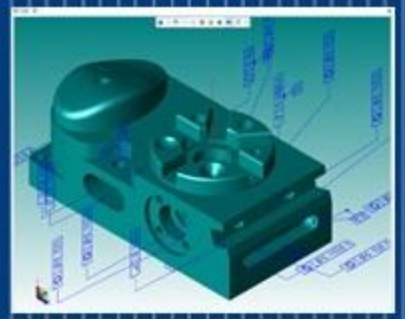

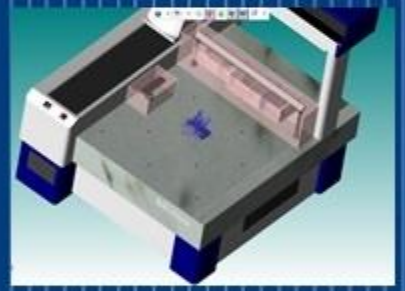

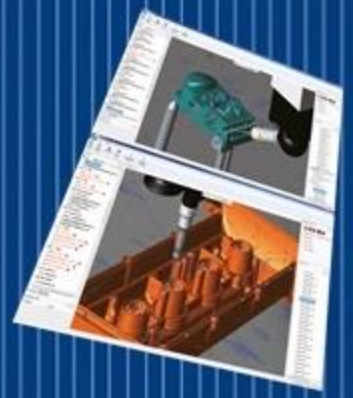

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MiCAT Planner

Changing the relationship between
people and precision measurement with one click

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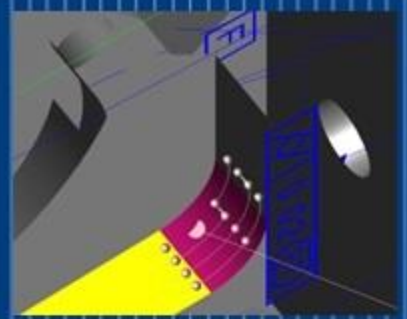

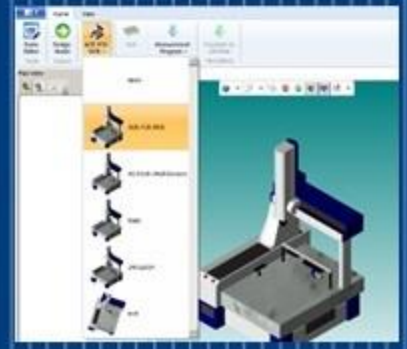

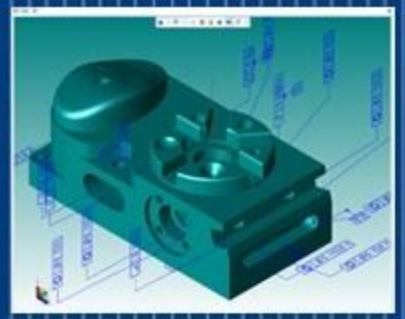

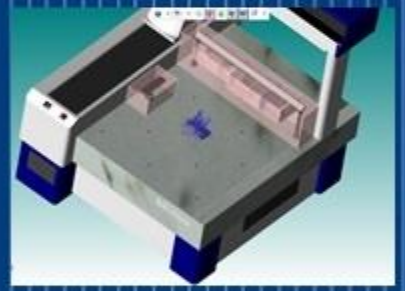

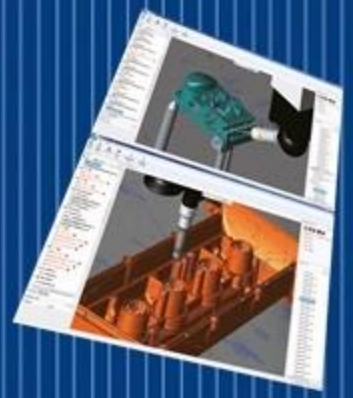

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Three Letter Acronyms (TLAs)

- 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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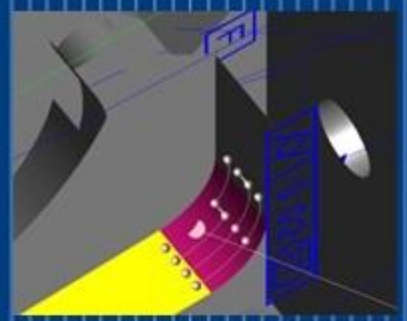

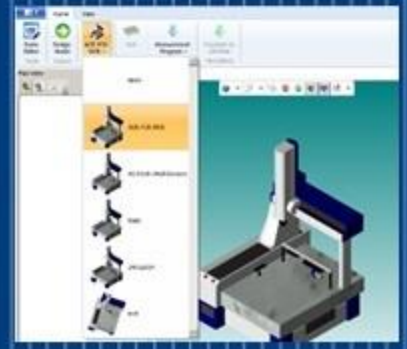

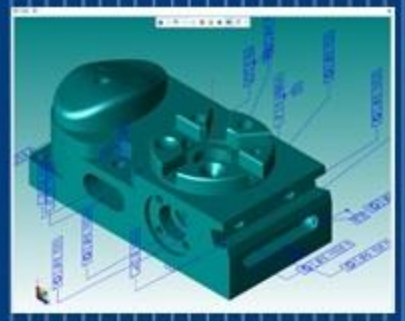

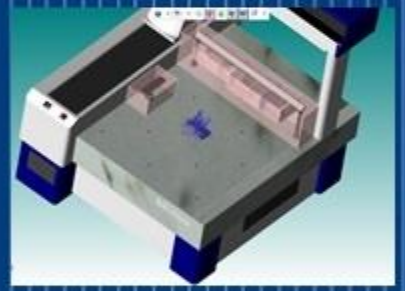

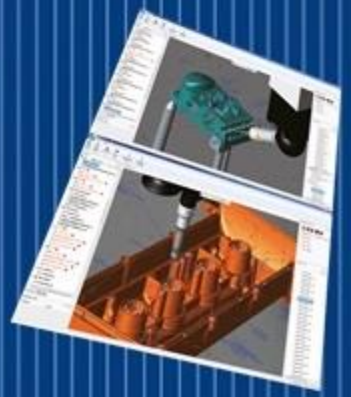

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Defining MBDs

- 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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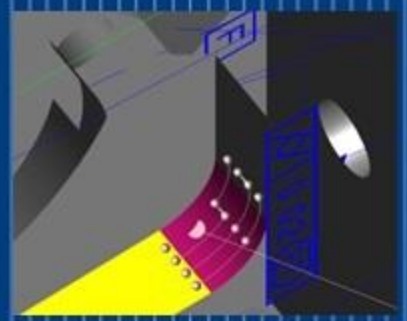

