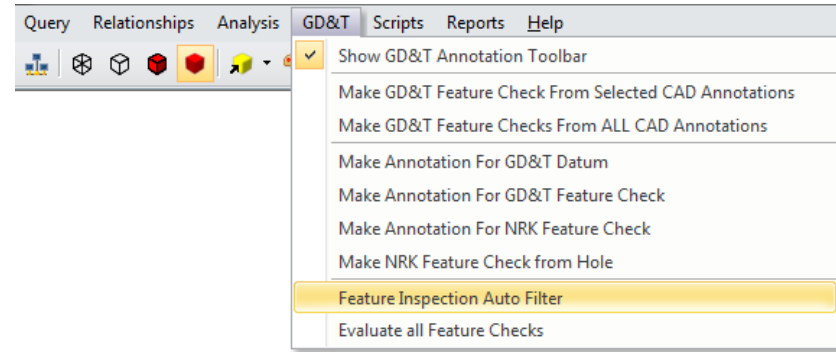
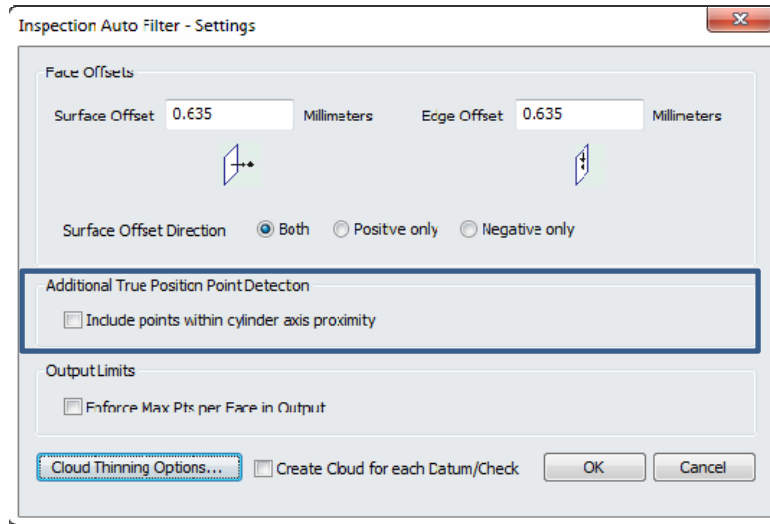


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GD&T Inspection

Automatic Point Association



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Reporting

SA TreeBar

- ▶ A
- ▶ Instruments
- ▶ Point Groups
- ▶ Frames
- ▶ Lines
- ▶ Surfaces
- ▶ Annotations
- ▶ Datums
 - C
 - B
 - E
 - A
 - D
- ▶ Feature Checks
 - Geometrical Tolerance.18
 - Geometrical Tolerance.19
 - Geometrical Tolerance.28
 - Geometrical Tolerance.34
 - Geometrical Tolerance.38
 - Geome
 - Geome
 - Geome
 - Geome
 - Geome
 - Dimen
 - Dimen
 - Dimen
 - Dimen
 - Dimen
 - Dimen
 - Dimen
 - Dimen

- Associate Points
- Associate Clouds
- Clear Point/Cloud Associations
- Delete Associated Points/Clouds
- Trap Measurements from an Instrument
- Stop Trapping Measurements
- Inspection
- Properties
- Tolerance
- Delete
- Highlight
- Include in Composite Quick Reports
- Generate Quick Report
- Add to Active SA Report
- Report Options
- Change Order In List

Report Bar (WCF: A::WORLD)

└ .0020B CHECK PASSED 0.0004 Geometrical Tolerance.41 (60 meas)

GD&T Perpendicularity Check						
Geometrical Tolerance.41						
Measured Deviation	0.0004	Distance Out of Tolerance	0.0000			
Datum Alignment Results						
Fit Transform	Tx	Ty	Tz	Rx	Ry	Rz
	0.0004	0.5502	0.2372	0.1105	-0.0157	-0.0002
Tolerance	Datums					
	0.002000	Primary	Secondary	Tertiary		
Fit Residuals Max	B					
Fit Residuals Avg	0.0002					
Fit Residuals StdDev	0.0001					

