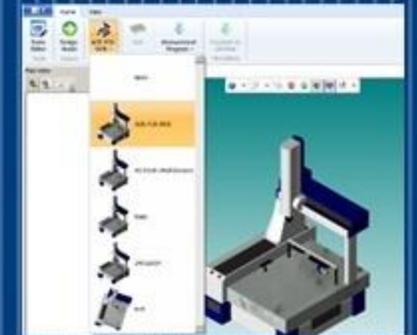
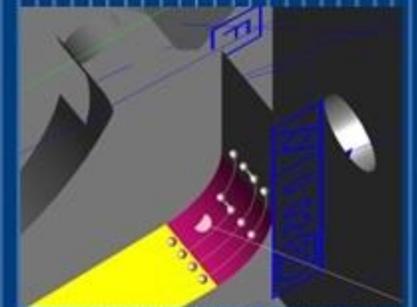
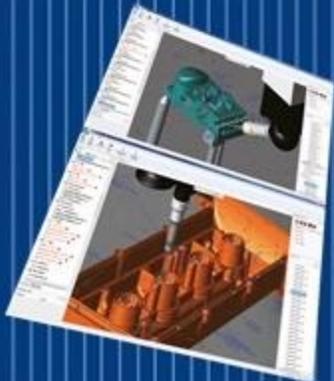
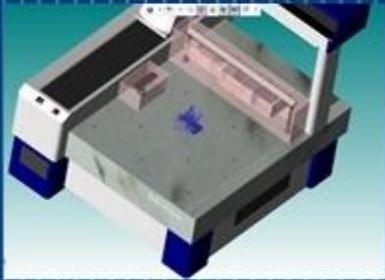
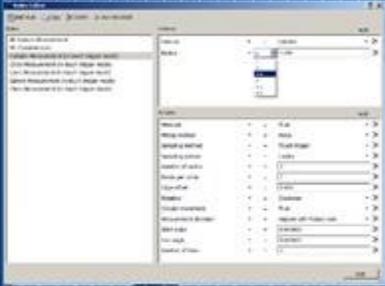
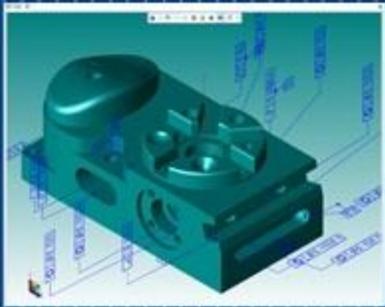


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MiCAT Planner

Changing the relationship between people and precision measurement with one click



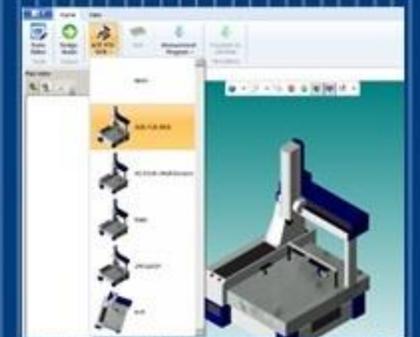
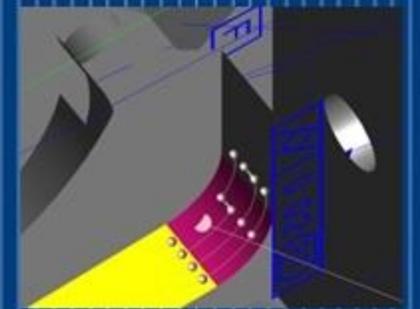
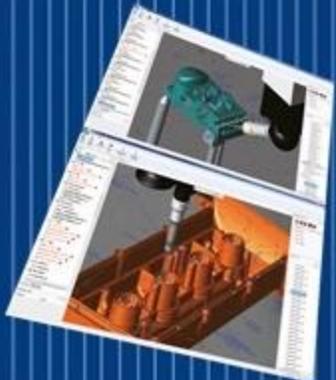
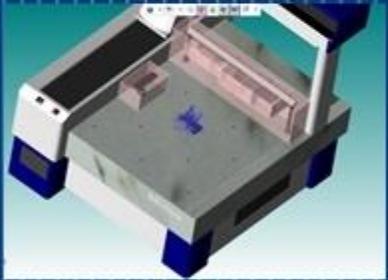
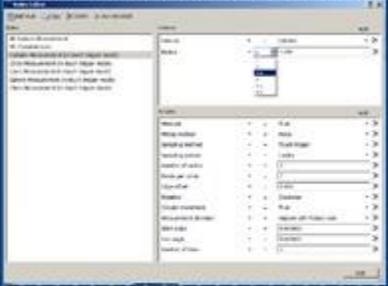
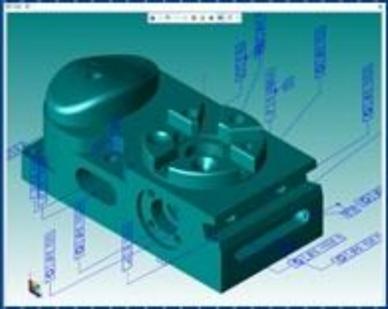
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Three Letter Acronyms (TLAs)

- MBD is Model Based Definition
- MBM is Model Based Manufacturing
- MBI is Model Based Inspection
- PMI is Product & Manufacturing Information
- DME is Dimensional Measurement Equipment

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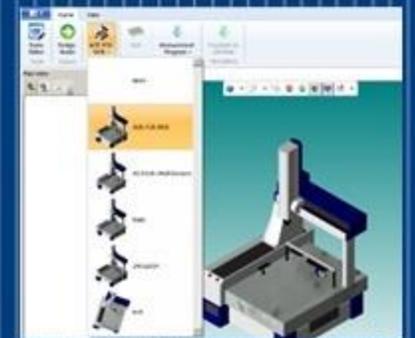
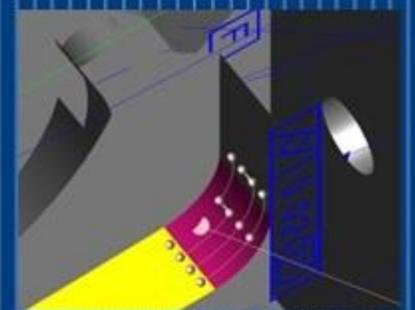
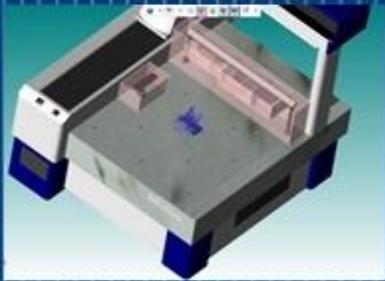
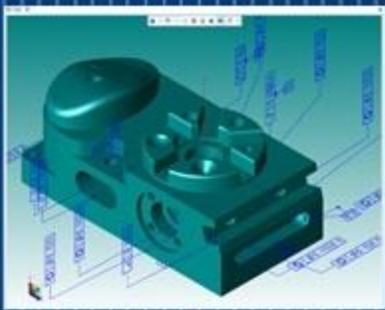


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Defining MBDs

- MBDs include PMI, which are visible dimensions, tolerances, notes, text, or symbols
- MBDs are created by Design Engineering but used by Manufacturing & Inspection
- MBD standards include ASME Y14.41-2012 *Digital Product Definition Data Practices* and Mil-Std-31000A *Technical Data Package*

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MBDs & two kinds of PMI

- Presentation PMI

- Visualizes PMI for the person
- Essentially creates a 3D drawing
- It may be organized by views in the CAD software

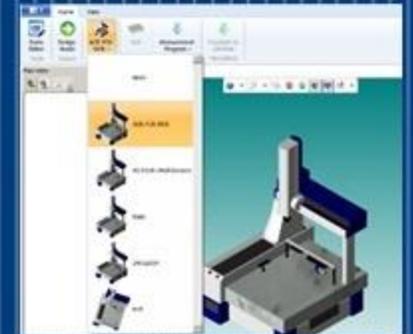
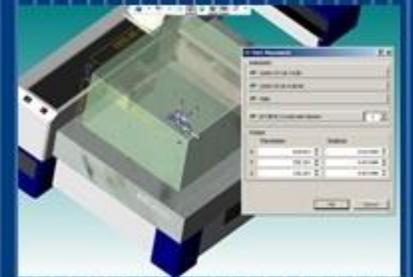
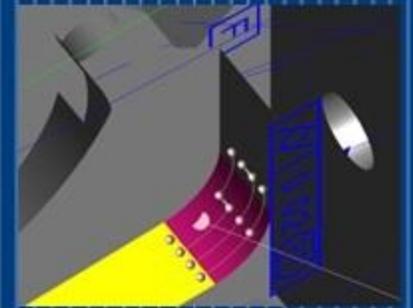
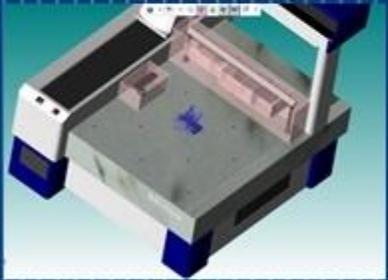
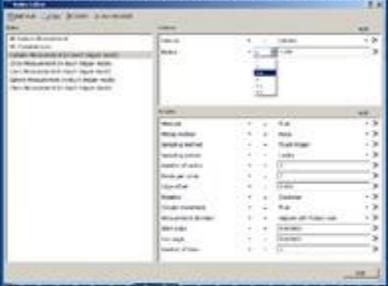
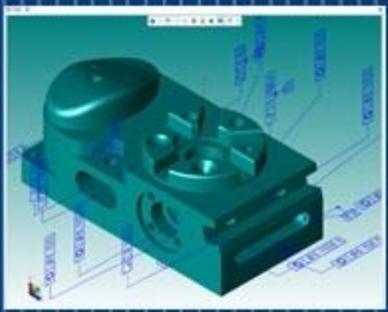
- Representation PMI

- Complements Presentation PMI
- Also known as 'Semantic' PMI
- Enables Model Based Inspection

Joshua Lubell at NIST notes: “Unambiguous representation and presentation of PMI are critical for digital product definition”

Ref: Lubell, J. “[PMI Validation and Conformance Testing for Model-based Engineering](#)” NIST Systems Engineering Conference in Washington DC (SEDC) April 3, 2014

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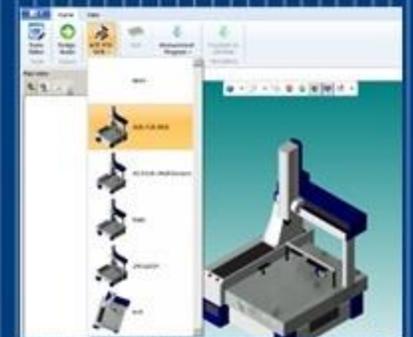
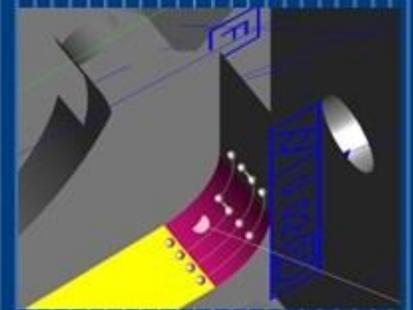
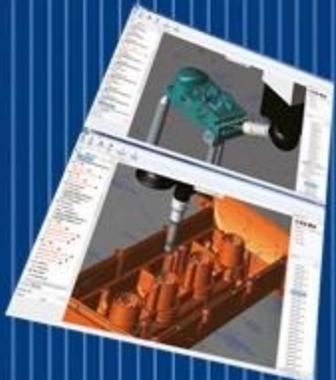
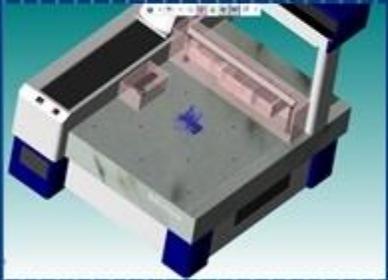
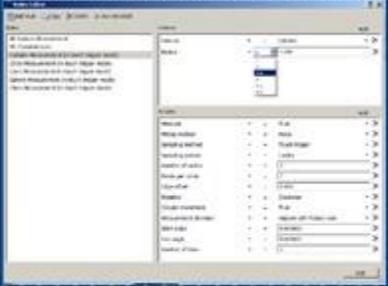
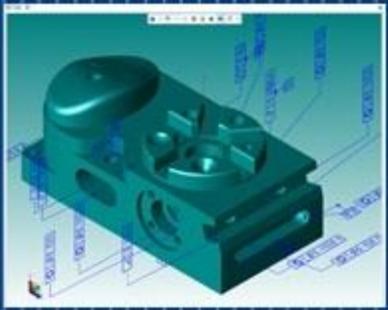


The MBD Journey

- Drawing Based workflow, where the 2D Drawing is the Master
- Model Centric workflow, where the 2D Drawing is the Master and the 3D Model provides part geometry
- Model Based Definition Workflow, where the 3D Model with PMI is the Master

To assess your company's model based capability:

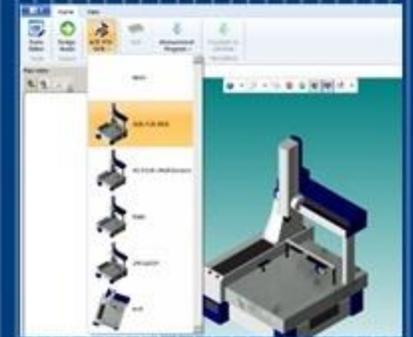
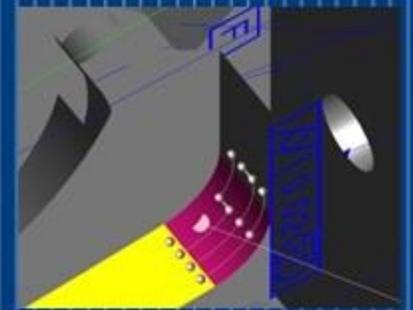
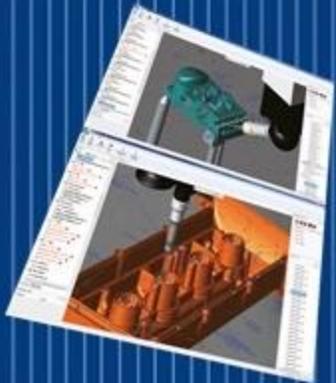
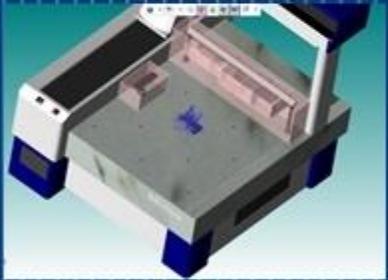
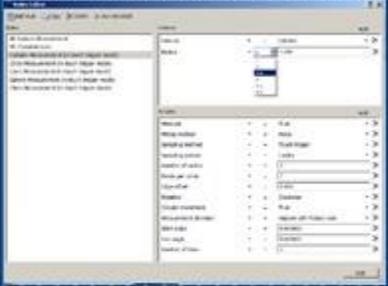
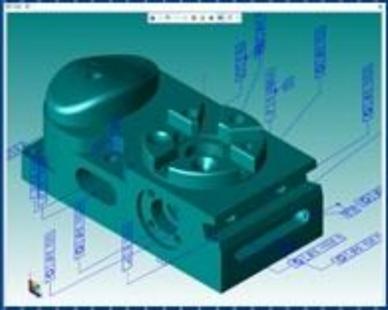
<http://model-based-enterprise.org/mbe-assessment-tool.html>