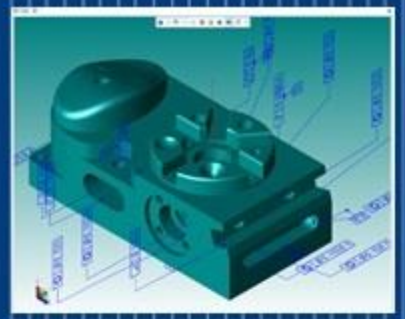

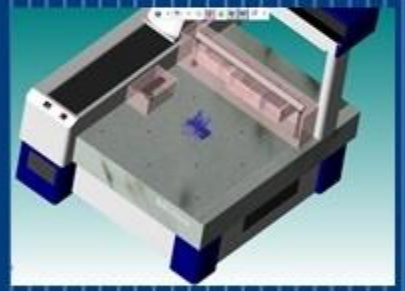

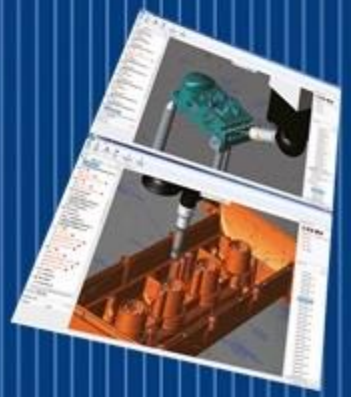

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MBDs & two kinds of PMI

- 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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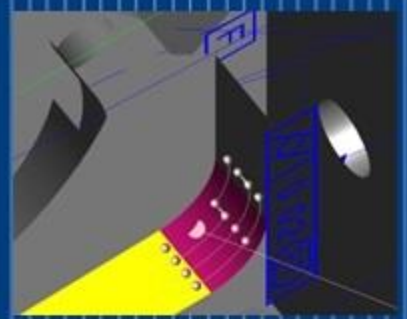

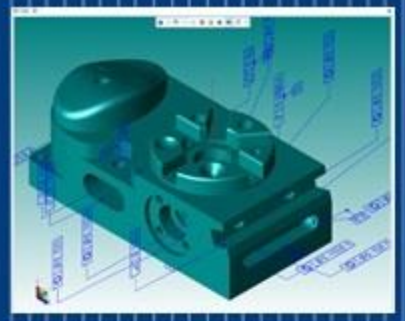

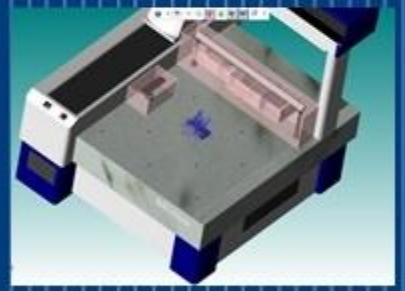

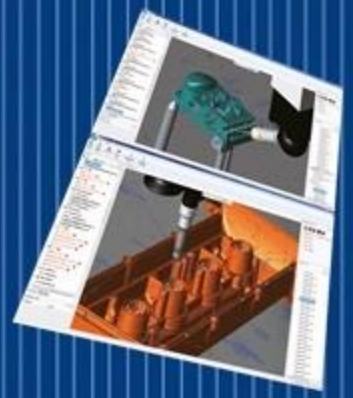

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The MBD Journey

- 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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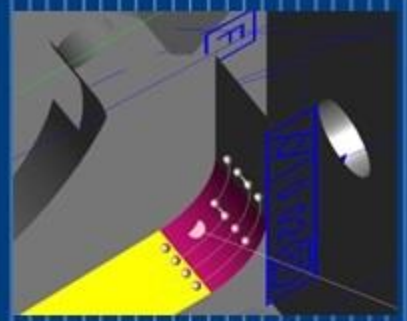

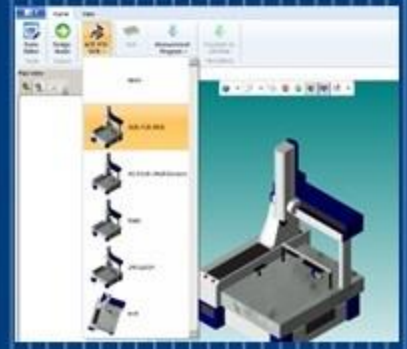

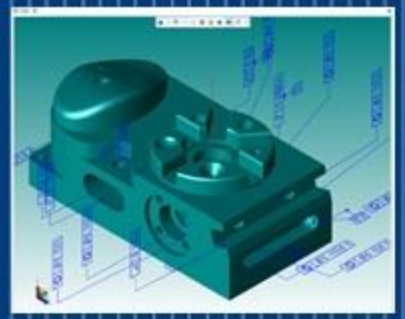

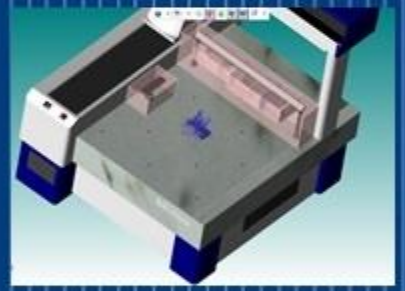

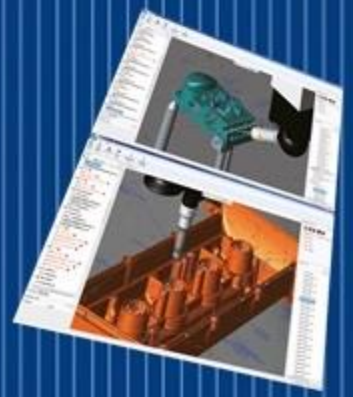

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MBDs & Supplemental Geometry

- 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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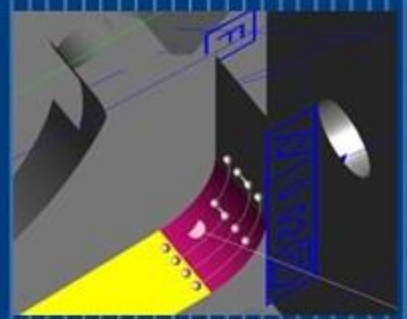