GD&T Perpendicularity Check Feature Results						
Geometrical Tolerance.41						
Feature Summary						
Measured Deviation	0.0004	Distance Out of Tolerance	0.0000			
Plane						
Nominal						
	X	Y	Z			
Origin	4.7244	4.7244	0.4921			
Normal	0.0000	1.0000	0.0000			
Actual						
	X	Y	Z			
Origin	4.7969	5.2733	0.8104			
Normal	0.0001	1.0000	0.0000			
Actual Data						
	X	Y	Z	Offset		
A::SFM_39_Measurements1::SFM_39	4.2875	4.8425	0.6237	0.1181		
Meas1 P785						
A::SFM_39_Measurements1::SFM_39	4.2867	4.8425	0.6222	0.1181		
Meas1 P786						
A::SFM_39_Measurements1::SFM_39	4.2861	4.8425	0.6198	0.1181		
Meas1 P787						
A::SFM_39_Measurements1::SFM_39	4.2895	4.8424	0.6093	0.1181		
Meas1 P788						
A::SFM_39_Measurements1::SFM_39	4.3066	4.8424	0.5969	0.1181		
Meas1 P789						
A::SFM_39_Measurements1::SFM_39	4.3218	4.8423	0.5935	0.1181		
Meas1 P790						
A::SFM_39_Measurements1::SFM_39	4.3832	4.8423	0.5884	0.1181		
Meas1 P791						
A::SFM_39_Measurements1::SFM_39	4.4568	4.8423	0.5929	0.1181		
Meas1 P792						
A::SFM_39_Measurements1::SFM_39	4.4988	4.8424	0.5971	0.1181		
Meas1 P793						
A::SFM_39_Measurements1::SFM_39	4.5989	4.8424	0.6055	0.1181		

Geometrical Tolerance.41 (60 meas) (PASS)

Reporting

Summary Table

- Fit Transform
- Datum Statistics

Details Table

- Point Deviations

Report Bar (WCF: A::WORLD)

Tolerance.34 Meas1 P689 A::Geometrical	0.5042	5.5402	2.3619	0.1181	0.0004	0.0002
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P690 A::Geometrical	0.5082	5.5468	2.3508	0.1181	0.0029	0.0014
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P691 A::Geometrical	0.5138	5.5532	2.3380	0.1181	0.0038	0.0019
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P692 A::Geometrical	0.5243	5.5641	2.3127	0.1181	0.0040	0.0020
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P693 A::Geometrical	0.5247	5.5637	2.3106	0.1181	0.0017	0.0008
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P694 A::Geometrical	0.5291	5.5671	2.2996	0.1181	0.0001	-0.0001
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P695 A::Geometrical	0.5322	5.5724	2.2886	0.1181	0.0017	0.0008
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P696 A::Geometrical	0.5358	5.5844	2.2651	0.1181	0.0083	0.0042
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P697 A::Geometrical	0.5337	5.5962	2.2464	0.1181	0.0189	0.0095
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P698 A::Geometrical	0.5350	5.6002	2.2366	0.1181	0.0208	0.0104
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P699 A::Geometrical	0.5330	5.5974	2.2343	0.1181	0.0142	0.0071
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P700 A::Geometrical	0.5322	5.5955	2.2335	0.1181	0.0099	0.0050
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P701 A::Geometrical	0.5311	5.5919	2.2320	0.1181	0.0022	0.0011
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P702 A::Geometrical	0.5296	5.5922	2.2249	0.1181	0.0014	-0.0007
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P703 A::Geometrical	0.5295	5.5940	2.2185	0.1181	0.0013	-0.0007
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P704 A::Geometrical	0.5284	5.5980	2.2050	0.1181	0.0010	-0.0005
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P705 A::Geometrical	0.5281	5.5991	2.2005	0.1181	0.0012	-0.0006
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P706 A::Geometrical	0.5418	5.6072	2.1669	0.1181	0.0014	-0.0007
olerance.34_Measurements1::Geometrical						

Geometrical Tolerance.34 (123 meas) (FAIL)



Reporting

Vectors for Visualization:

- Specific Alignment
- DoF Understanding

Report Bar (WCF: A::WORLD)