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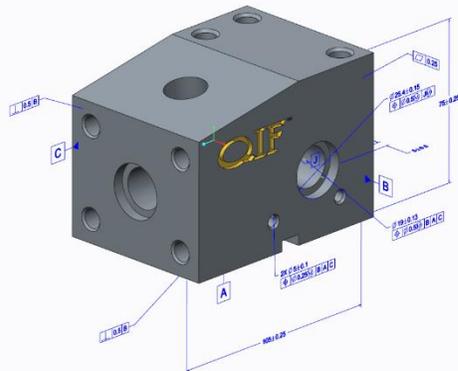
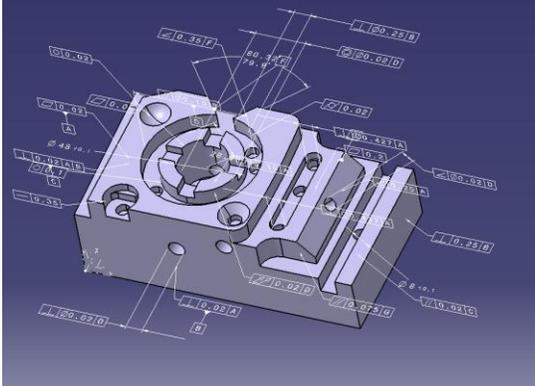
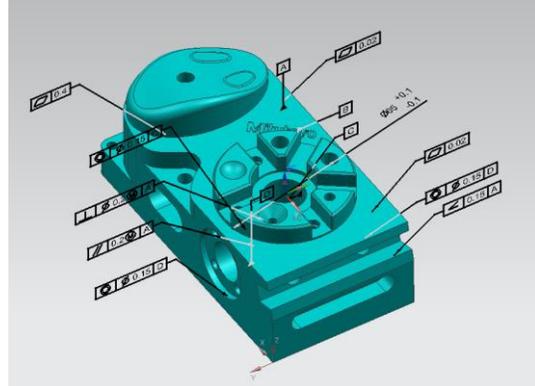
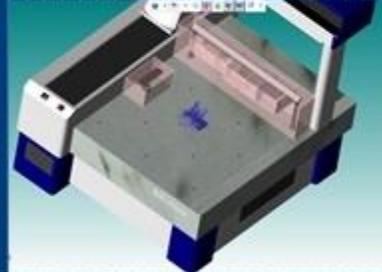
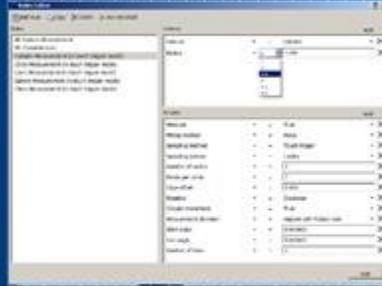
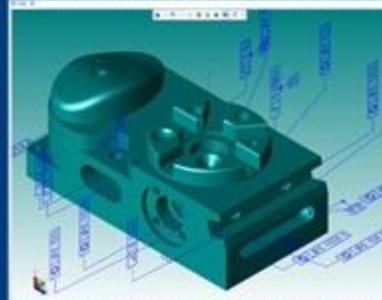
MBDs & Supplemental Geometry

- Supplemental geometry communicates design requirements but is not intended to represent a real part feature
- Some examples of supplemental geometry are
 - Center Lines
 - Center Planes
 - Datum Targets
 - Bolt Circles

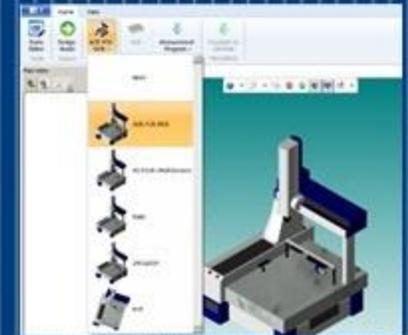
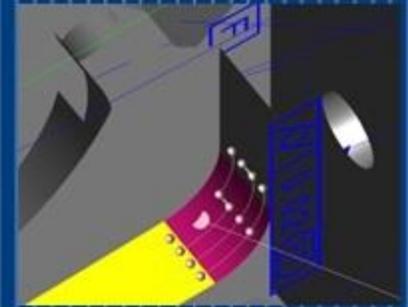


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Questions before we proceed?



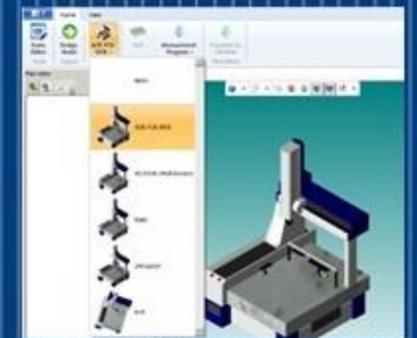
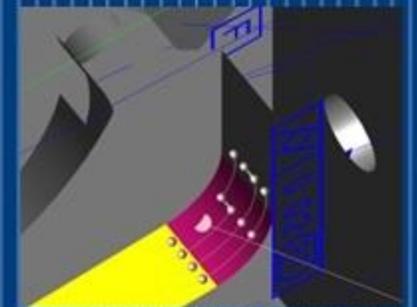
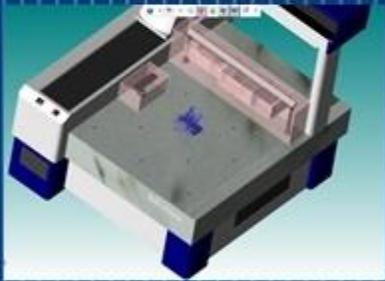
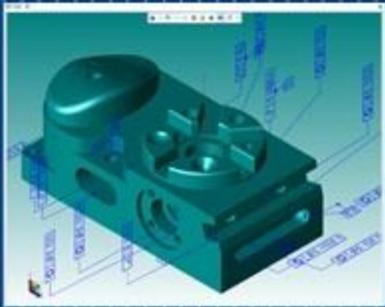
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What's Required for MBI?

- A 3D BRep Solid Model that includes semantic PMI
- A virtual DME and its actual counterpart
- A Measurement Plan that contains Rules and Settings
- The MiCAT Planner, of course

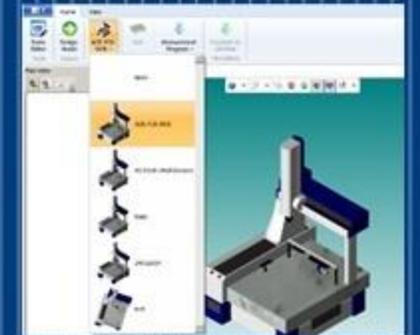
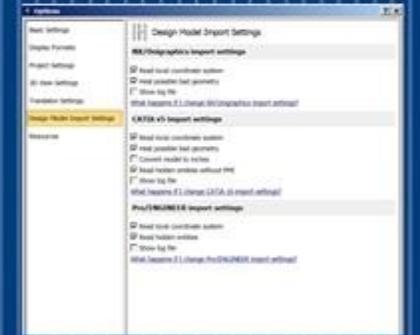
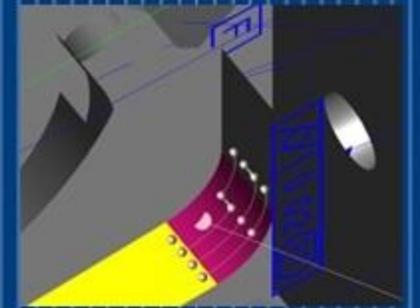
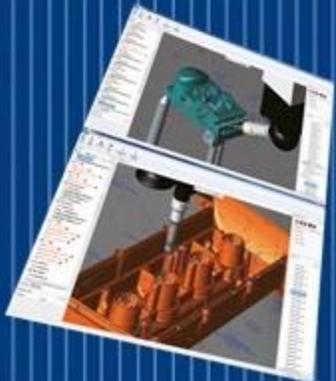
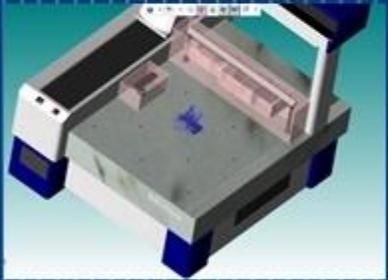
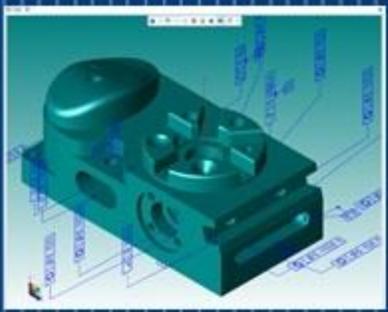


MiCAT

Dimensional Measuring Equipment

- Model Based Inspection is used often with CNC DMEs
- The most common CNC DME is the Coordinate Measurement Machine (aka CMM)
- Most current and new Mitutoyo CNC CMMs support MBI when used with the MiCAT Planner

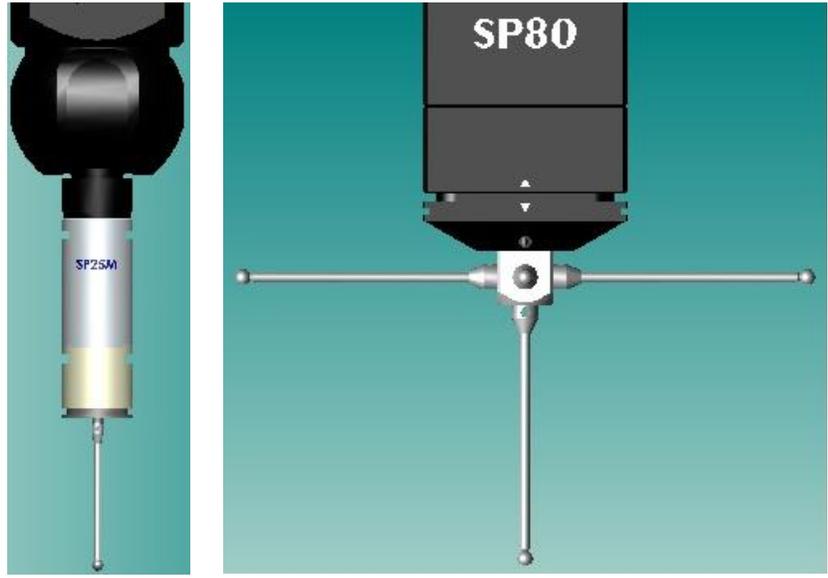
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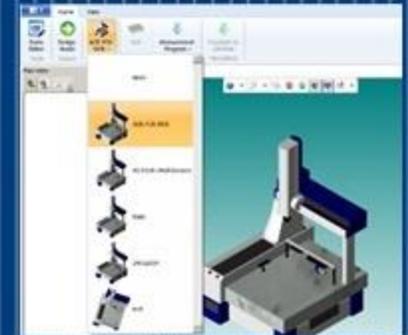
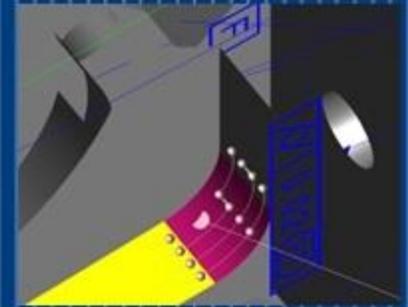
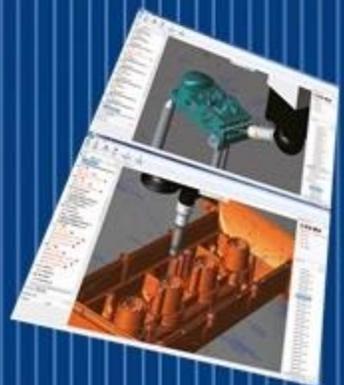
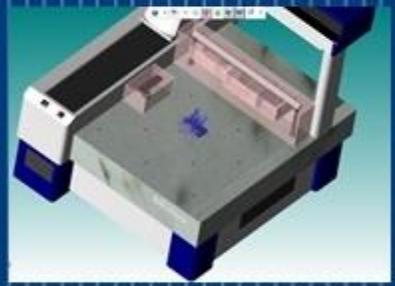
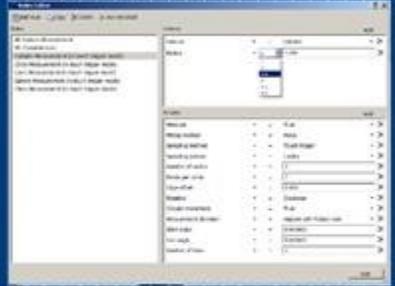
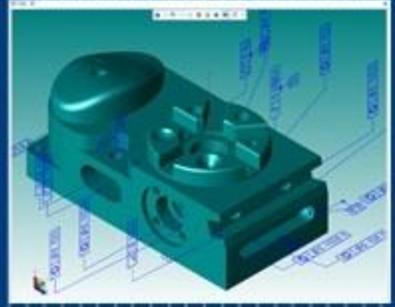
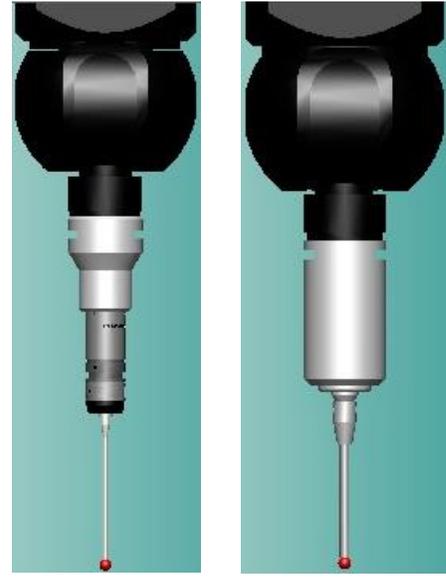
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Sensors for MBI

CONTACT SCANNING

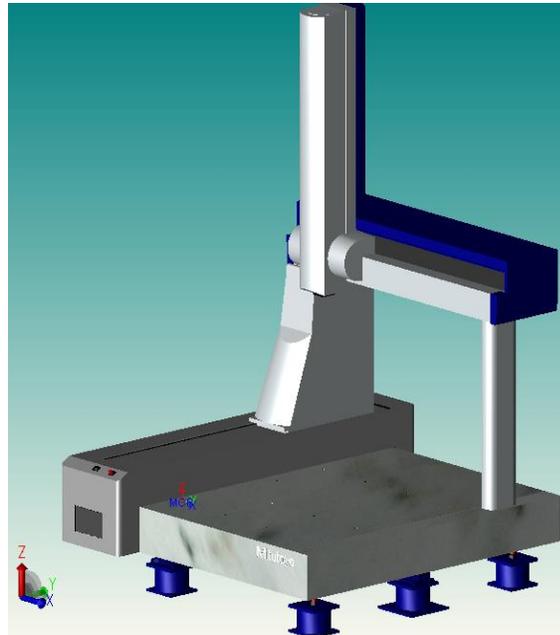
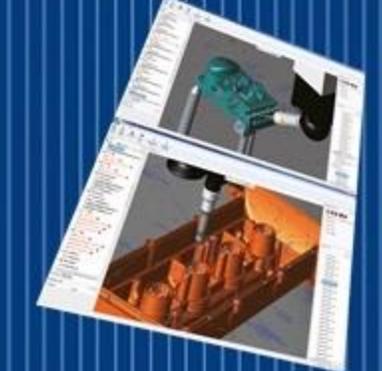
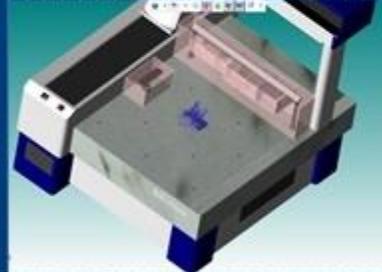
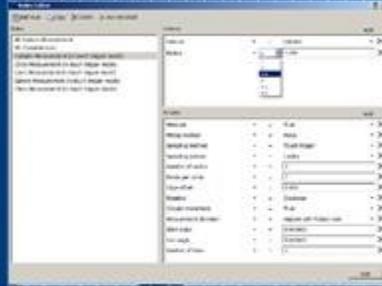
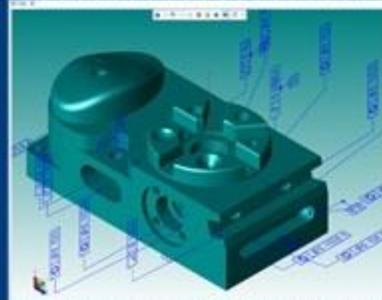


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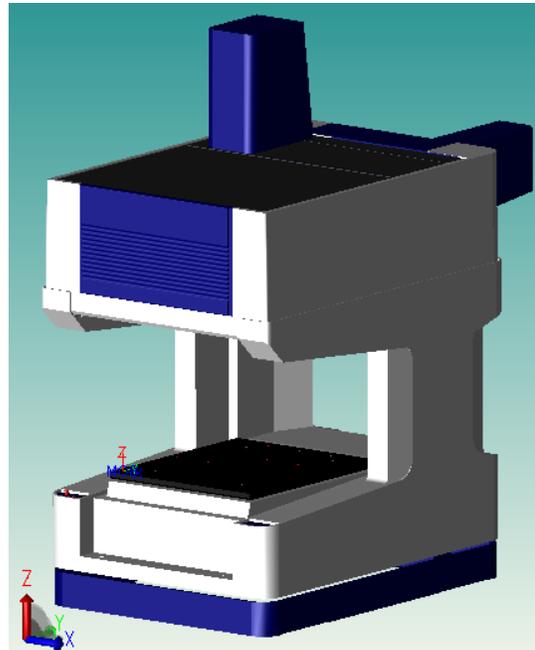