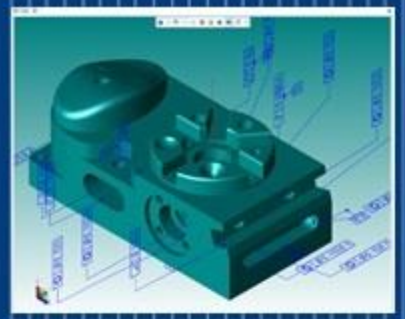

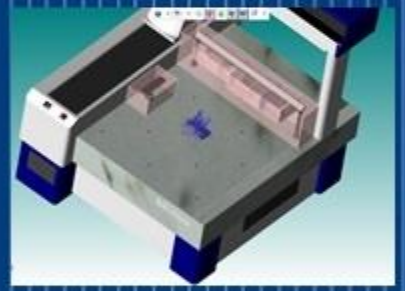

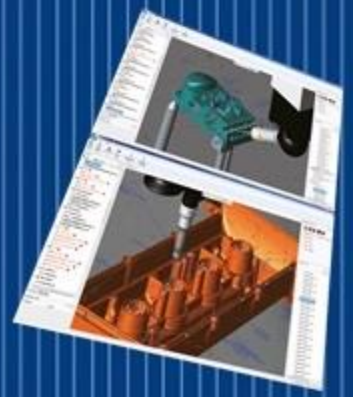

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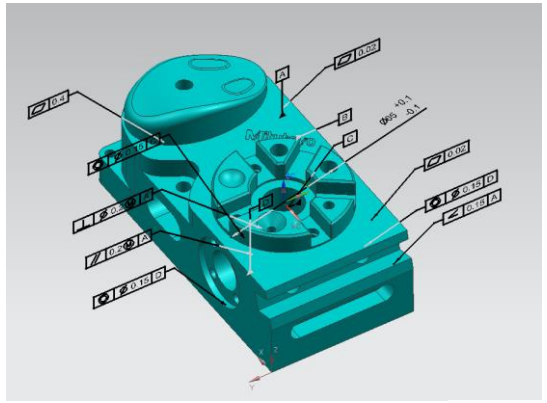
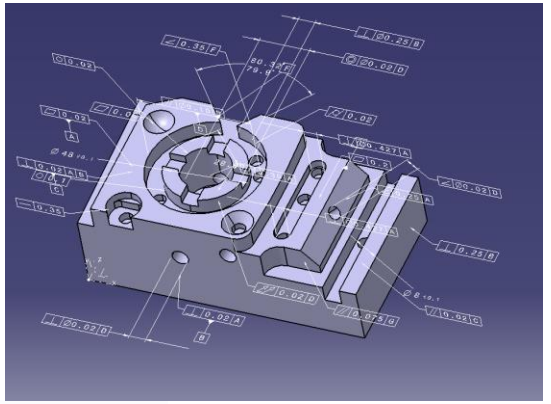
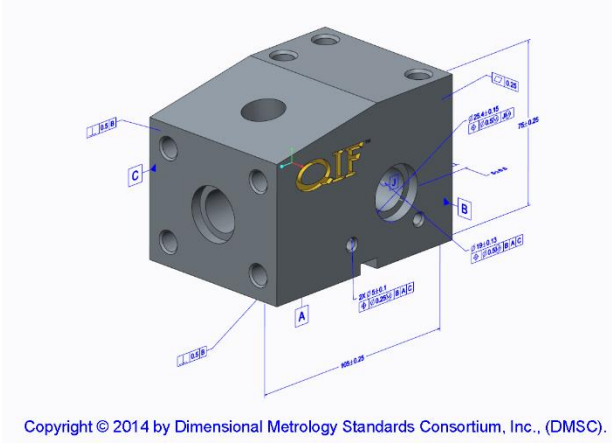
Questions before we proceed?







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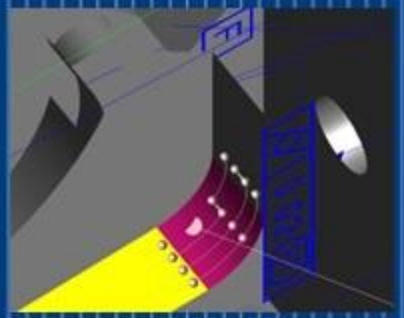

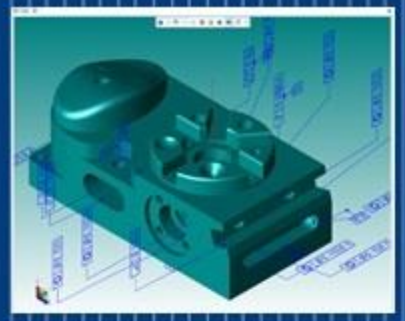

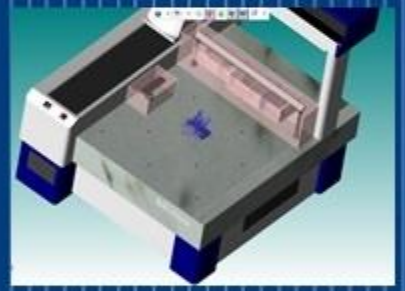

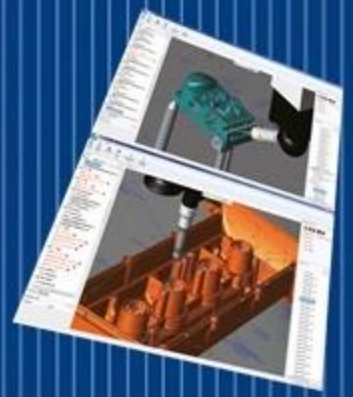

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What's Required for MBI?

- 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

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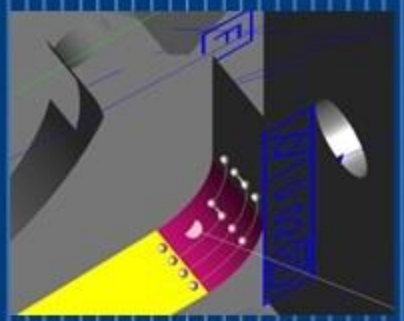

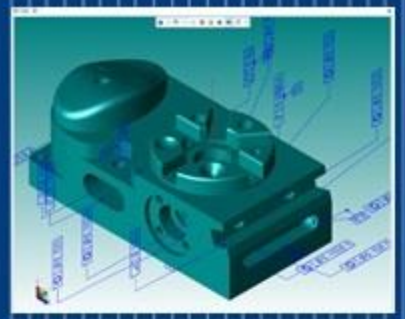

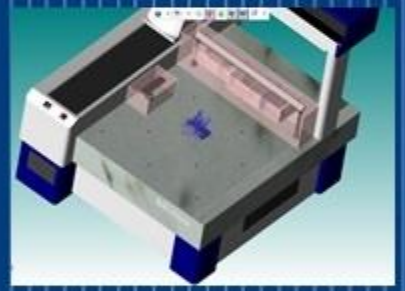

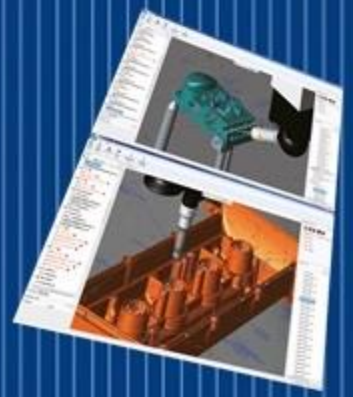

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Dimensional Measuring Equipment

- 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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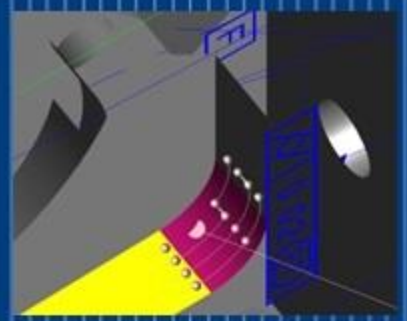