Tolerance.34 Meas1 P689 A::Geometrical	0.5042	5.5402	2.3619	0.1181	0.0004	0.0002
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P690 A::Geometrical	0.5082	5.5468	2.3508	0.1181	0.0029	0.0014
olerance.34_Measurements1::Geometrical Tolerance.34 Meas1 P691 A::Geometrical	0.5138	5.5532	2.3380	0.1181	0.0038	0.0019
					0.0040	0.0020
					0.0017	0.0008
					0.0001	-0.0001
					0.0017	0.0008
					0.0083	0.0042
					0.0189	0.0095
					0.0208	0.0104
					0.0142	0.0071
					0.0099	0.0050
					0.0022	0.0011
					0.0014	-0.0007
					0.0013	-0.0007
					0.0010	-0.0005
					0.0012	-0.0006
					0.0014	-0.0007

GD&T Datum Alignment

Selected Datums

The datums currently selected for alignment are shown below. To configure datums for the alignment, either select a GD&T Feature Check (to use the datums from that check), or manually select datums. You may also return back to automatic datum selection by clicking the "Choose For Me" button.

Primary: **A**
Secondary: **B**
Tertiary: **C**

Select Datums Based on a GD&T Feature Check

GD&T Feature Check Name	Primary	Secondary	Tertiary
Geometrical Tolerance.18	C		
Geometrical Tolerance.19	B		
Geometrical Tolerance.28	A	B	C
Geometrical Tolerance.34	A	B	C
Geometrical Tolerance.39	C		
Geometrical Tolerance.40	D		

Manually Select Datums

Datum Name	Selection
<input checked="" type="checkbox"/> C	Tertiary
<input checked="" type="checkbox"/> B	Secondary
<input type="checkbox"/> E	
<input checked="" type="checkbox"/> A	Primary
<input type="checkbox"/> D	

Prompt for Additional Objects to Move

Choose For Me... OK Cancel

Reporting

SA TreeBar

- ▶ **A**
- ▶ Instruments
- ▶ Point Groups
- ▶ Frames
- ▶ Lines
- ▶ Surfaces
- ▶ Annotations
- ▶ **A** Datums
 - C
 - B
 - E
 - A
 - D
- ▶ **+** Feature Checks
 - Geometrical Tolerance.18
 - Geometrical Tolerance.19
 - Geometrical Tolerance.28
 - Geometrical Tolerance.34
 - Geometrical Tolerance.38
 - Geometrical Tolerance.39
 - Geometrical Tolerance.40
 - Geometrical Tolerance.41
 - Geometrical Tolerance.43
 - Dimension.6
 - Dimension.8
 - Dimension.9
 - Dimension.14
 - Geometrical Tolerance.42
 - Dimension.17
 - Geometrical Tolerance.35
 - Dimension.13
 - Dimension.16

A::SAReport1

File Edit View

A::SAReport1

File Edit View

Ø1.575	Δ .0080 A B C	CHECK FAILED 0.0208 0.01
	\square .0040	CHECK PASSED 0.00

1.9690^{+0.0020}
-0.0040 INCOMPLETE

GD&T Distance Between Check
Dimension.9

Measurements are needed for the feature(s)
Unable to create GD&T feature object(s)