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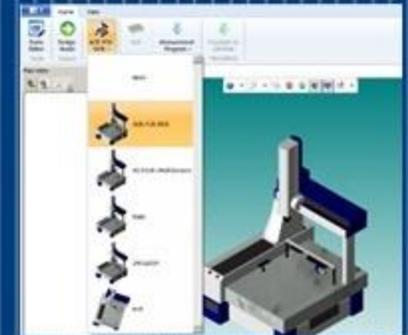
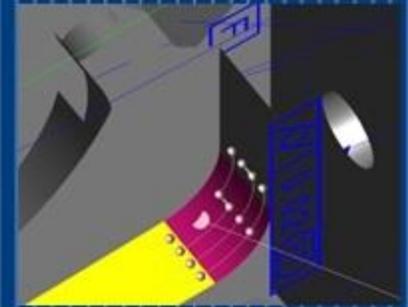
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BRIDGE



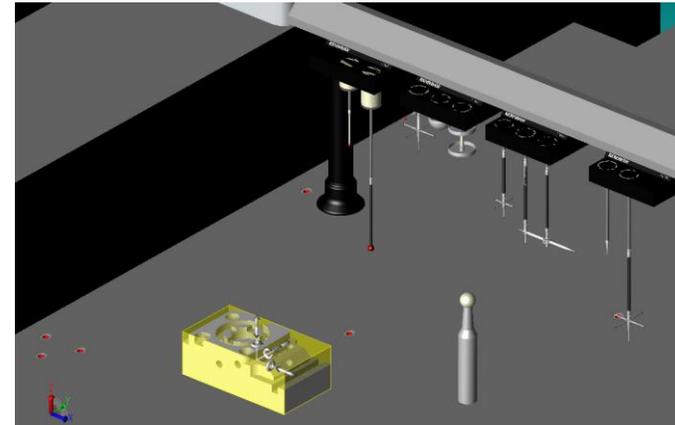
**Shop Hardened
GANTRY**



MiCAT

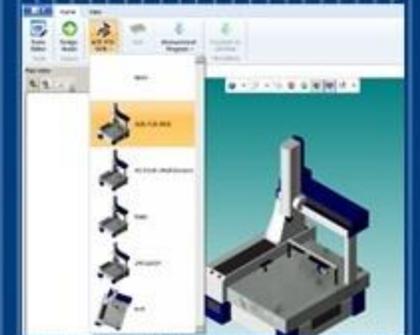
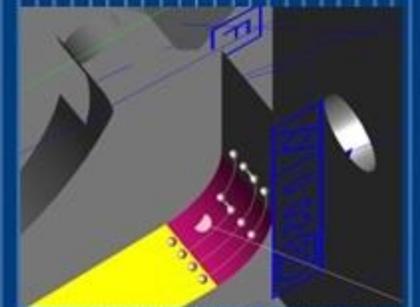
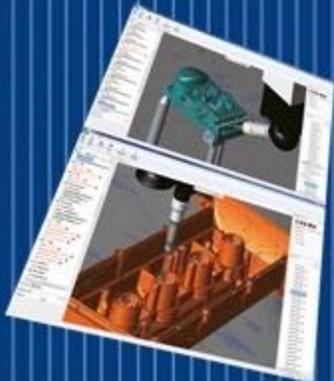
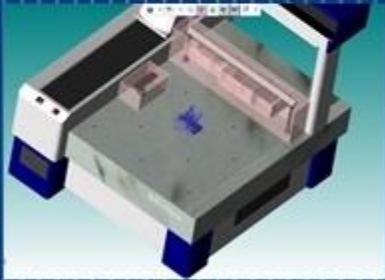
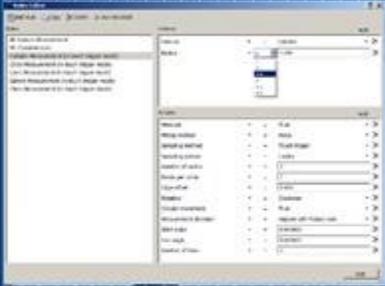
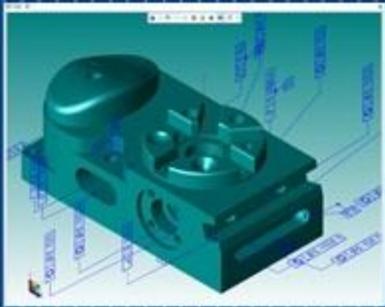
CMMs and Components for MBI

Shop Hardened
HORIZONTAL ARM



Change Racks, Modules
& Stylii

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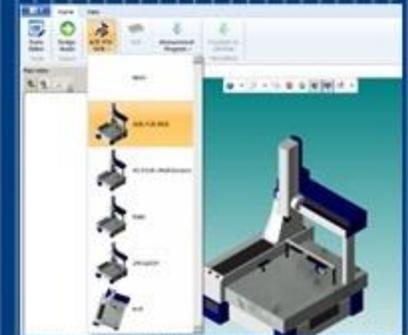
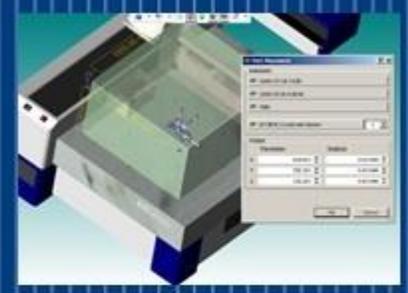
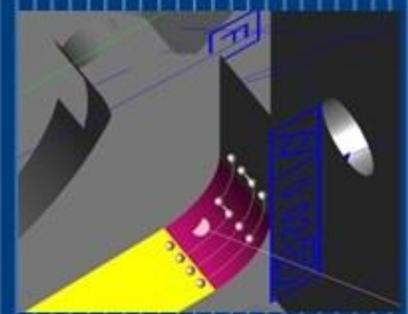
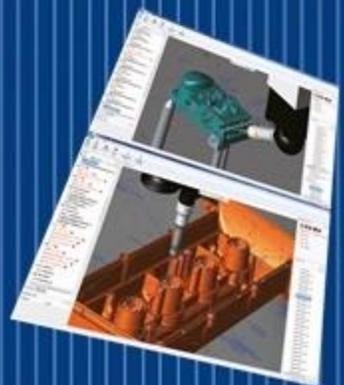
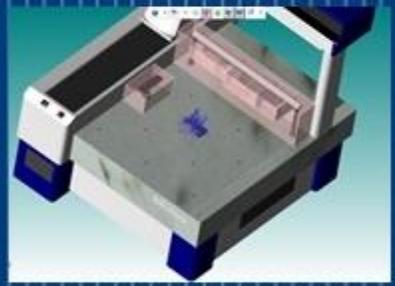
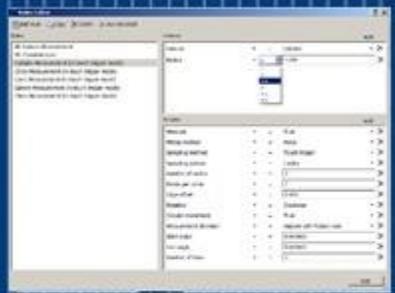
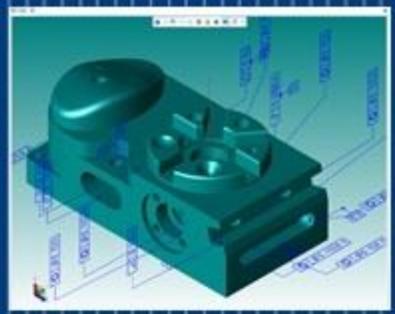
Questions before we proceed?



Virtual Legex CMM



Actual Legex CMM

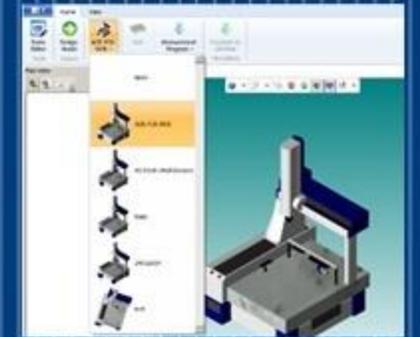
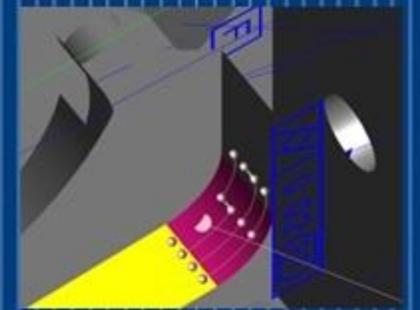
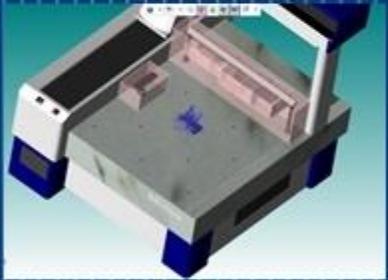
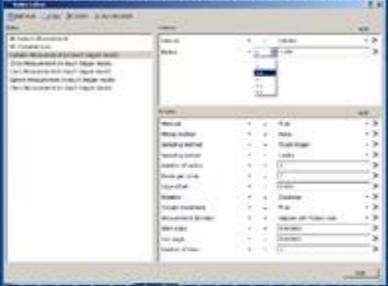
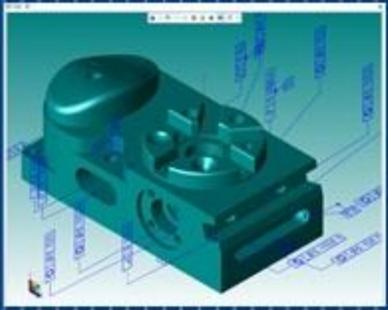


MiCAT

What is MiCAT Planner?

It is a measurement program software from Mitutoyo that enables one-click automated generation of CNC CMM programs.

MiCAT Planner makes model based inspection a practical and worthwhile reality.

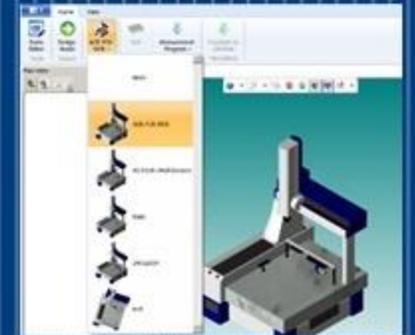
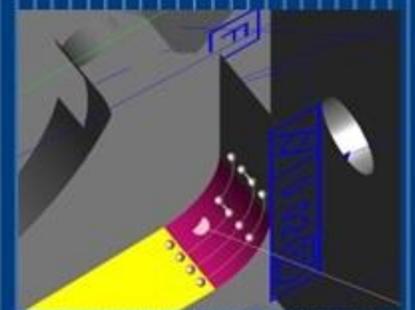
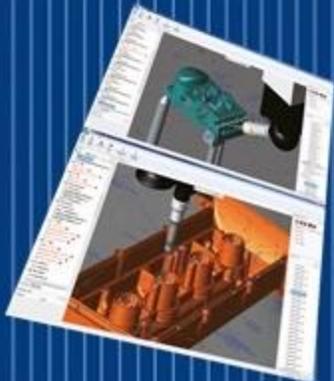
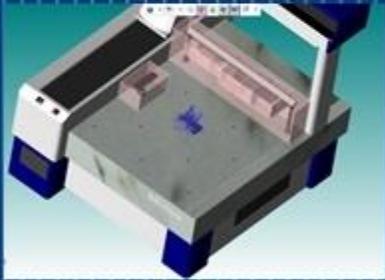
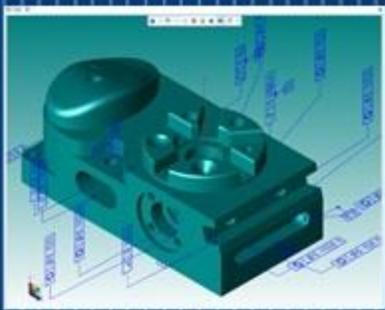


MiCAT

Upstream of MiCAT Planner

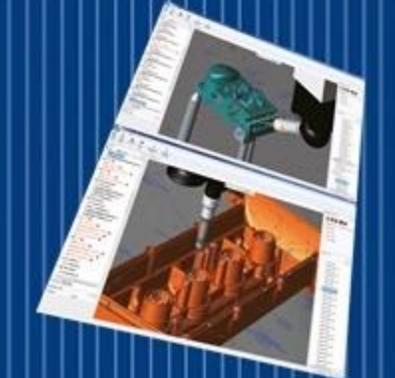
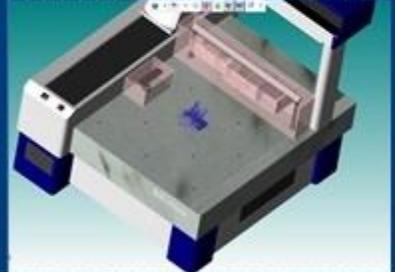
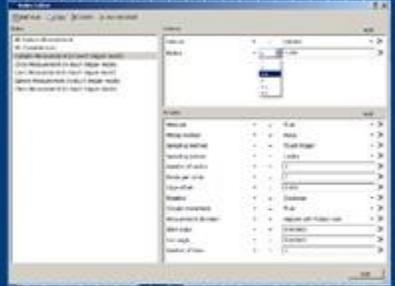
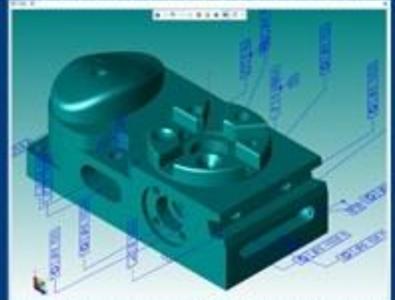
- Activities upstream of the MiCAT Planner MBI solution include
 - 3D Modeling
 - 3D Model Annotation
 - Model Based Procedures
 - MBD Validation
 - Best Practice MBI Rules

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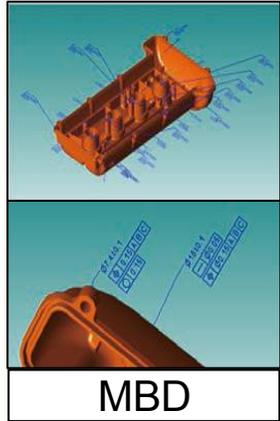


MiCAT

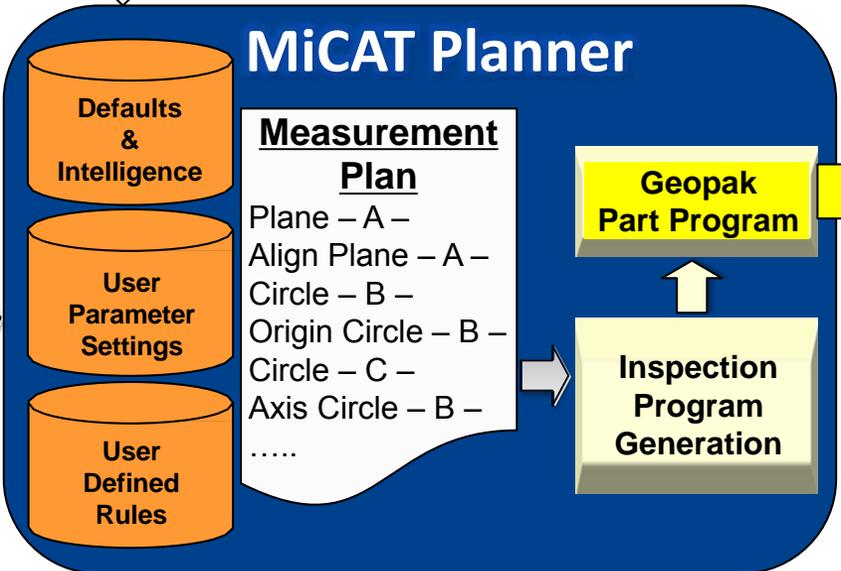
The MiCAT Planner MBI Work Flow



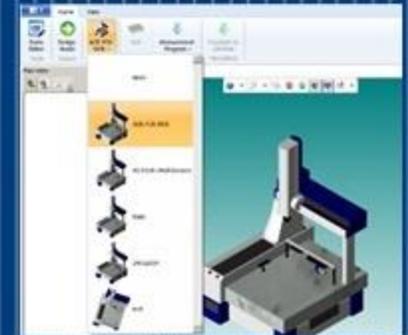
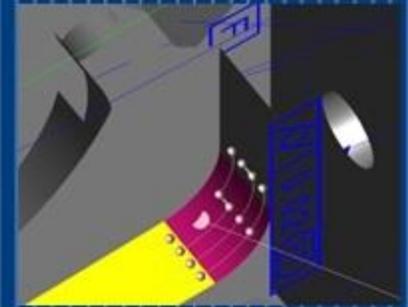
Configured virtual CMM (DME)