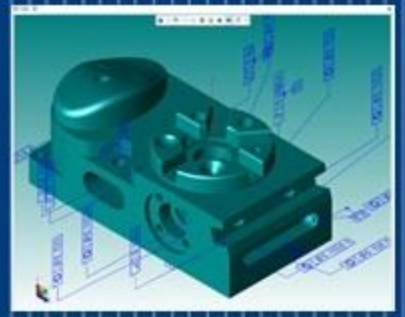

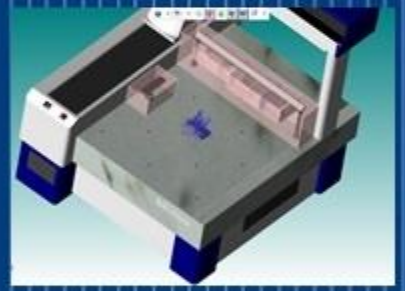

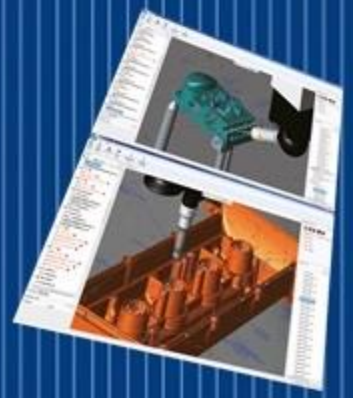

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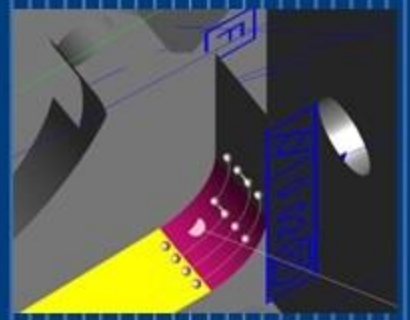
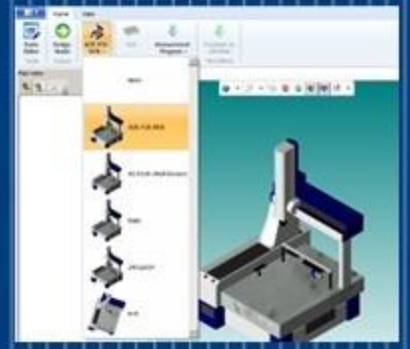
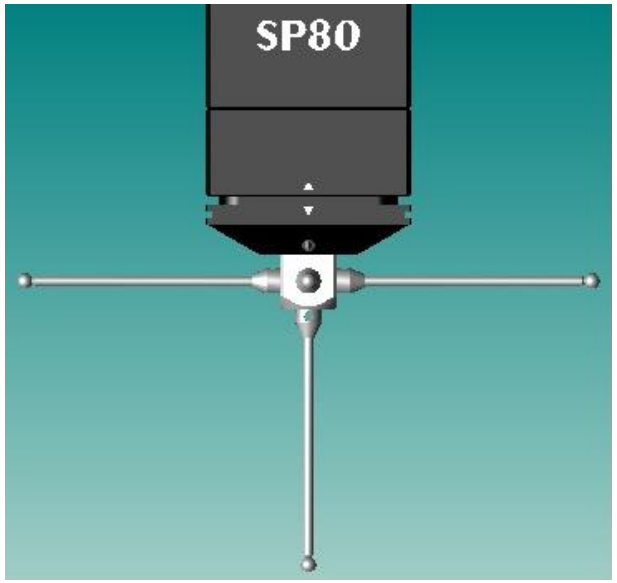
Sensors for MBI





CONTACT SCANNING



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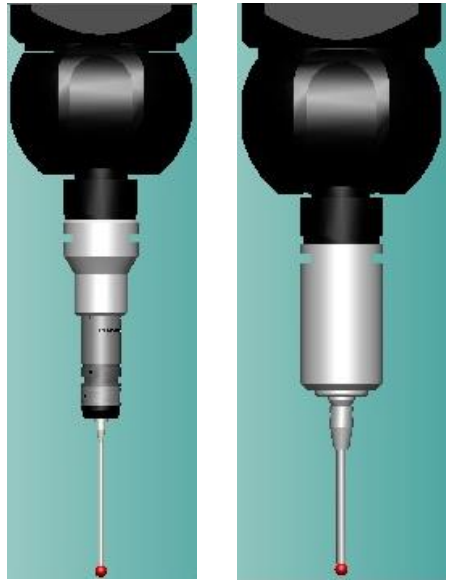

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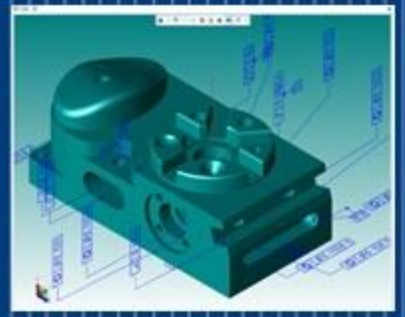
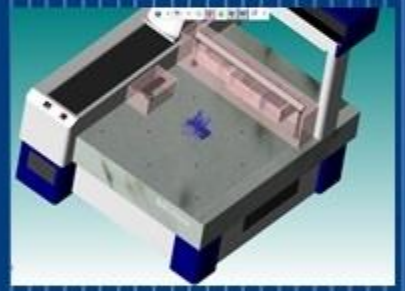
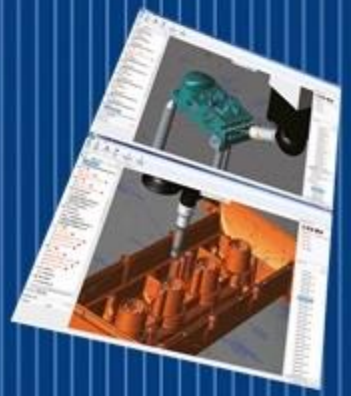
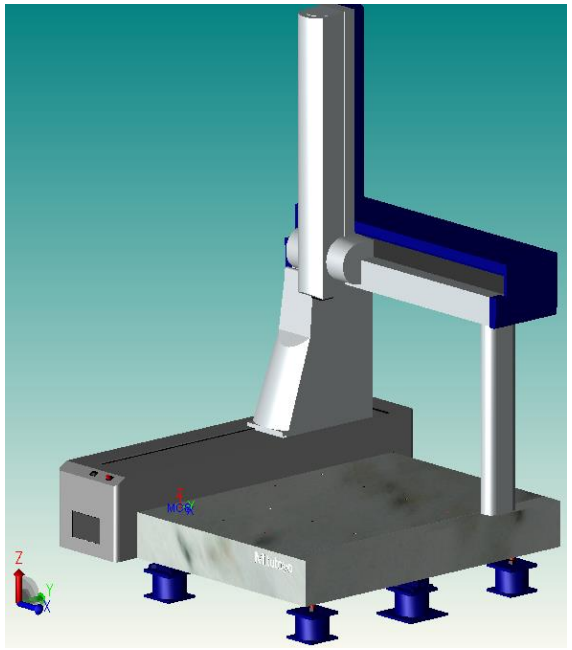