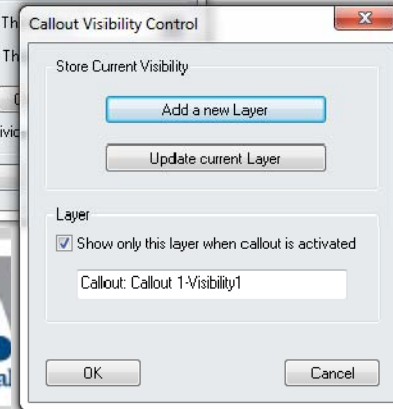
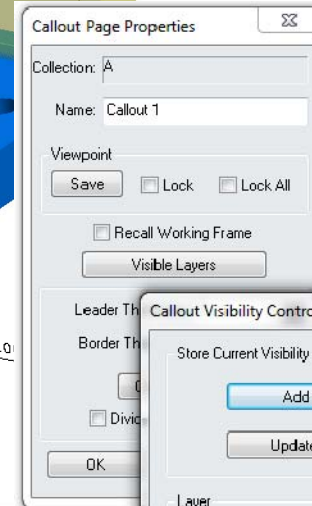
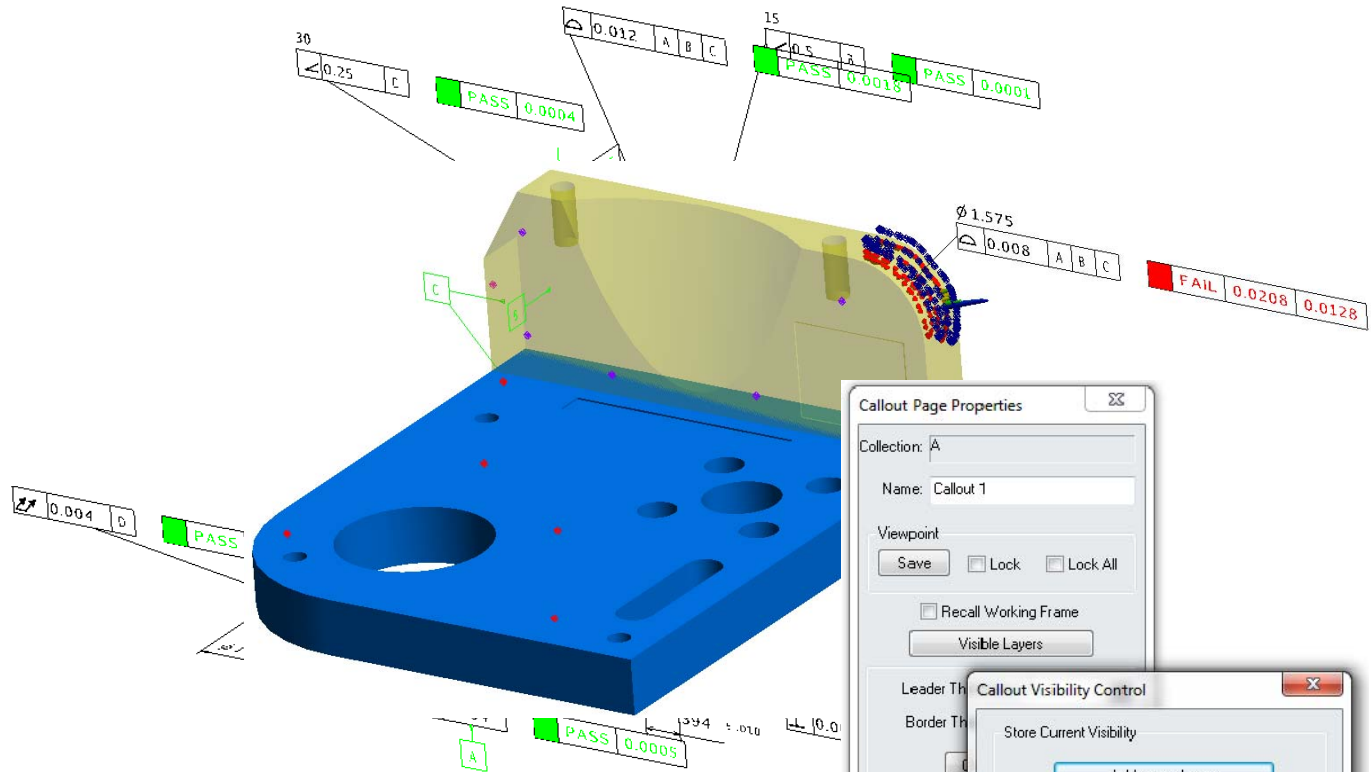


W

Reporting

SA TreeBar

- ▶ Instruments
- ▶ Point Groups
- ▶ Frames
- ▶ Lines
- ▶ Surfaces
- ▶ Annotations
- ▶ **A** Datums
 - C
 - B
 - E
 - A
 - D
- ▶ **+** Feature Checks
 - Geometrical Tolerance.18
 - Geometrical Tolerance.19
 - Geometrical Tolerance.28
 - Geometrical Tolerance.34
 - Geometrical Tolerance.38
 - Geometrical Tolerance.39
 - Geometrical Tolerance.40
 - Geometrical Tolerance.41
 - Geometrical Tolerance.43
 - Dimension.6
 - Dimension.8
 - Dimension.9
 - Dimension.14
 - Geometrical Tolerance.42
 - Dimension.17
 - Geometrical Tolerance.35
 - Dimension.13
 - Dimension.16