MBD



Mitutoyo

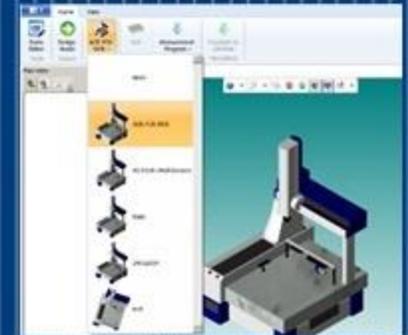
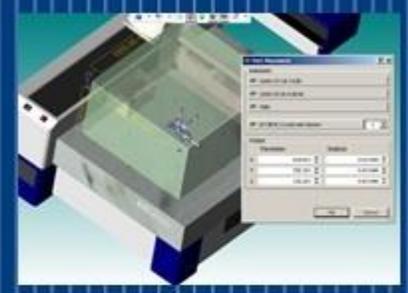
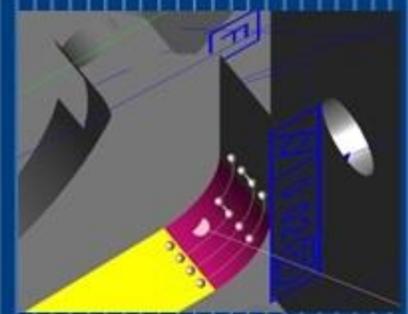
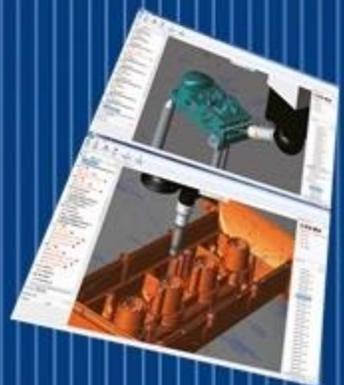
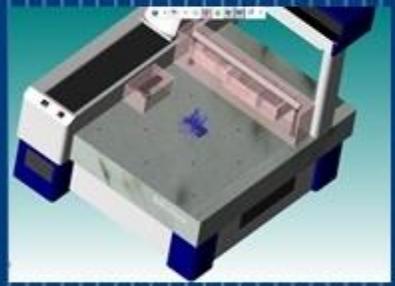
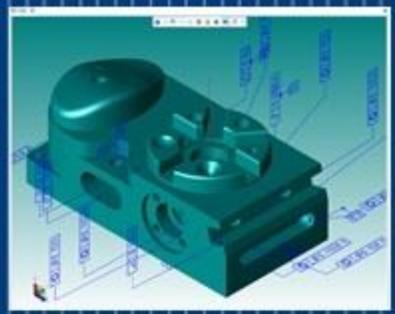


MiCAT

Defaults & Intelligence

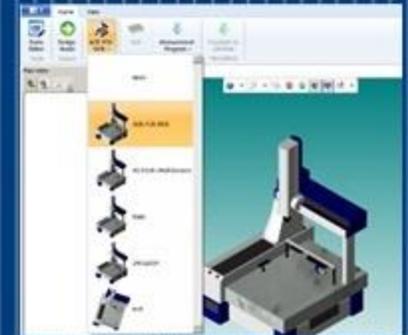
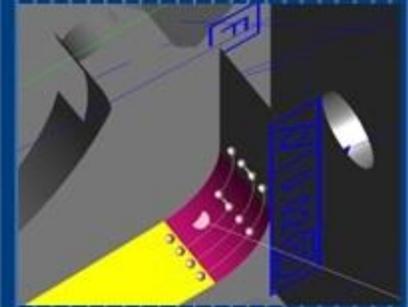
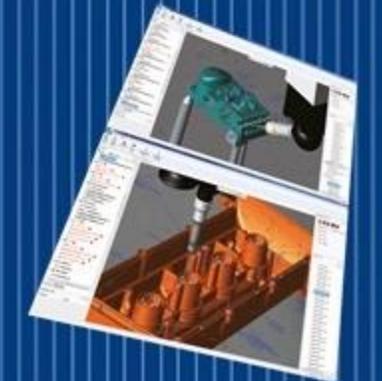
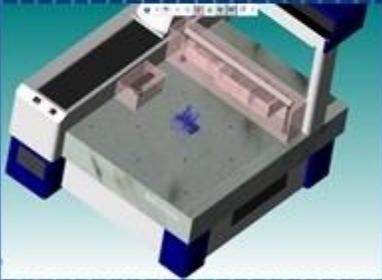
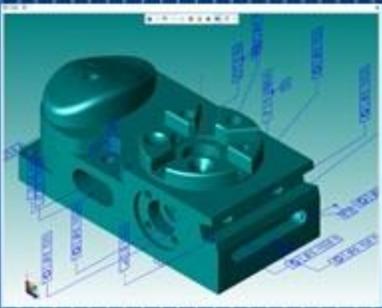
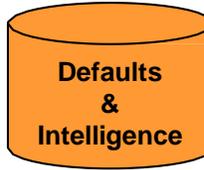
Defaults & Intelligence

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MiCAT

Defaults & Intelligence



Options

Basic Settings

Display Formats

Project Settings

3D View Settings

Translator Settings

Design Model Import Settings

Resources

Basic Settings

Language and regional configuration

Language: English (US)

Restart the application to apply this setting

[What happens when I change the language?](#)

MCOSMOS installation path

C:\MCOSMOS_V40\

[Why should I change the installation path?](#)

English (US)

Chinese

English (US)

English (UK)

French

German

Italian

Japanese

Portuguese (Brazil)

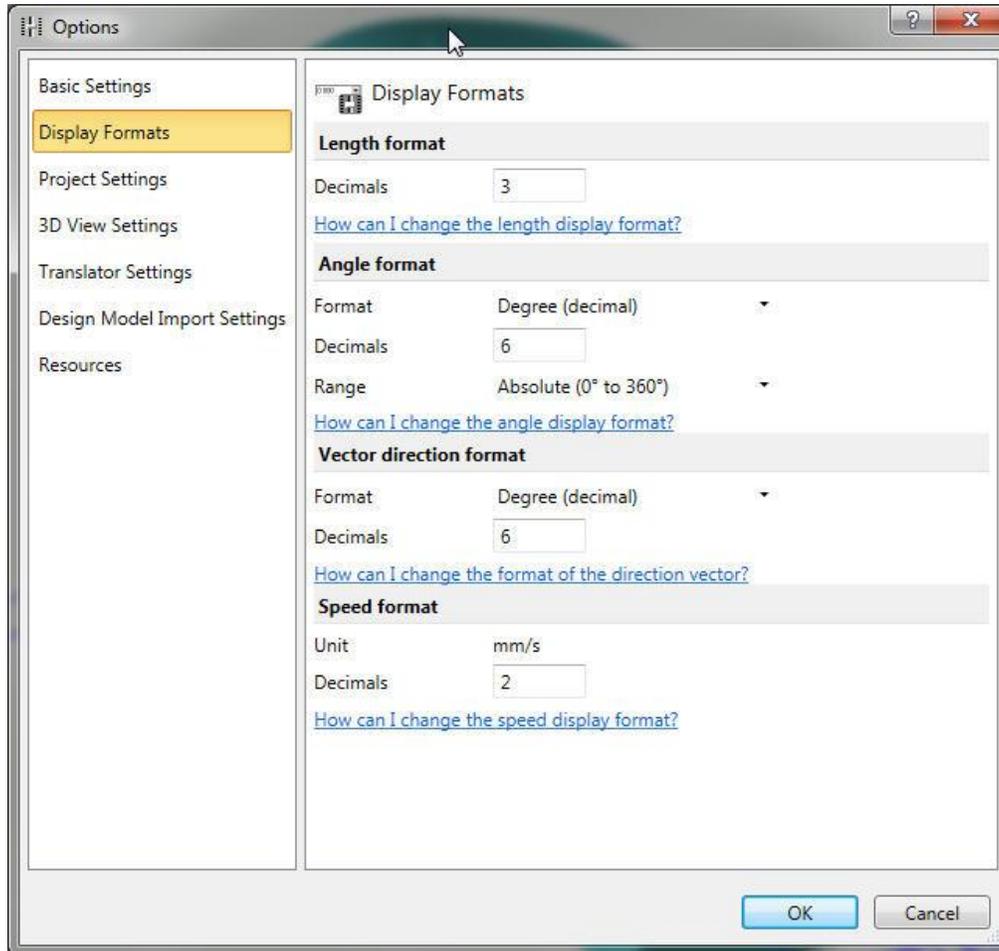
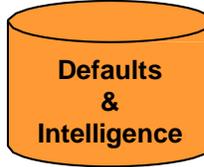
Spanish

OK Cancel

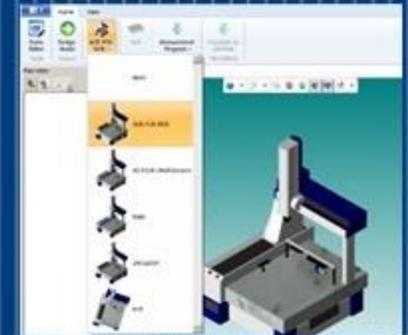
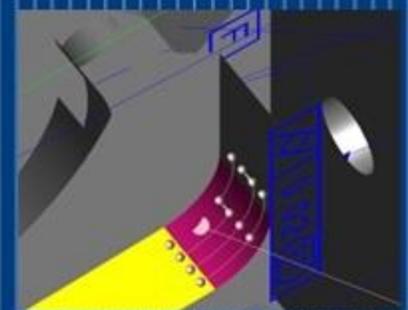
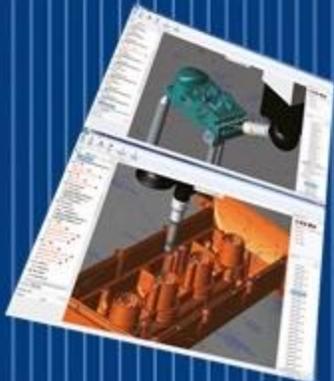
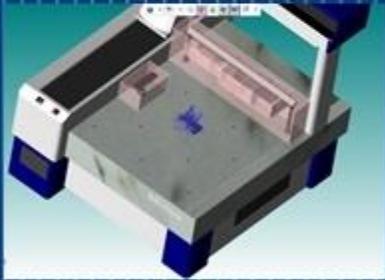
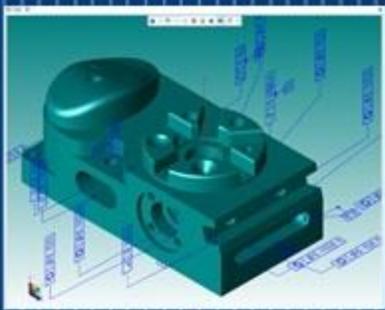


MiCAT

Defaults & Intelligence

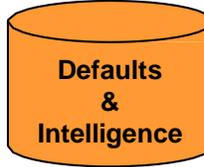


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MiCAT

Defaults & Intelligence

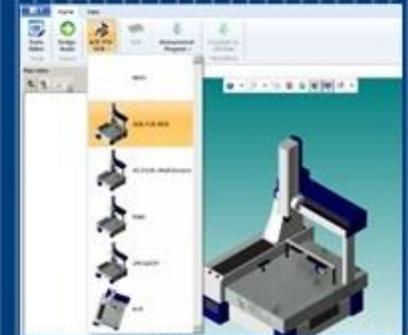
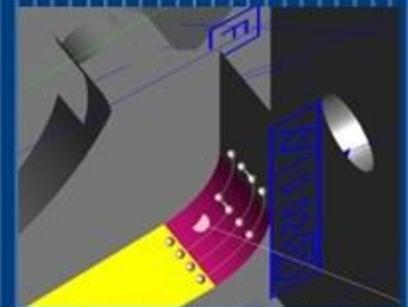
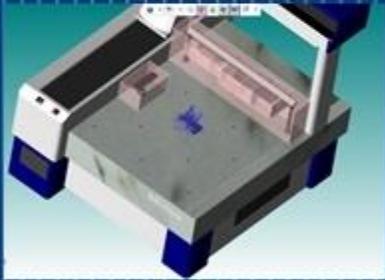
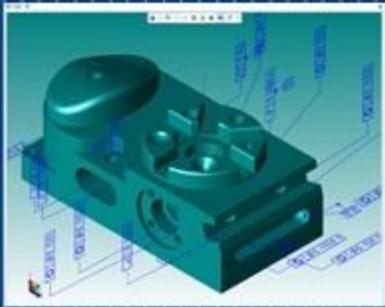


The screenshot shows the 'Options' dialog box with the 'Project Settings' tab selected. The 'Default project template' section has a text field containing 'Touch Trigger Template' and a 'Select...' button. A red arrow points from this button to a smaller 'Select Default Template' dialog box that is open in the foreground. This sub-dialog has a table with the following data:

Name	Modified
Touch Trigger Template	12/22/2014 11:00:22 AM
Contact Scanning Template	12/22/2014 11:00:21 AM

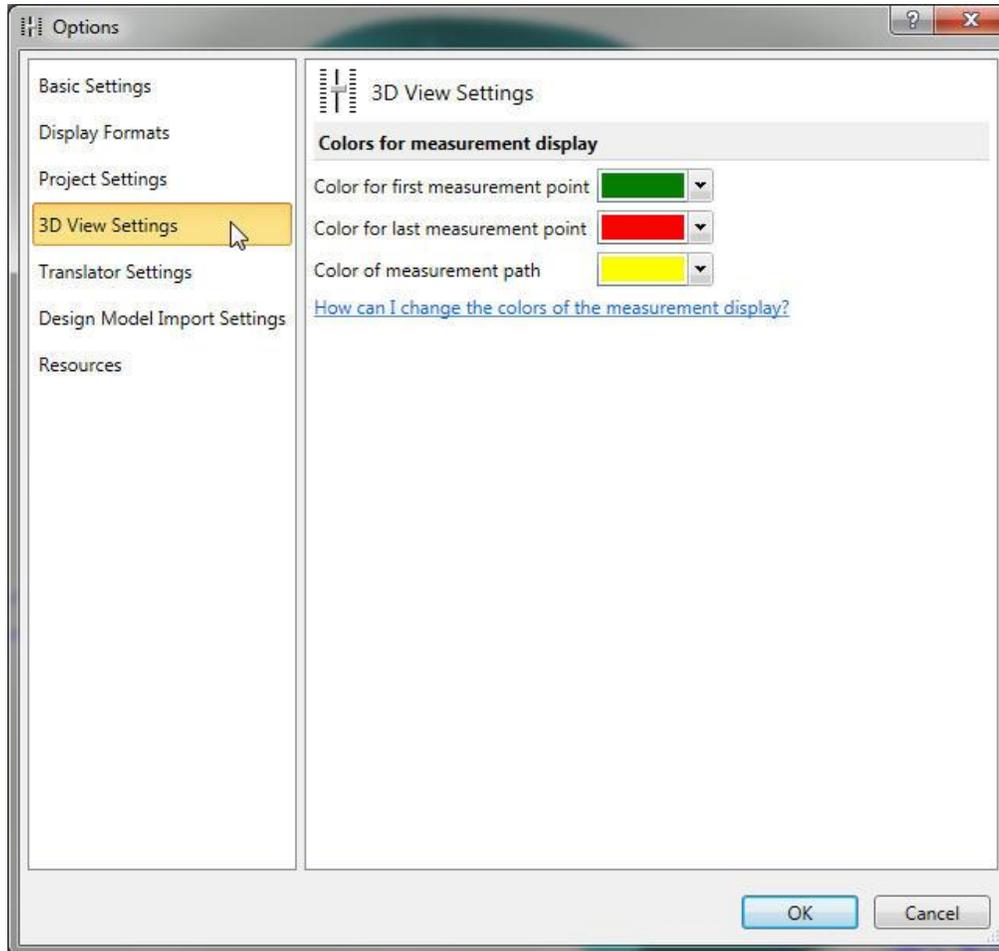
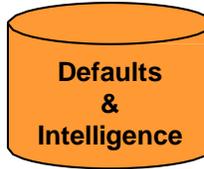
Buttons for 'Open', 'Cancel', 'OK', and 'Cancel' are visible at the bottom of the sub-dialog.