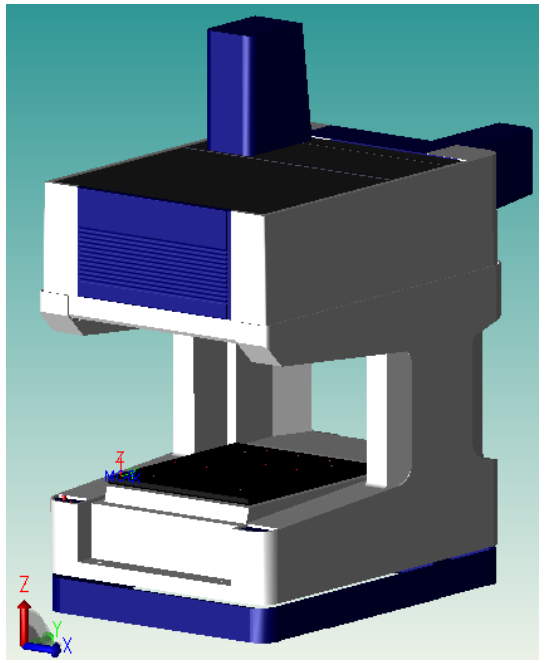


MiCAT

CMMs for MBI

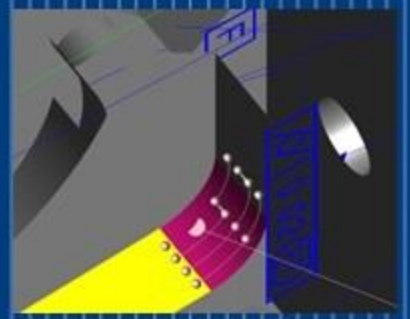


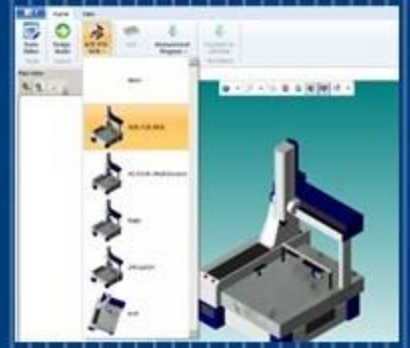
BRIDGE

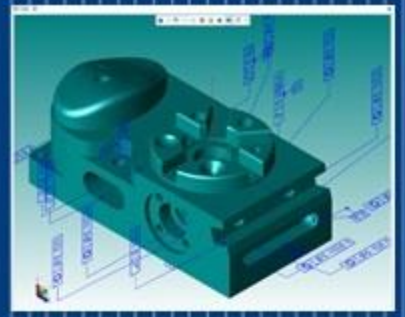


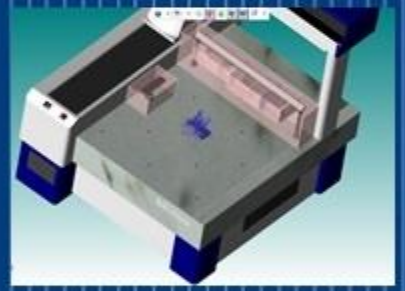
Shop Hardened GANTRY

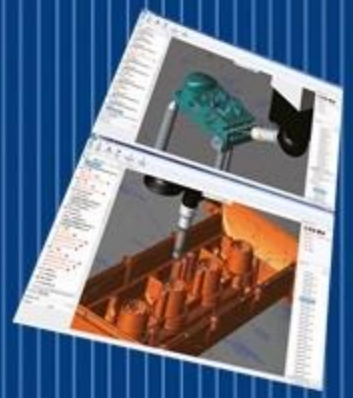
Mitutoyo







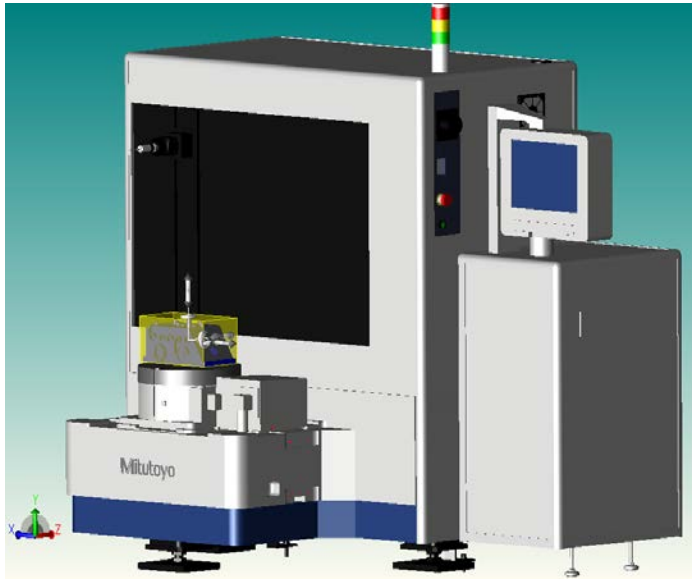


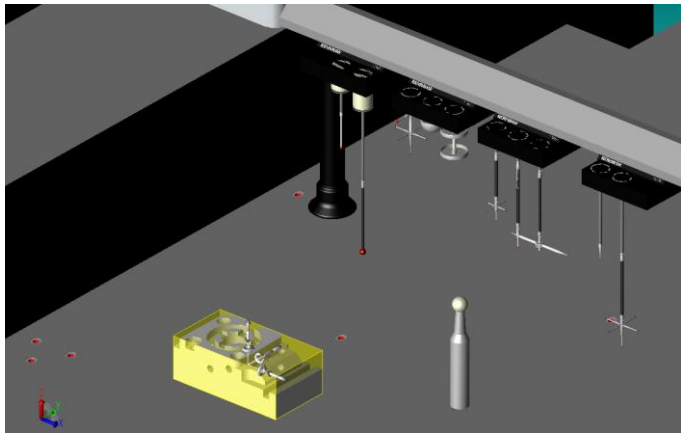


MiCAT

CMMs and Components for MBI

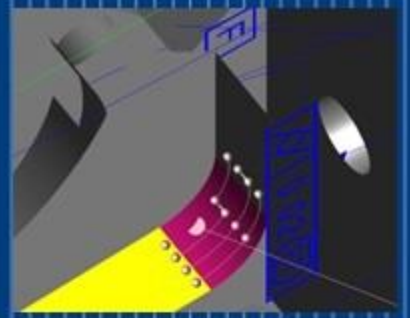
Shop Hardened
HORIZONTAL ARM

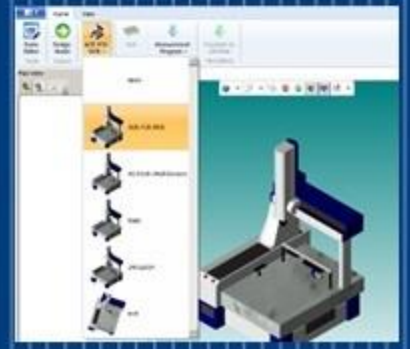


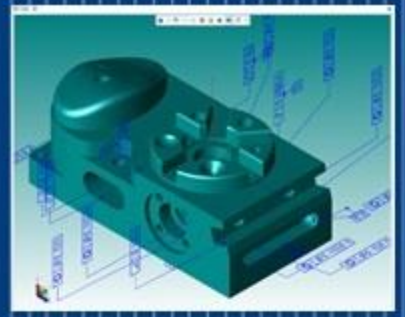


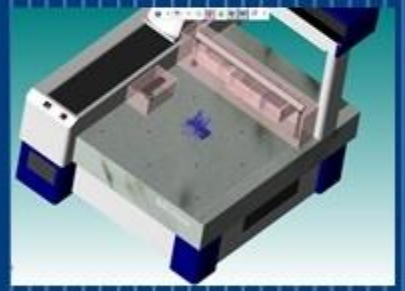
Change Racks, Modules
& Stylii

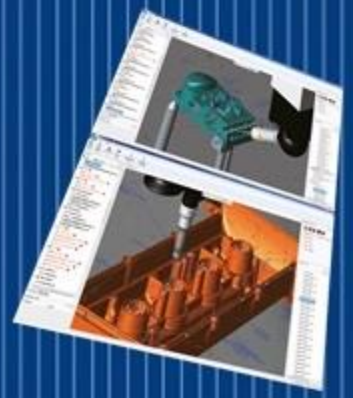
Mitutoyo











MiCAT

Questions before we proceed?