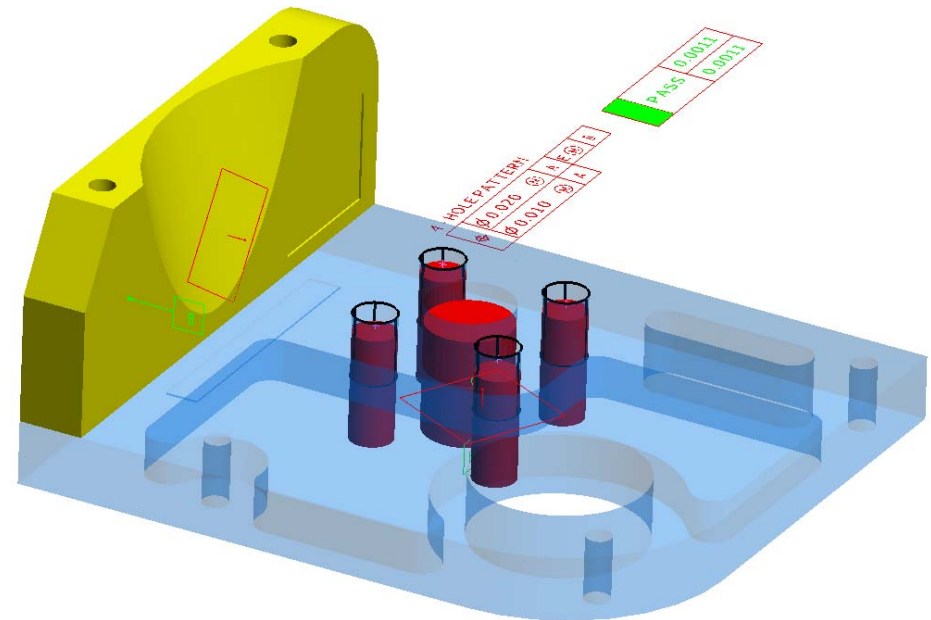
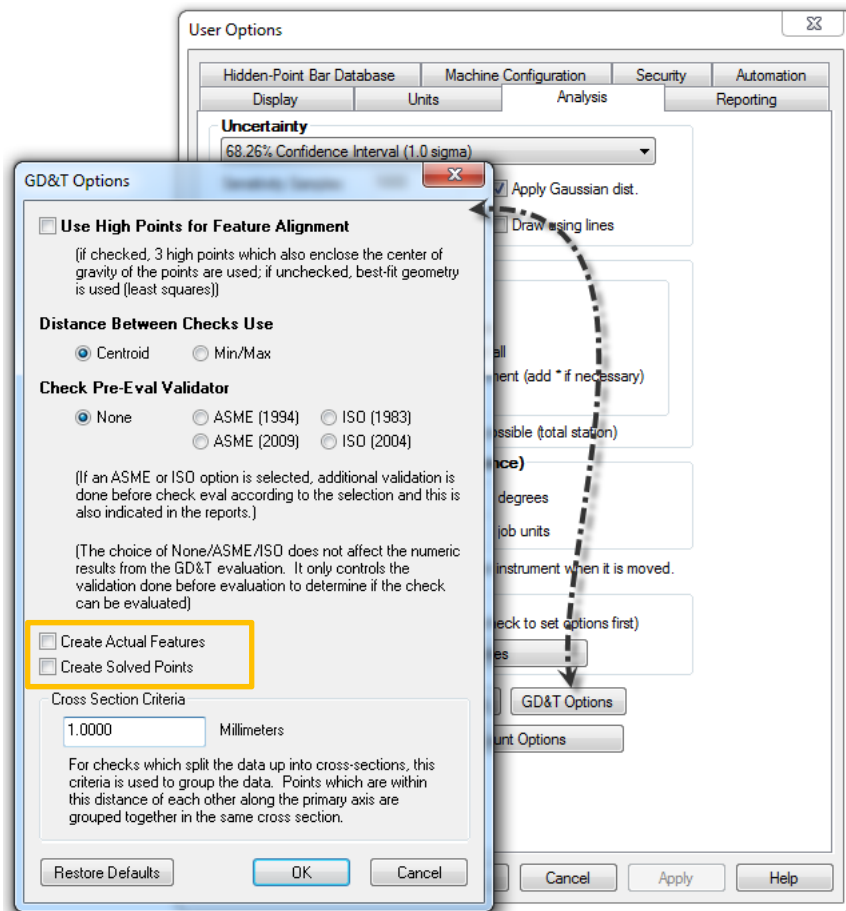


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MORE ACCURATE, EFFICIENT, PRODUCTIVE

Thank You