Mitutoyo

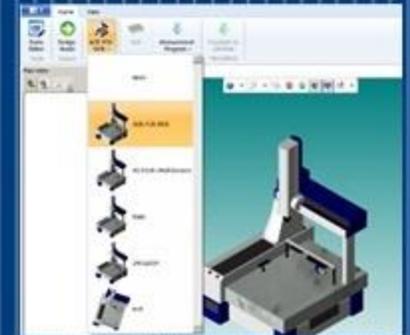
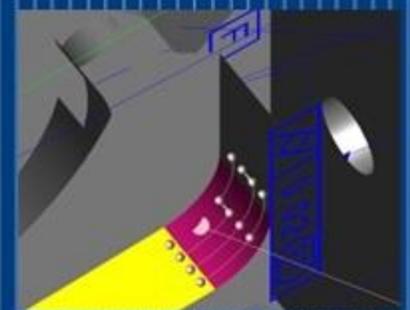
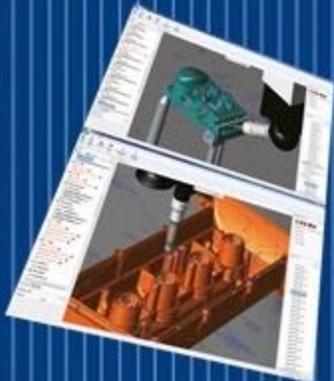
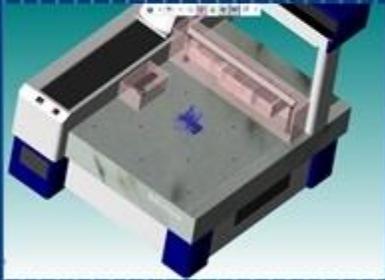
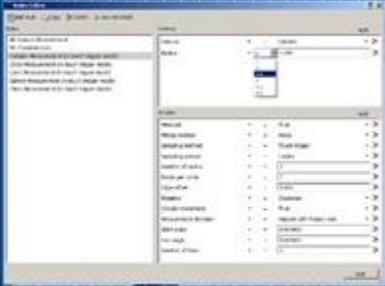
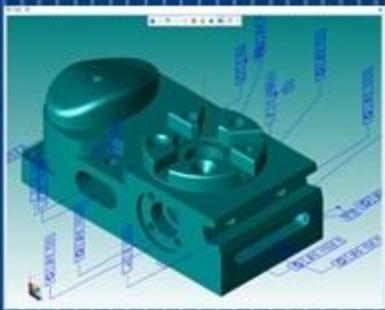


MiCAT

Defaults & Intelligence

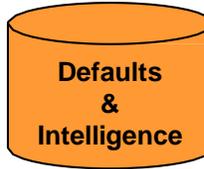


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MiCAT

Defaults & Intelligence



Basic Settings

Display Formats

Project Settings

3D View Settings

Translator Settings

Design Model Import Settings

Resources

Translator Settings

Probe tree change

Enable probe tree change warning

[What happens when I enable/disable the probe tree change warning?](#)

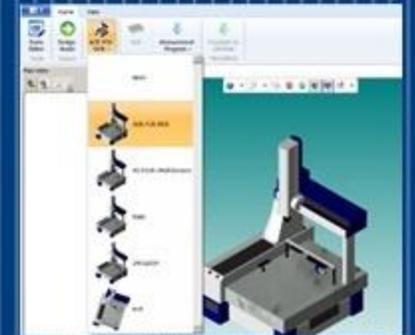
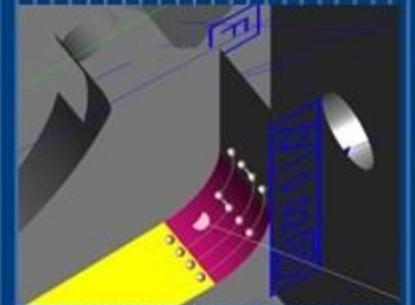
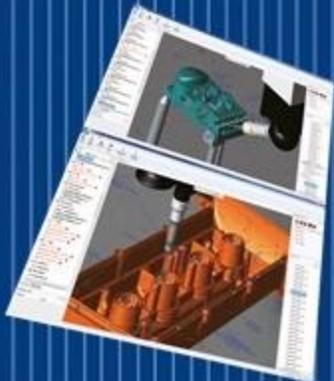
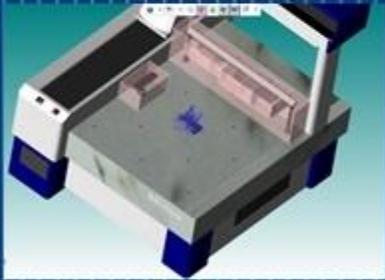
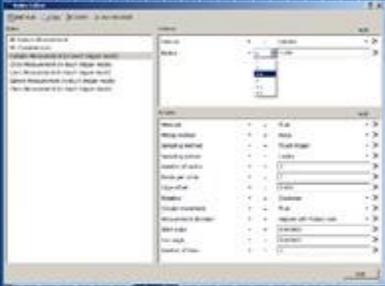
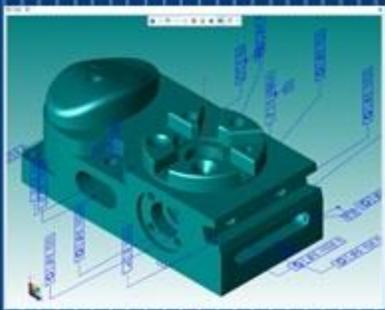
Characteristics

Use measured points only

[What happens when I switch on/off Use measured points only?](#)

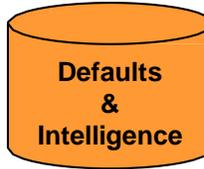
OK Cancel

Mitutoyo



MiCAT

Defaults & Intelligence



Basic Settings
Display Formats
Project Settings
3D View Settings
Translator Settings
Design Model Import Settings
Resources

Design Model Import Settings

NX/Unigraphics import settings

- Read local coordinate system
- Heal possible bad geometry
- Show log file

[What happens if I change NX/Unigraphics import settings?](#)

CATIA v5 import settings

- Read local coordinate system
- Heal possible bad geometry
- Convert model to inches
- Read hidden entities without PMI
- Show log file

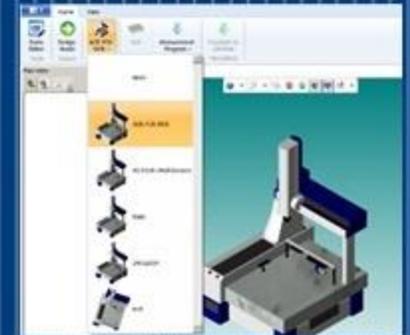
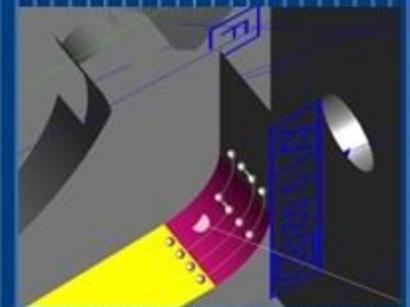
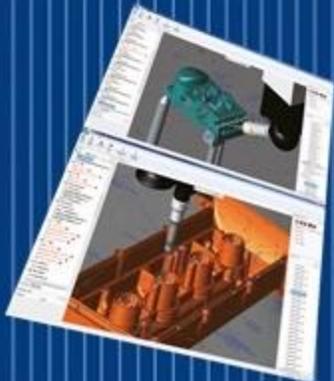
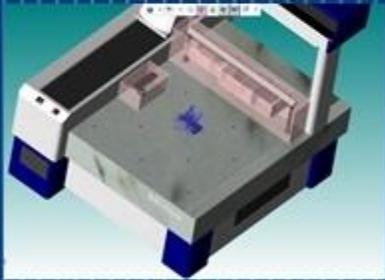
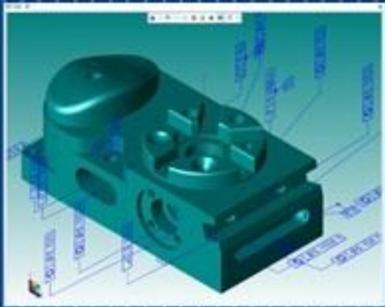
[What happens if I change CATIA v5 import settings?](#)

Pro/ENGINEER import settings

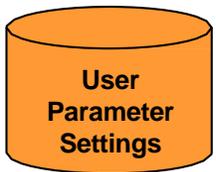
- Read local coordinate system
- Read hidden entities
- Show log file

[What happens if I change Pro/ENGINEER import settings?](#)

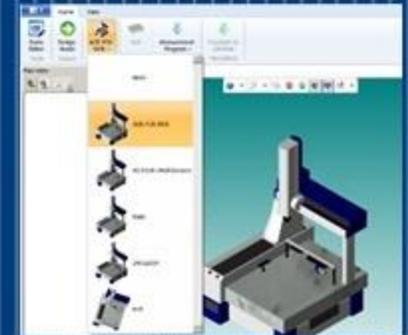
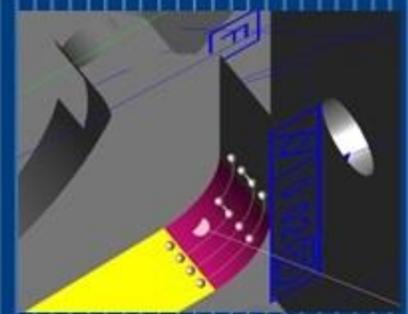
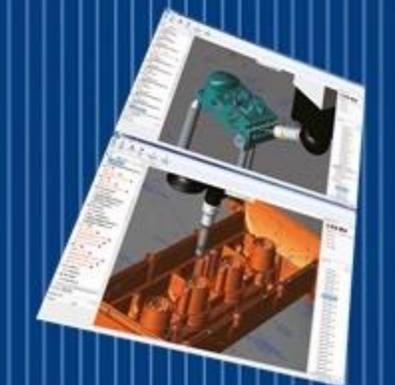
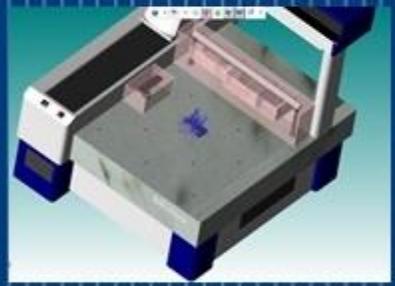
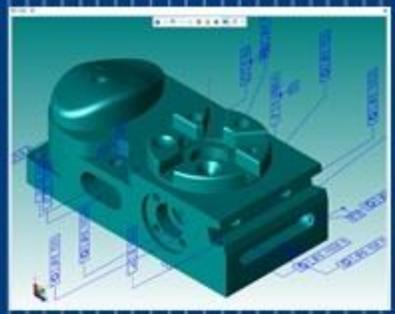
OK Cancel



MiCAT



Program Generation Options



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MiCAT

Program Generation Options

User
Parameter
Settings

Program Generation Options

Generation Settings

Collision Avoidance Settings

CNC Parameters

Generation Settings

Tool selection

Minimum percentage of feature area coverage: 25 %

Maximum angle difference applied to cylinder, circle, cone and sphere: 5.000000

[What happens if I change the tool selection settings?](#)

Evaluation order of characteristics

Evaluation: At the end

[What happens if I change the evaluation order of characteristics?](#)

Placement uncertainty

X: 50.000 mm

Y: 50.000 mm

Z: 50.000 mm (up)

Limit movement in Z to: DME table

[What happens if I change the alignment uncertainty?](#)

Reduce runtime: On

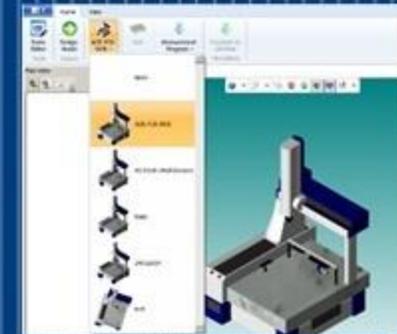
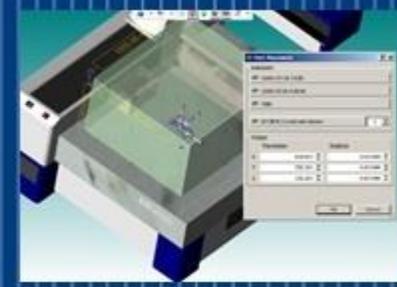
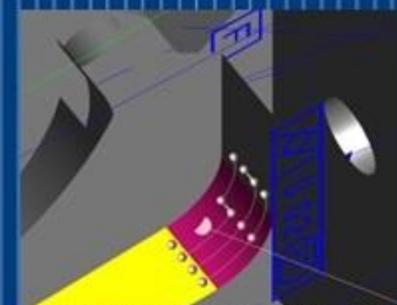
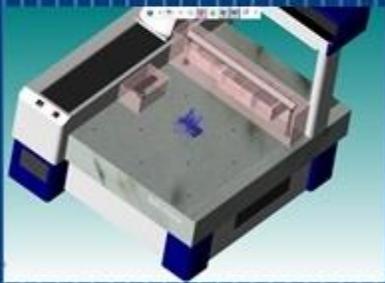
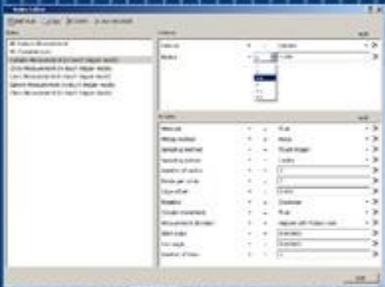
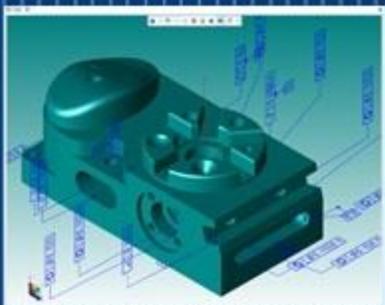
Reduce runtime automatically: Off

Maximum percentage of feature area coverage reduction: 5 %

[What happens if I change the reduce runtime settings?](#)

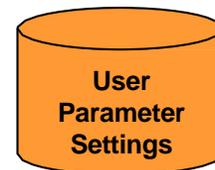
Save Cancel

Mitutoyo



MiCAT

Program Generation Options



Program Generation Options

Generation Settings

Collision Avoidance Settings

CNC Parameters

Enable DME components

Master ball(s)

[What happens if I enable or disable DME components?](#)

Clearance distances for move types

Enter a collision avoidance clearance distance for each of these move-types

Between measurements 5.000 mm

To and from a measurement 5.000 mm

When measuring a point 0.400 mm

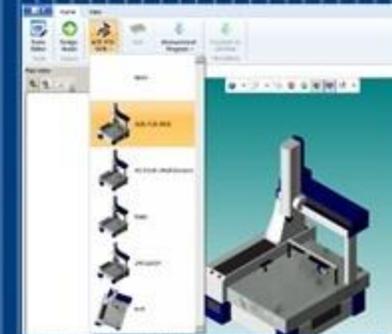
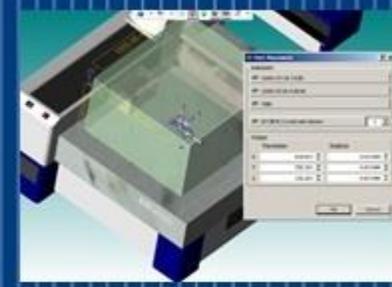
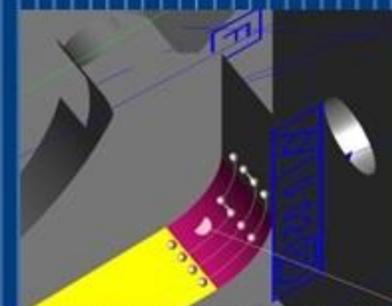
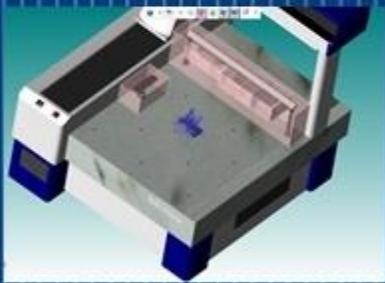
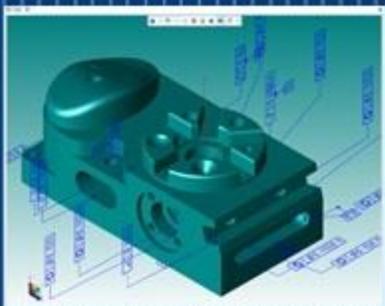
Clearance distance between DME and other non-moving objects

To racks, master balls, ... 10.000 mm

[What happens if I change the collision avoidance clearance distances?](#)