Virtual Legex CMM

Actual Legex CMM

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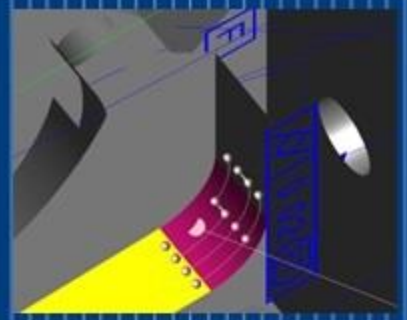
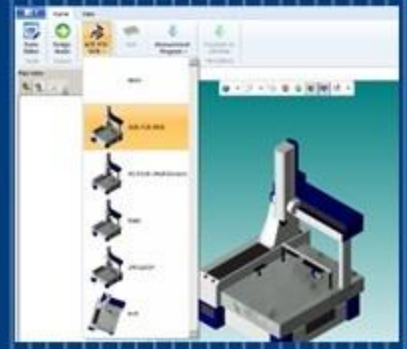
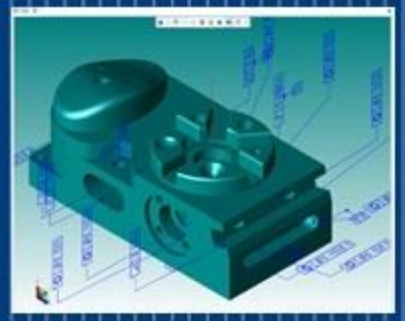
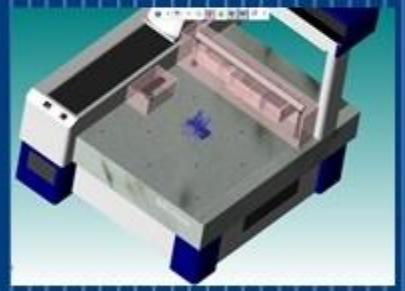
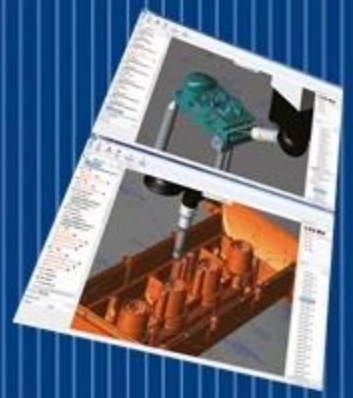










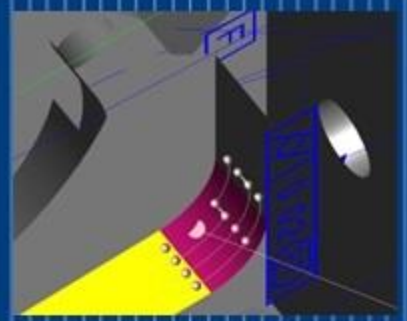
MiCAT

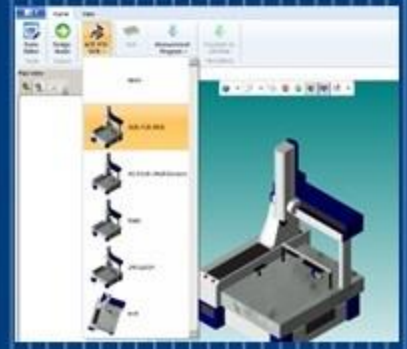
What is MiCAT Planner?

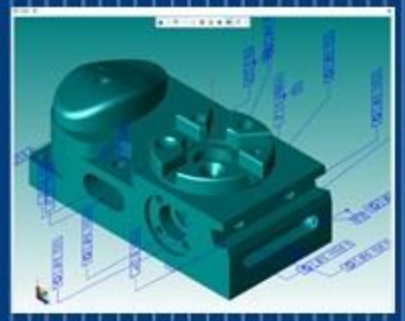
It is a measurement program software from Mitutoyo that enables one-click automated generation of CNC CMM programs.

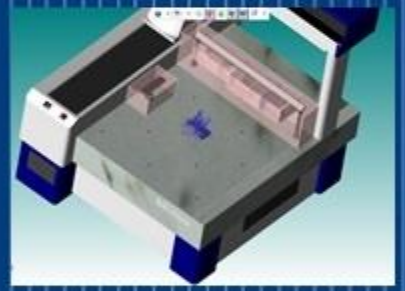
MiCAT Planner makes model based inspection a practical and worthwhile reality.

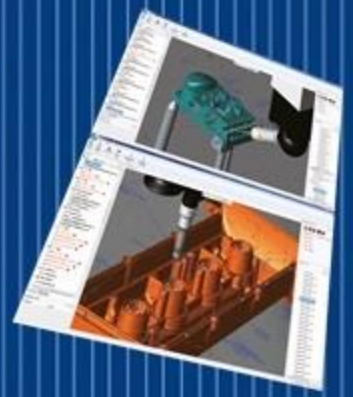
Mitutoyo











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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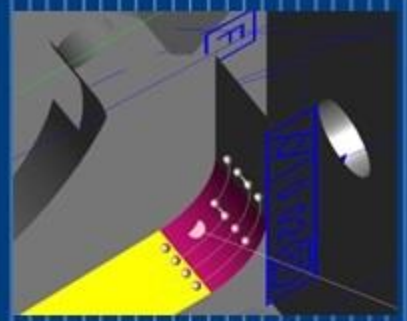
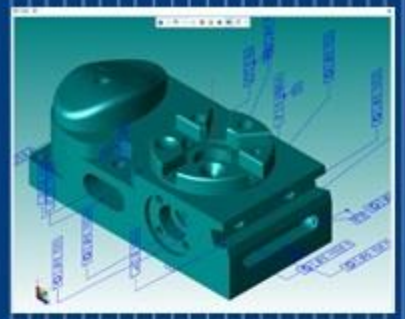
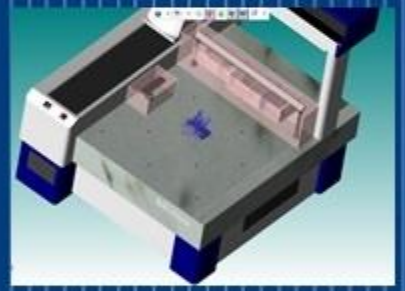
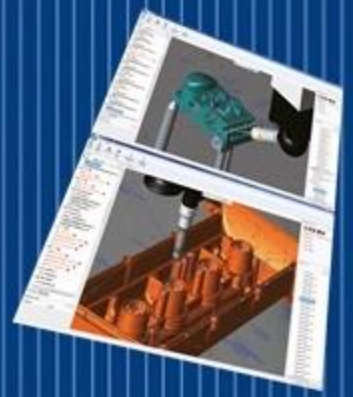


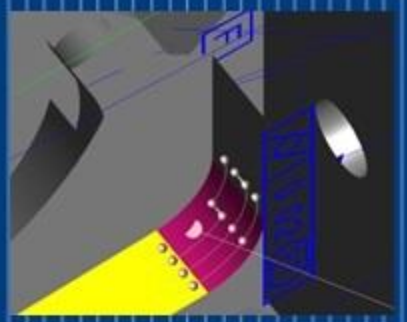


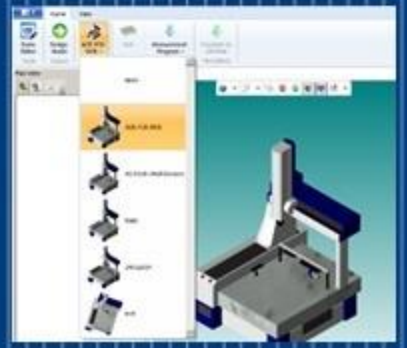




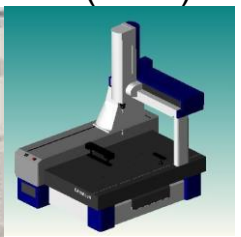
MiCAT

The MiCAT Planner MBI Work Flow

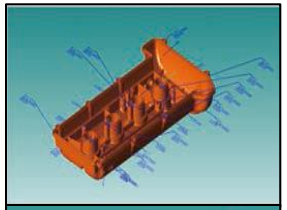




Configured virtual CMM (DME)



MCOSMOS PartManager (On-line/Off-line)



MBD

MiCAT Planner

Defaults & Intelligence

User Parameter Settings

User Defined Rules

Measurement Plan

Plane – A –
Align Plane – A –
Circle – B –
Origin Circle – B –
Circle – C –
Axis Circle – B –
…..