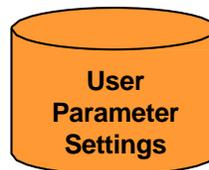
Save Cancel

Mitutoyo



MiCAT

Program Generation Options



Program Generation Options

Generation Settings

Collision Avoidance Settings

CNC Parameters

CNC Parameters

Speed settings

Movement speed 519.60 mm/s

Measurement speed 3.00 mm/s

[How can I change the CNC parameter for speed?](#)

Length settings

Approach distance 0.500 mm

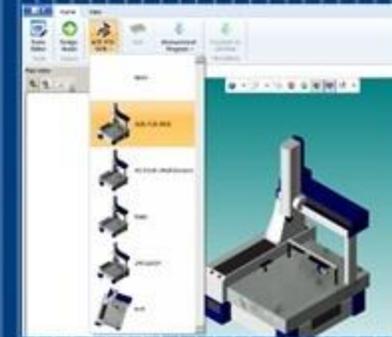
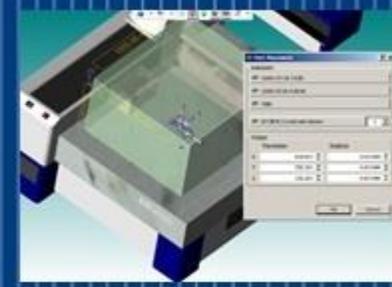
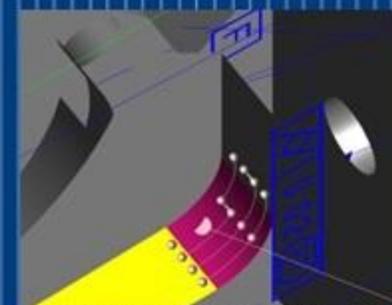
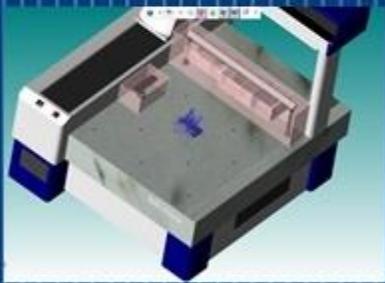
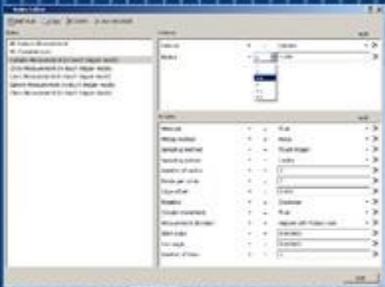
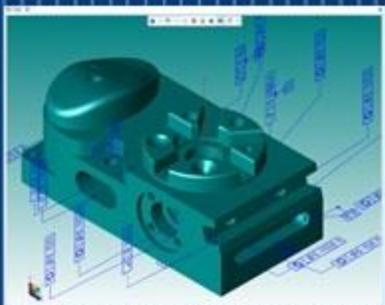
Retraction length 1.000 mm

Measurement length 100.000 mm

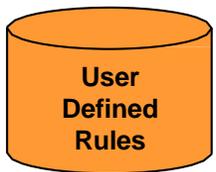
[How can I change the CNC parameter for length?](#)

Save Cancel

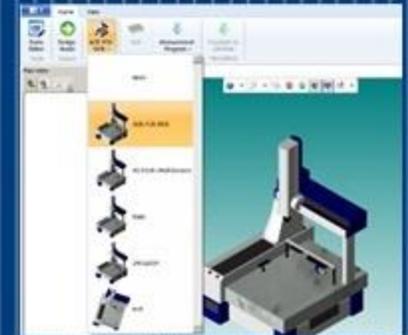
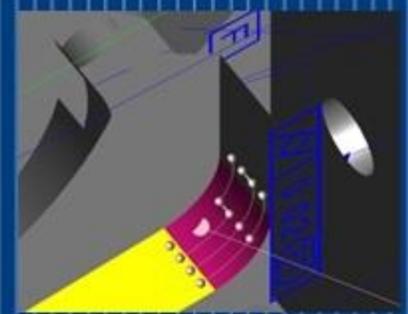
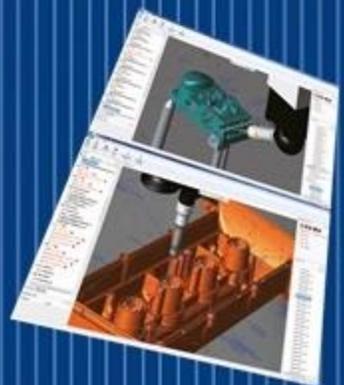
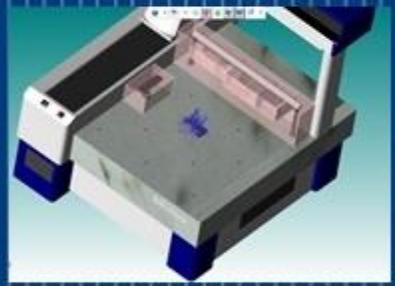
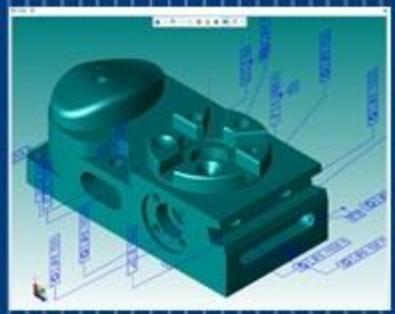
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User Defined Rules

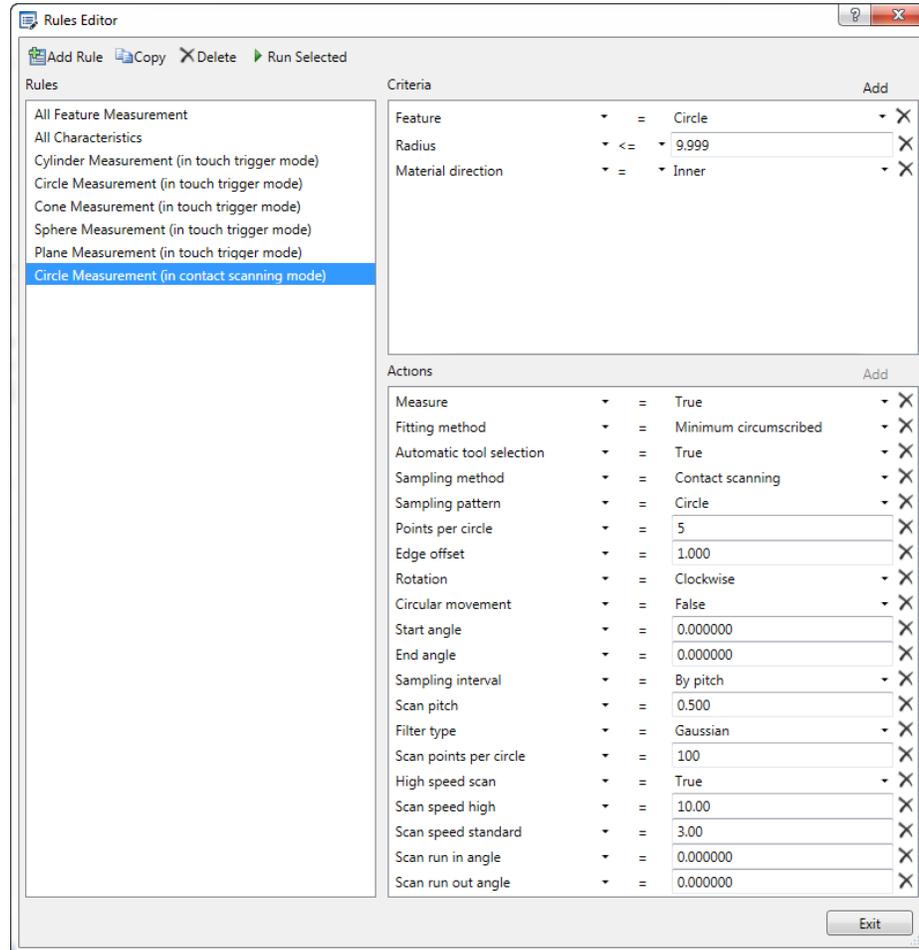


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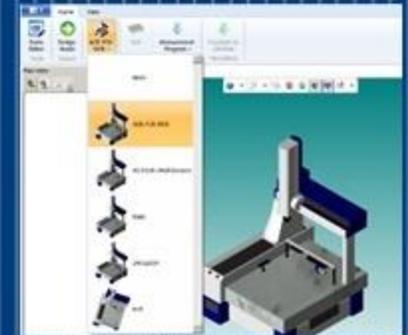
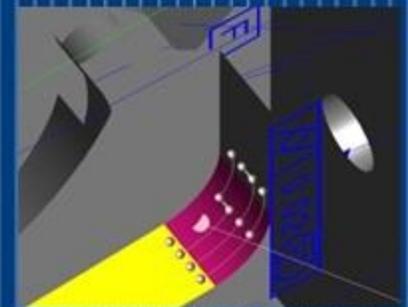
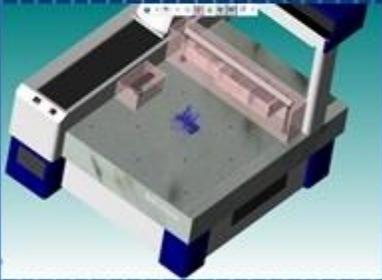
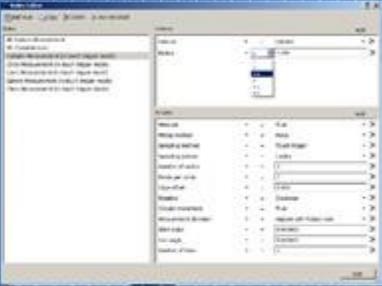
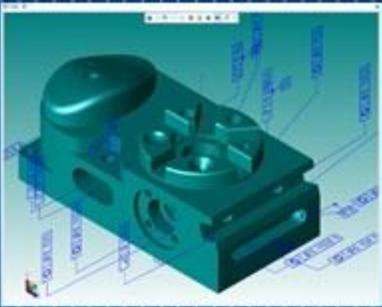
MiCAT

Rules Editor

User Defined Rules



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MiCAT

User Defined Rules

User Defined Rules

Rules Editor

Add Rule Copy Delete Run Selected

Rules

- All Feature Measurement
- All Characteristics
- Cylinder Measurement (in touch trigger mode)
- Circle Measurement (in touch trigger mode)
- Cone Measurement (in touch trigger mode)
- Sphere Measurement (in touch trigger mode)
- Plane Measurement (in touch trigger mode)
- Circle Measurement (in contact scanning mode)**

Defined Rules

Criteria

Feature	=	Circle	X
Radius	<=	9.999	X
Material direction	=	Inner	X

Criteria - For an Inner Circle measurement with a Radius of less than or equal to 9.999

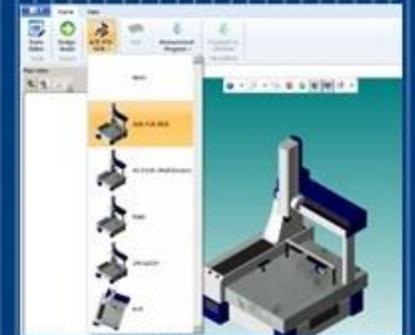
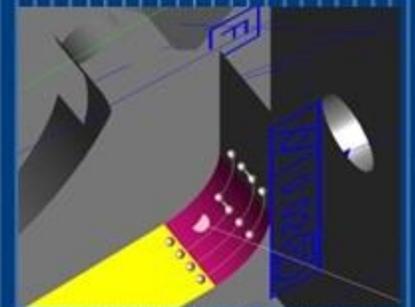
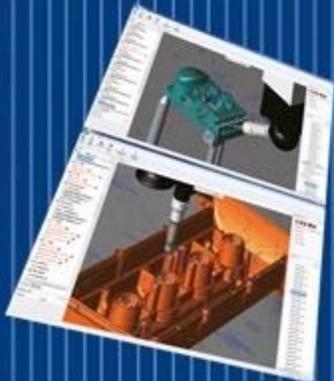
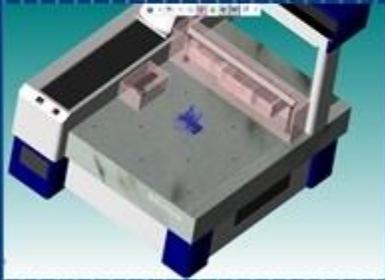
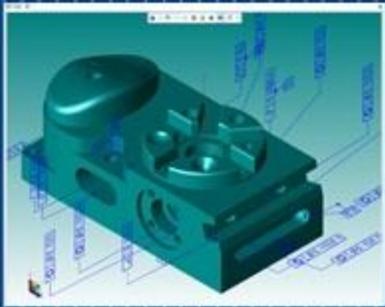
Actions - define all the parameters to be used for measuring all Circles in the Design Model that meet the Criteria

Actions

Measure	=	True	X
Fitting method	=	Minimum circumscribed	X
Automatic tool selection	=	True	X
Sampling method	=	Contact scanning	X
Sampling pattern	=	Circle	X
Points per circle	=	5	X
Edge offset	=	1.000	X
Rotation	=	Clockwise	X
Circular movement	=	False	X
Start angle	=	0.000000	X
End angle	=	0.000000	X
Sampling interval	=	By pitch	X
Scan pitch	=	0.500	X
Filter type	=	Gaussian	X
Scan points per circle	=	100	X
High speed scan	=	True	X
Scan speed high	=	10.00	X
Scan speed standard	=	3.00	X
Scan run in angle	=	0.000000	X
Scan run out angle	=	0.000000	X

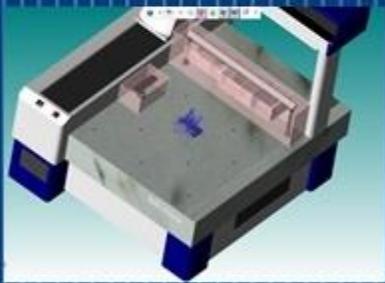
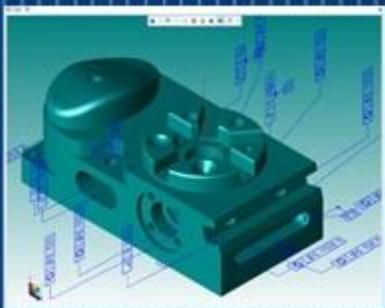
Exit

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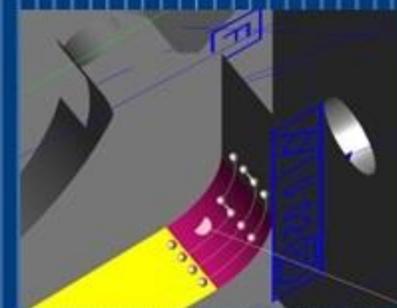
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Adding a Rule