Inspection Program Generation

Geopak Part Program

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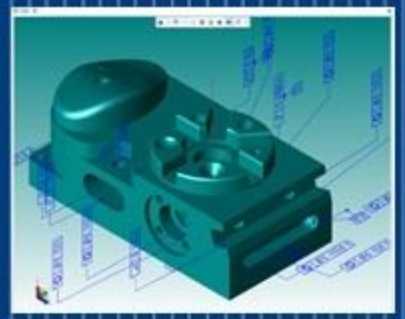
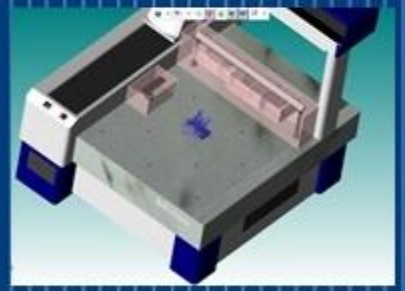
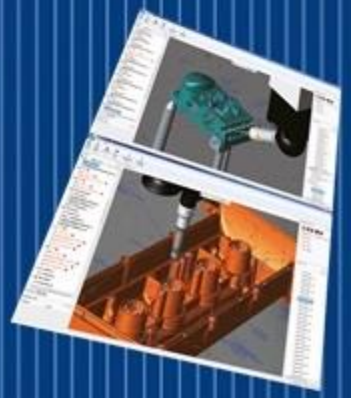