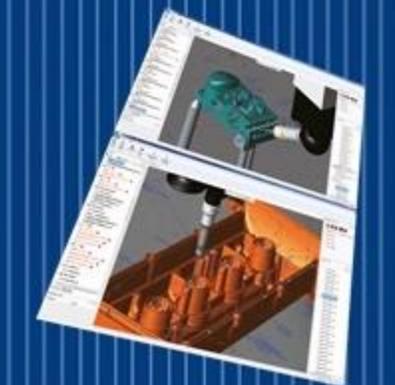
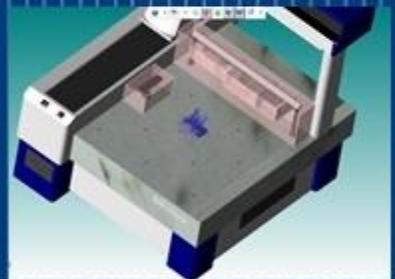
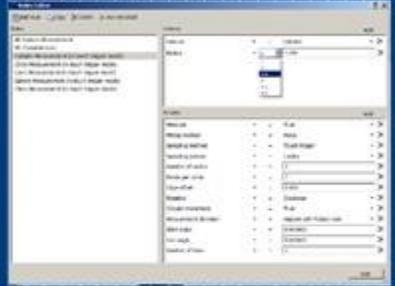
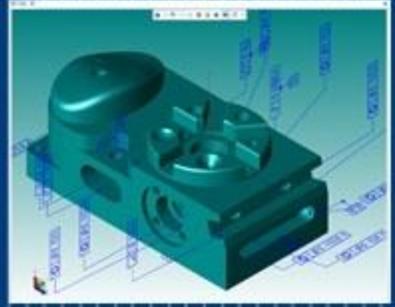
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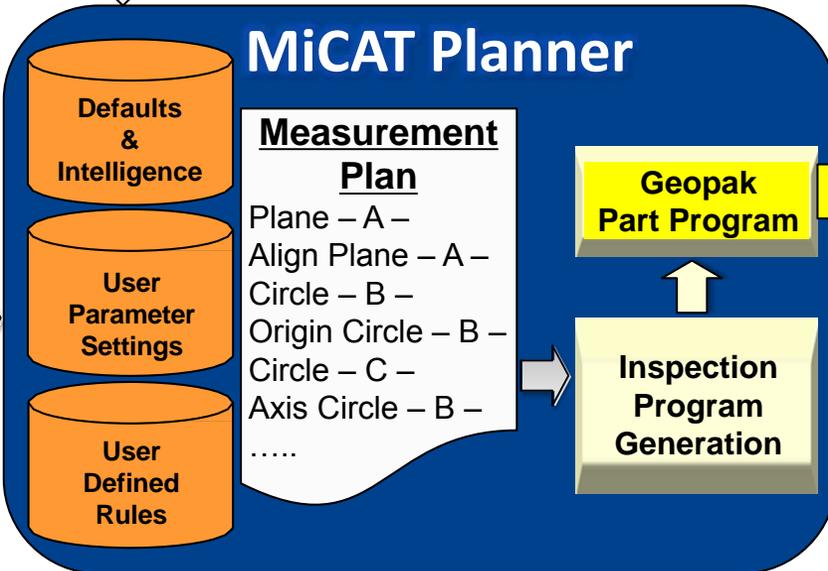
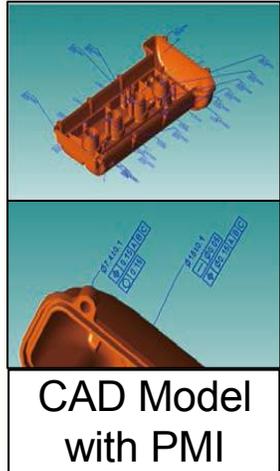
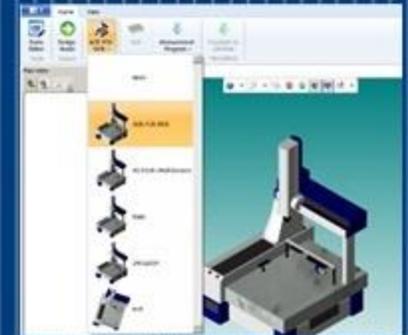
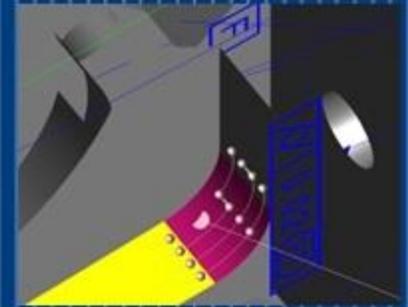
MiCAT Planner Work Flow under 6 Minutes



DME Configuration

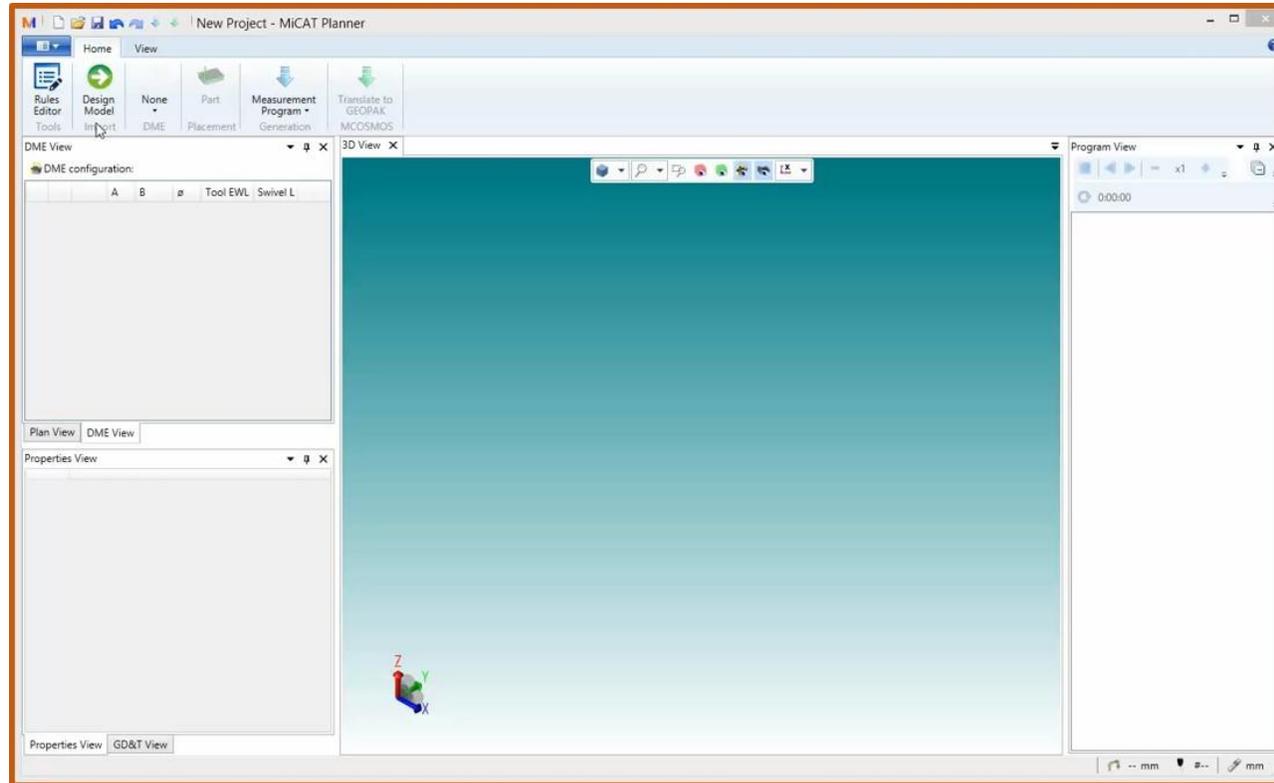


PartManager (On-line/Off-line)



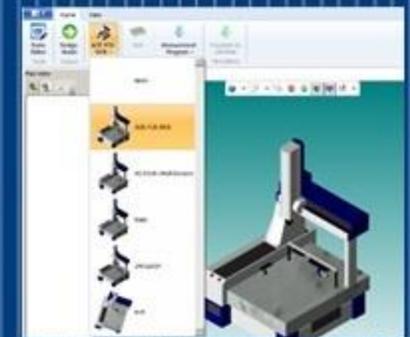
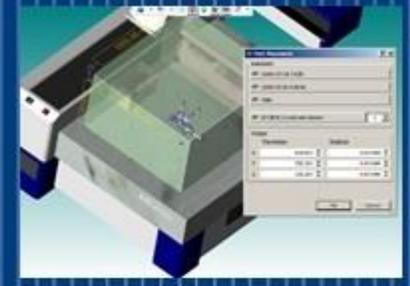
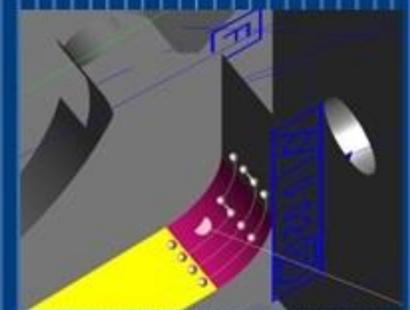
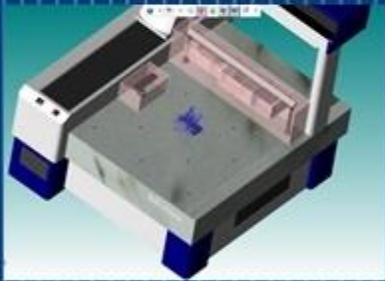
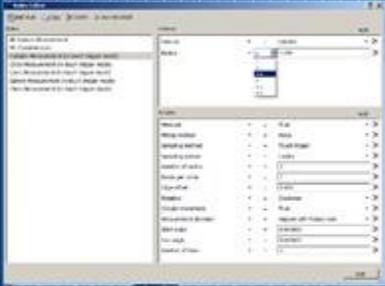
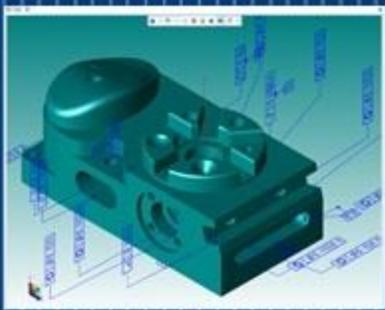
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MiCAT Planner Work Flow under 6 Minutes



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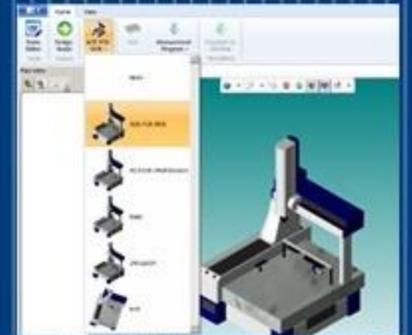
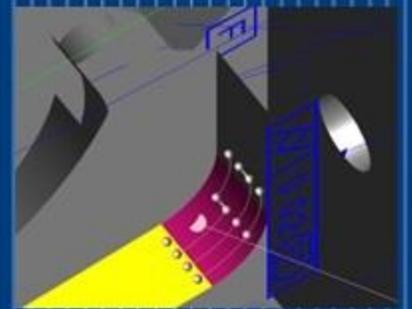
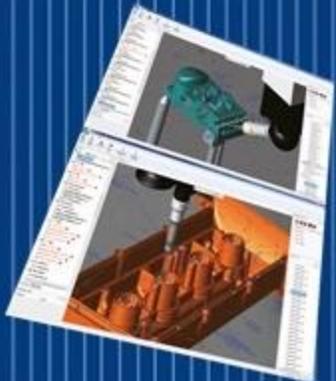
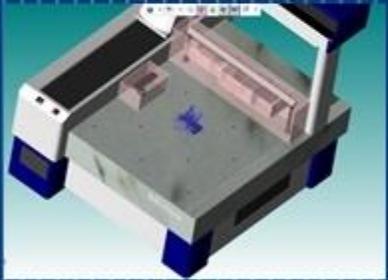
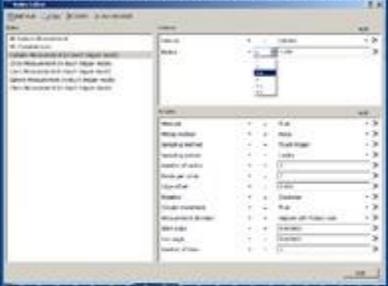
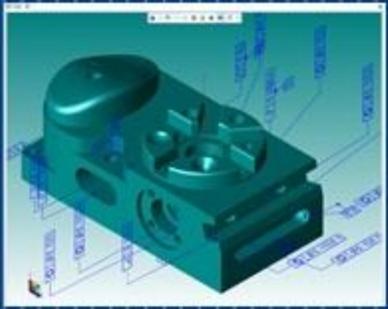
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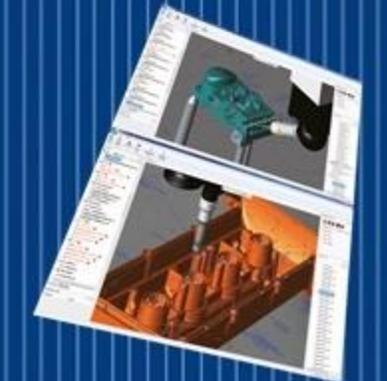
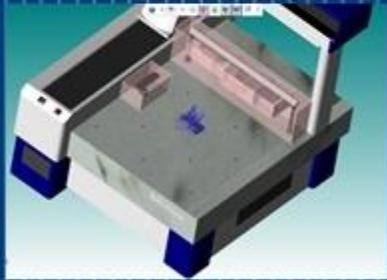
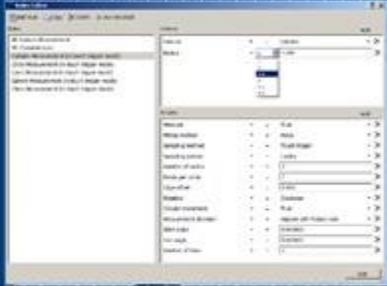
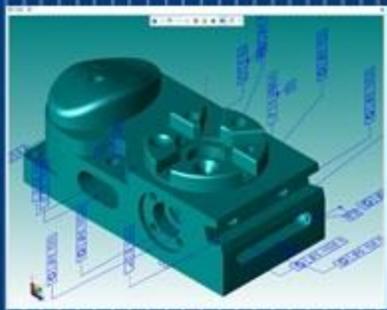
Part Program

Tasks Automatically Completed by MiCAT Planner

- Part Setup Information
- Operator Warnings (Optional On/Off)
- All Positional Moves
- All Measurement Commands
- All Sensor Changes
- All GD&T Applied
- Inspection Results Report Generated

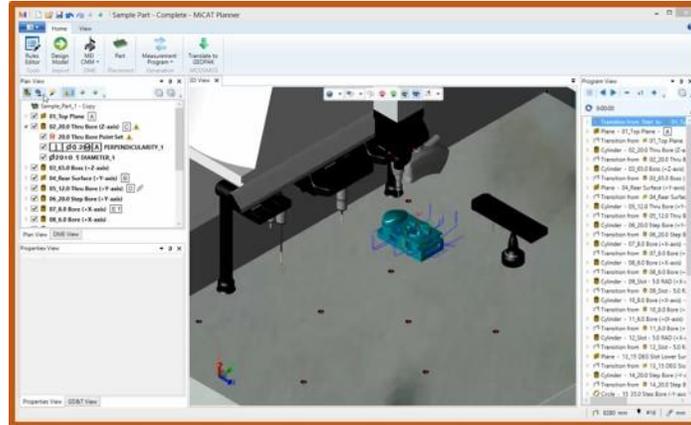
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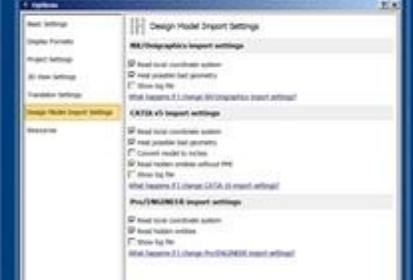
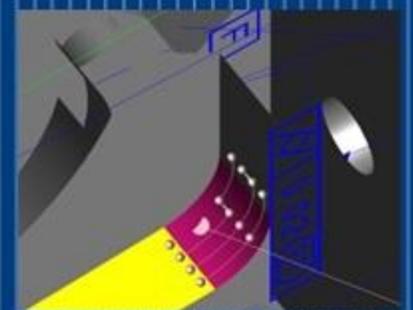
Managing Projects



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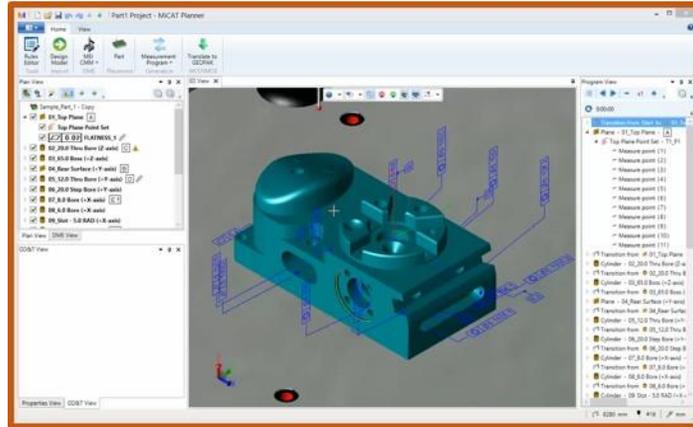
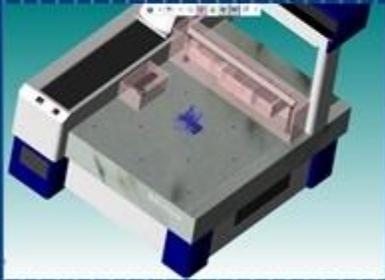
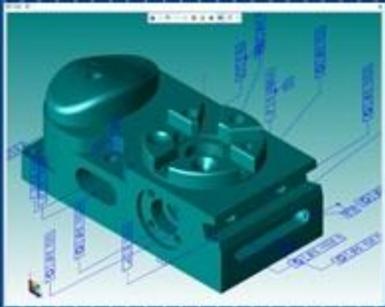
- **Flexibility** – a program can automatically be generated for most part features or for just a selected few, and each program can be saved as part of a complete project
- **Customization** – generate a project for First Article Inspection or in-process production or final inspection from the same MBD

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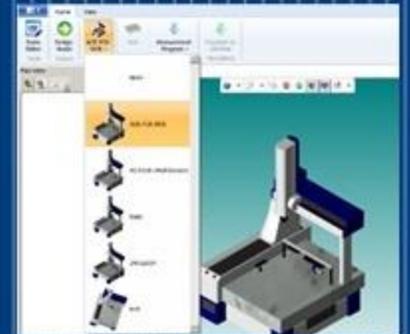
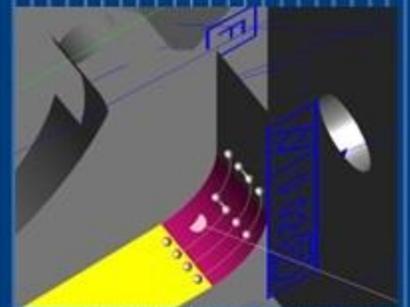
Associativity



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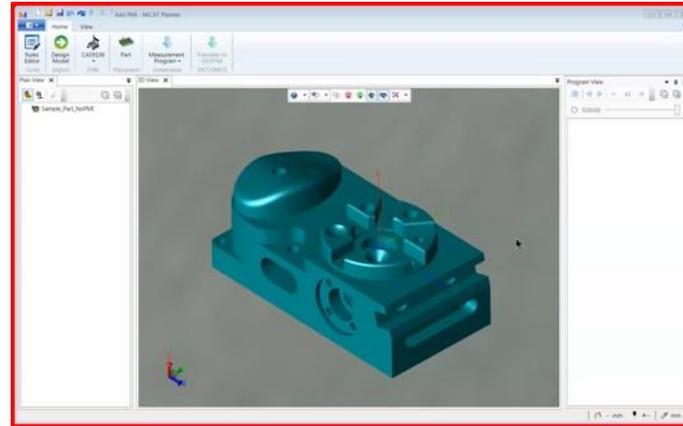
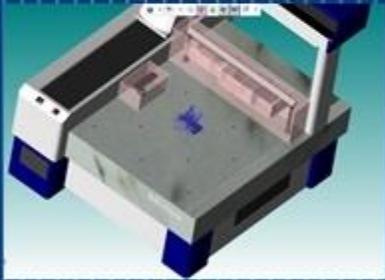
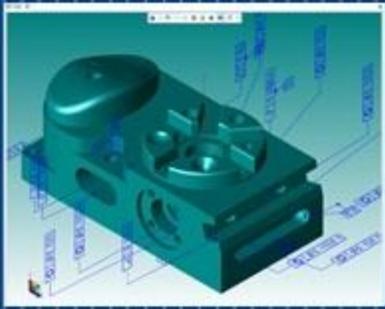
- **Associativity** – locate and view the relationships of features and characteristics quickly and easily

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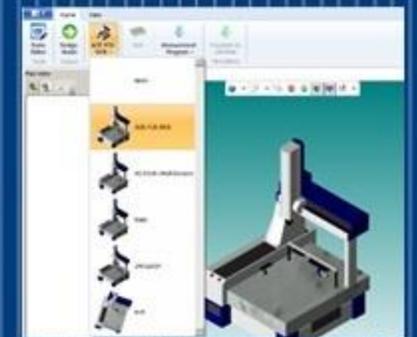
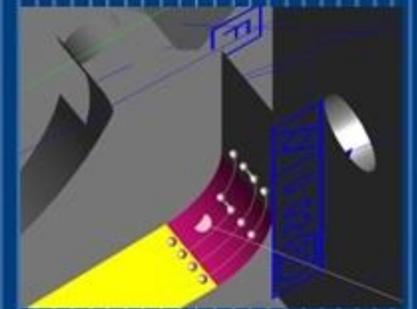
Adding GD&T



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- **GD&T Wizard** – Easily add PMI to a 'geometry only' CAD model

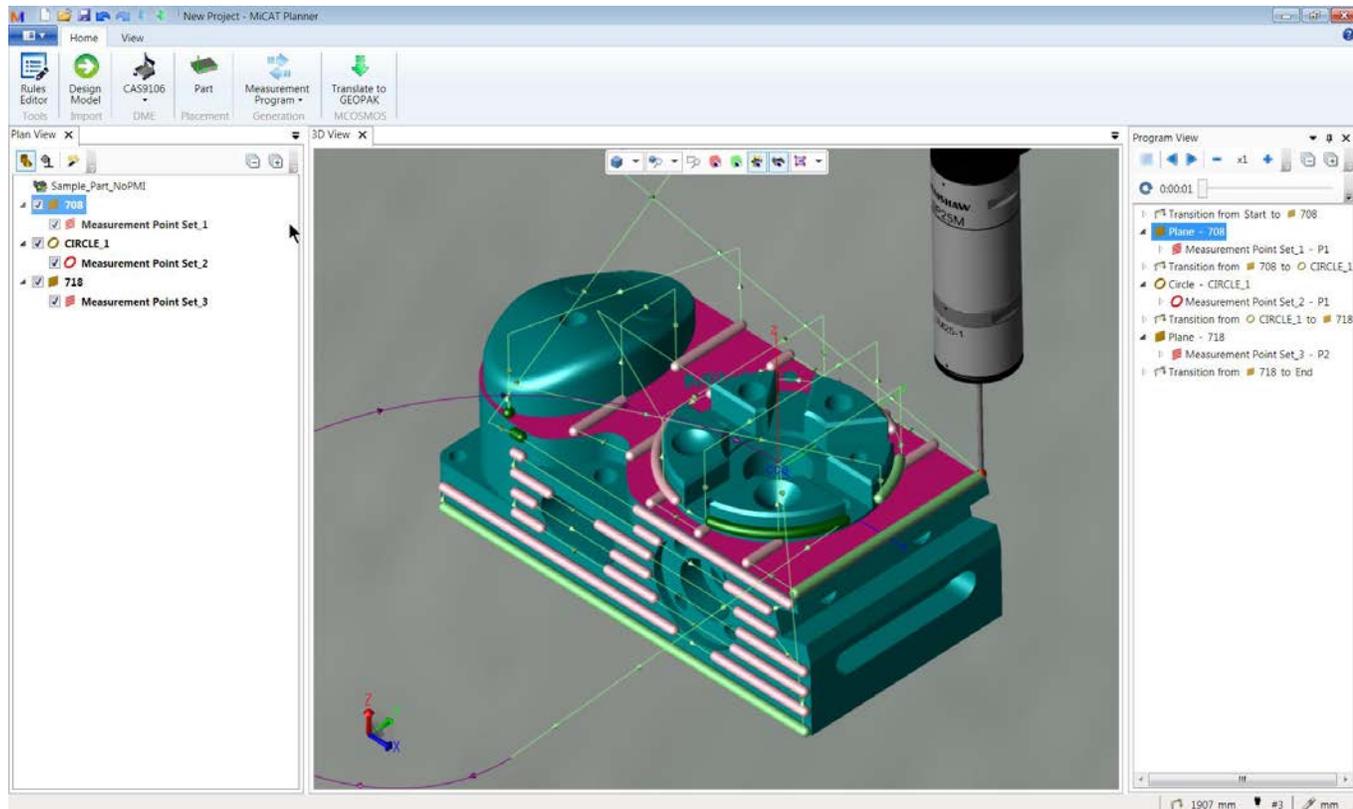
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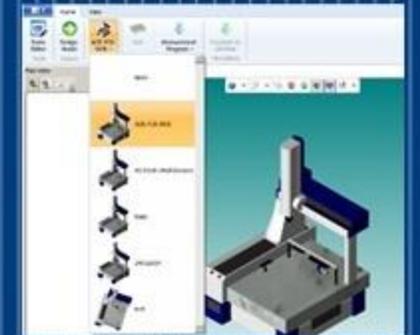
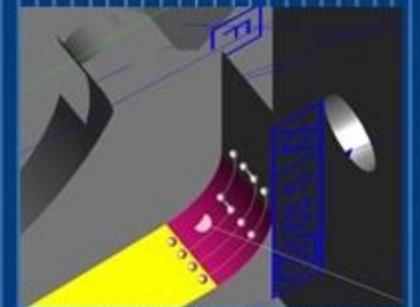
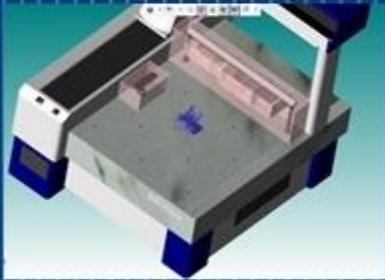
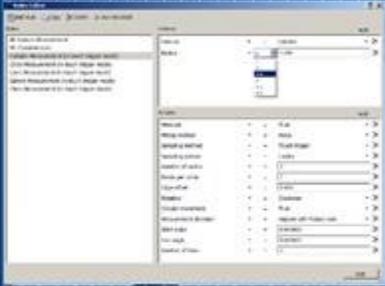
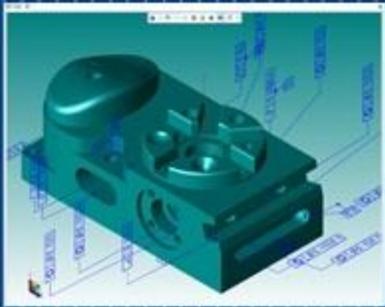
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Models (ex. Prototypes) without PMI?

- Just select the features to be measured...

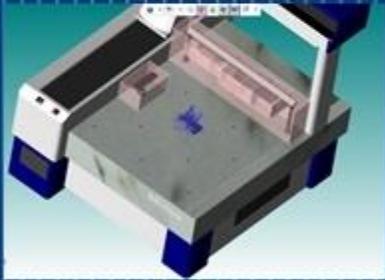
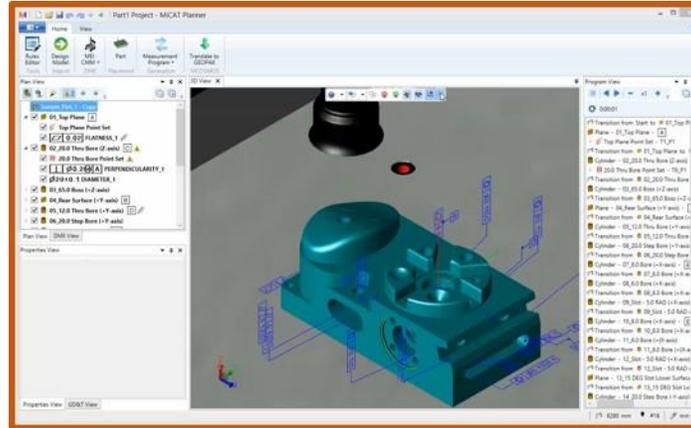
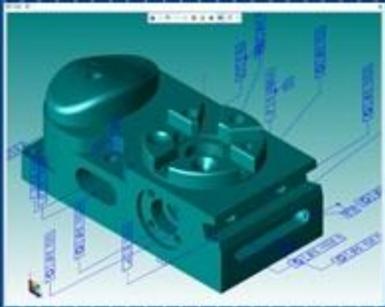


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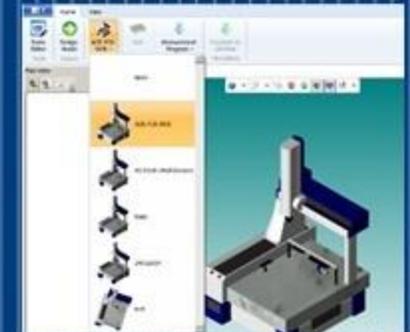
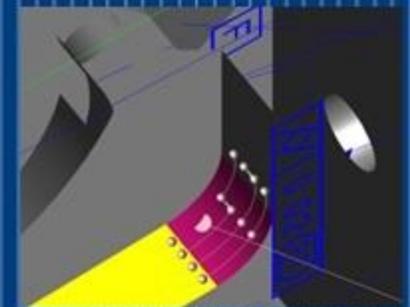
Animating a Selection



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- **Selective animation** – preview selected part program paths for verification, review, and measurement coverage

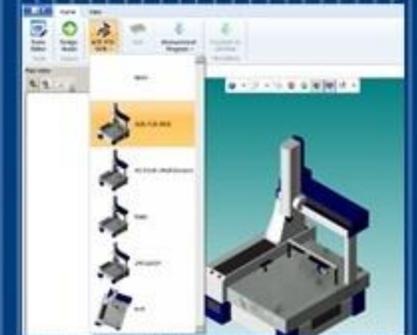
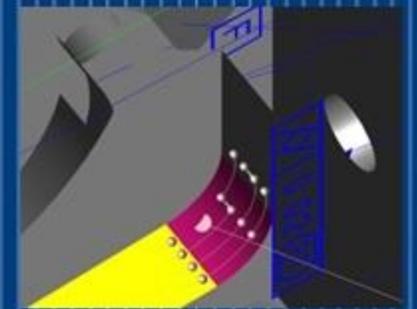
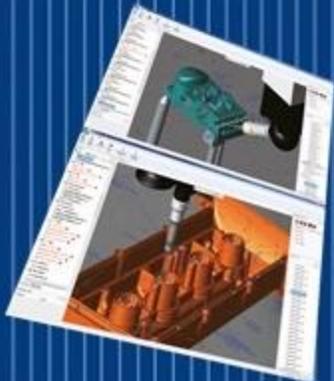
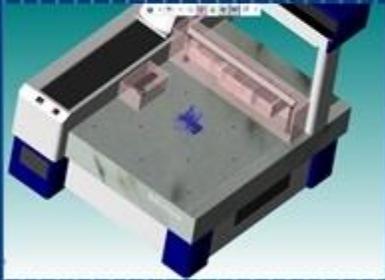
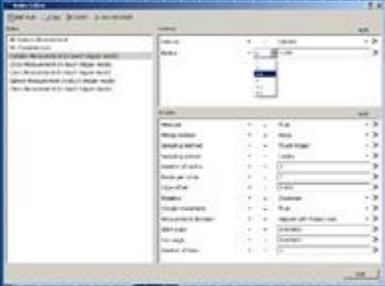
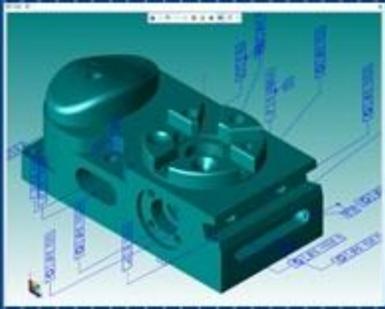
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Overall MiCAT Planner Benefits

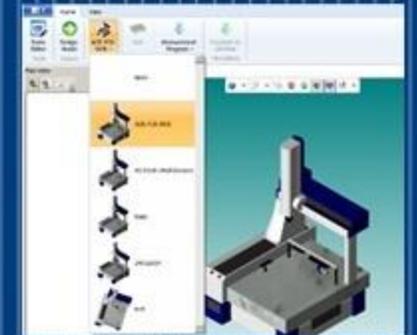
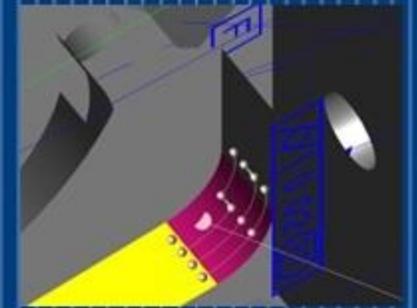
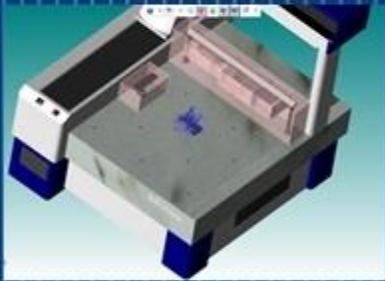
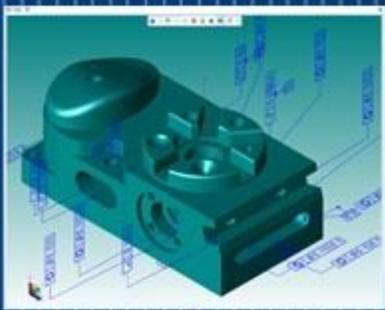
- Streamlined processes
- Improved productivity
- Reduced manufacturing costs
- Enhanced traceability
- Up to a 95-percent savings in time compared to drawing-based methods
- Suppliers receive a single CAD file to inspect a part



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Overall MiCAT Planner Benefits

- Features and characteristics are transferred directly into the inspection software, reducing the risk of misinterpretation
- CMM configurations can be changed at any point
- Enhanced workflow automation
- Part measurement consistency



MiCAT

Additional Information

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Product Demo Request

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Thank you...

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