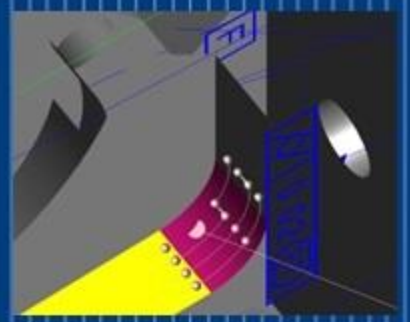


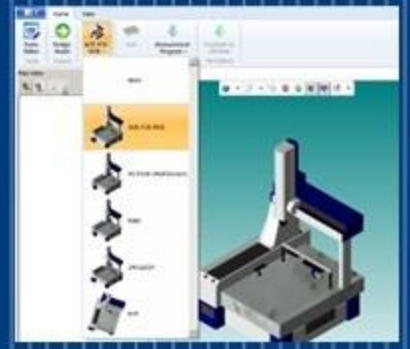
MiCAT

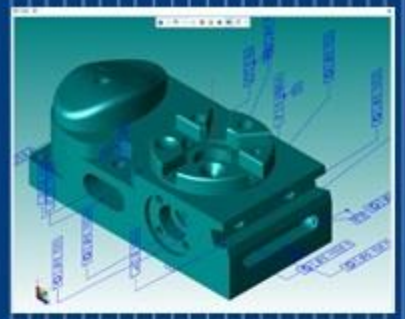
Defaults & Intelligence

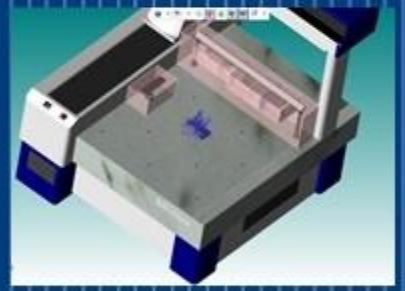
Defaults & Intelligence

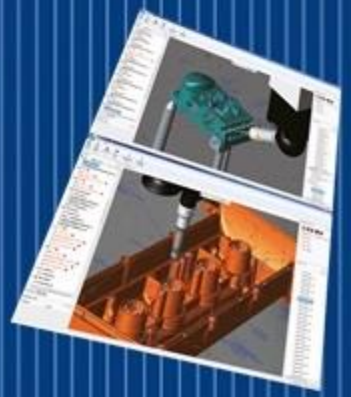
Mitutoyo





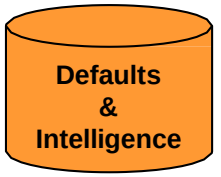


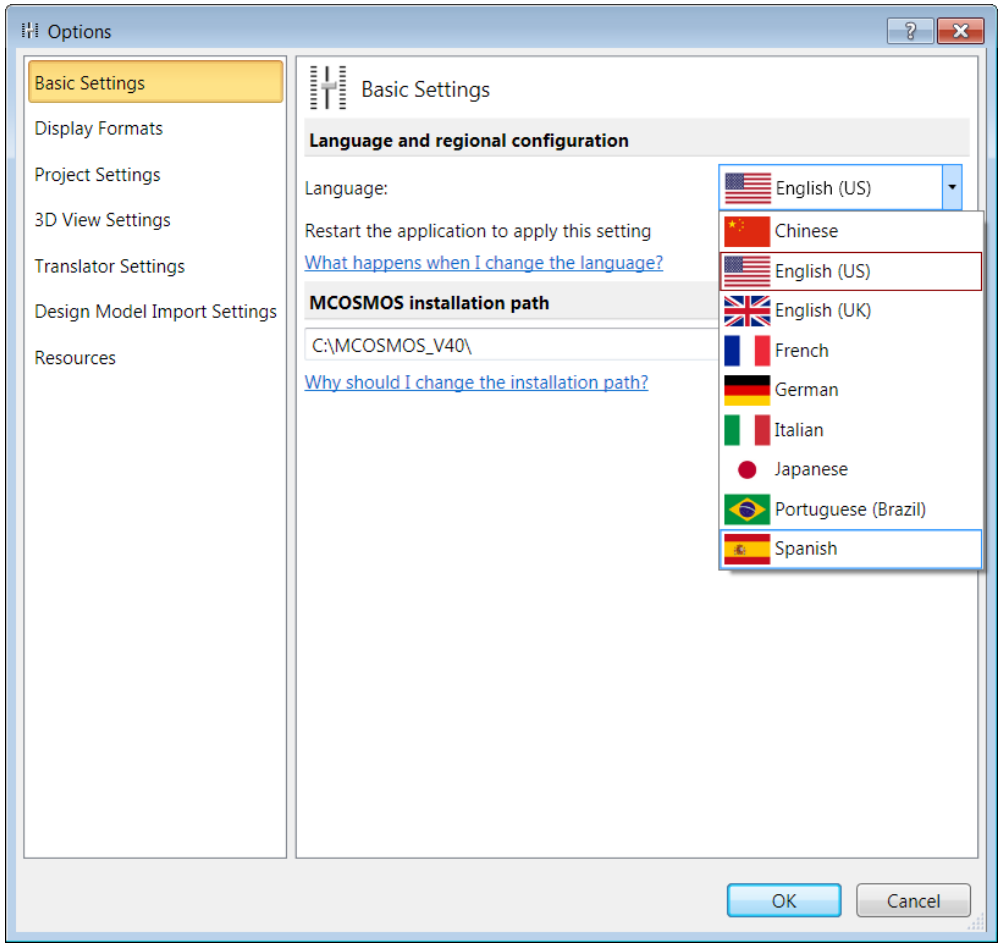


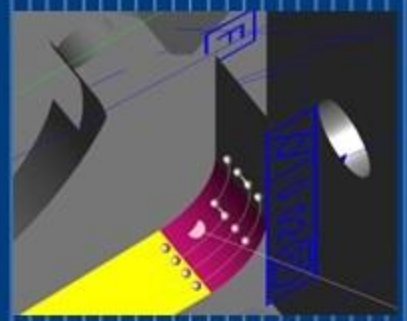


MiCAT

Defaults & Intelligence







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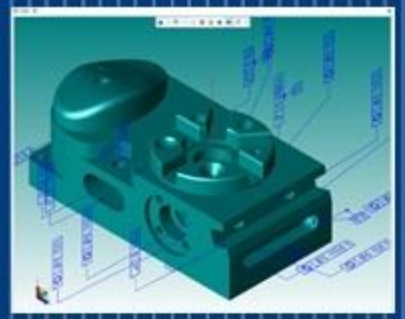
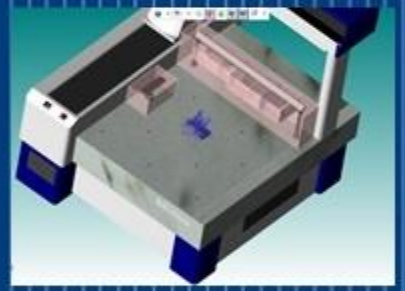
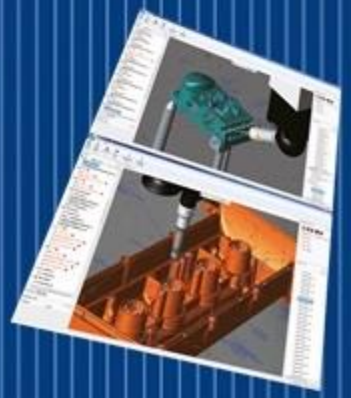
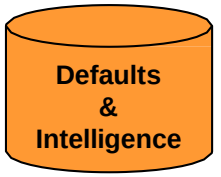


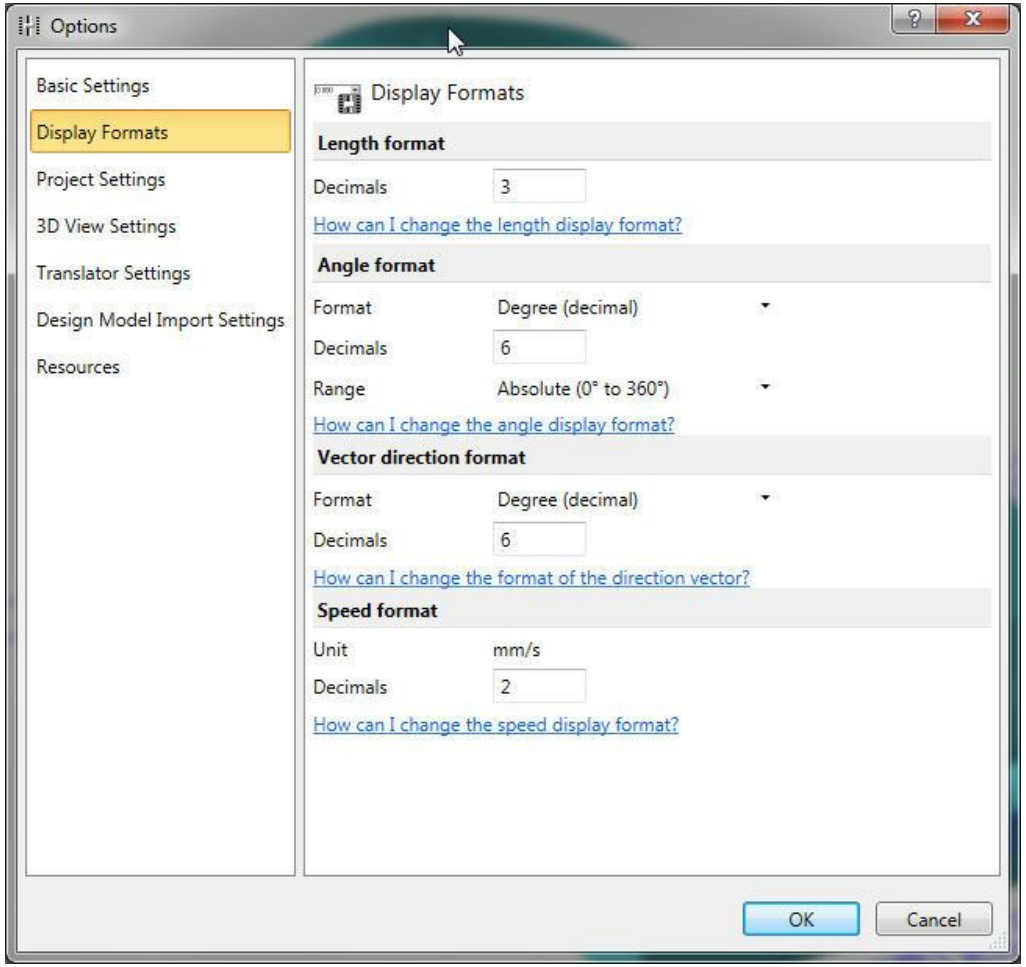


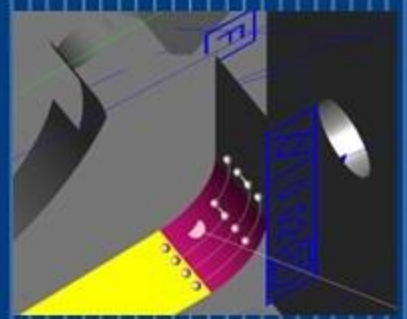


MiCAT

Defaults & Intelligence







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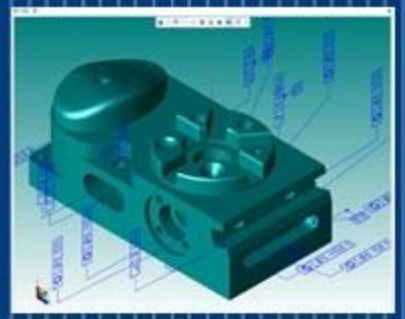
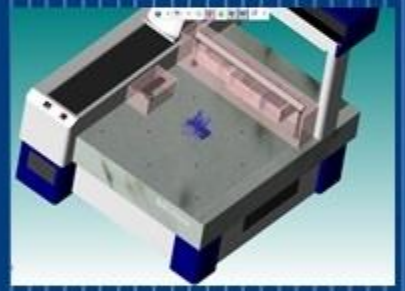
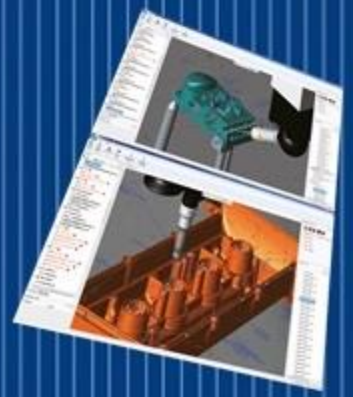
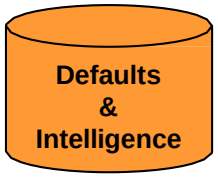


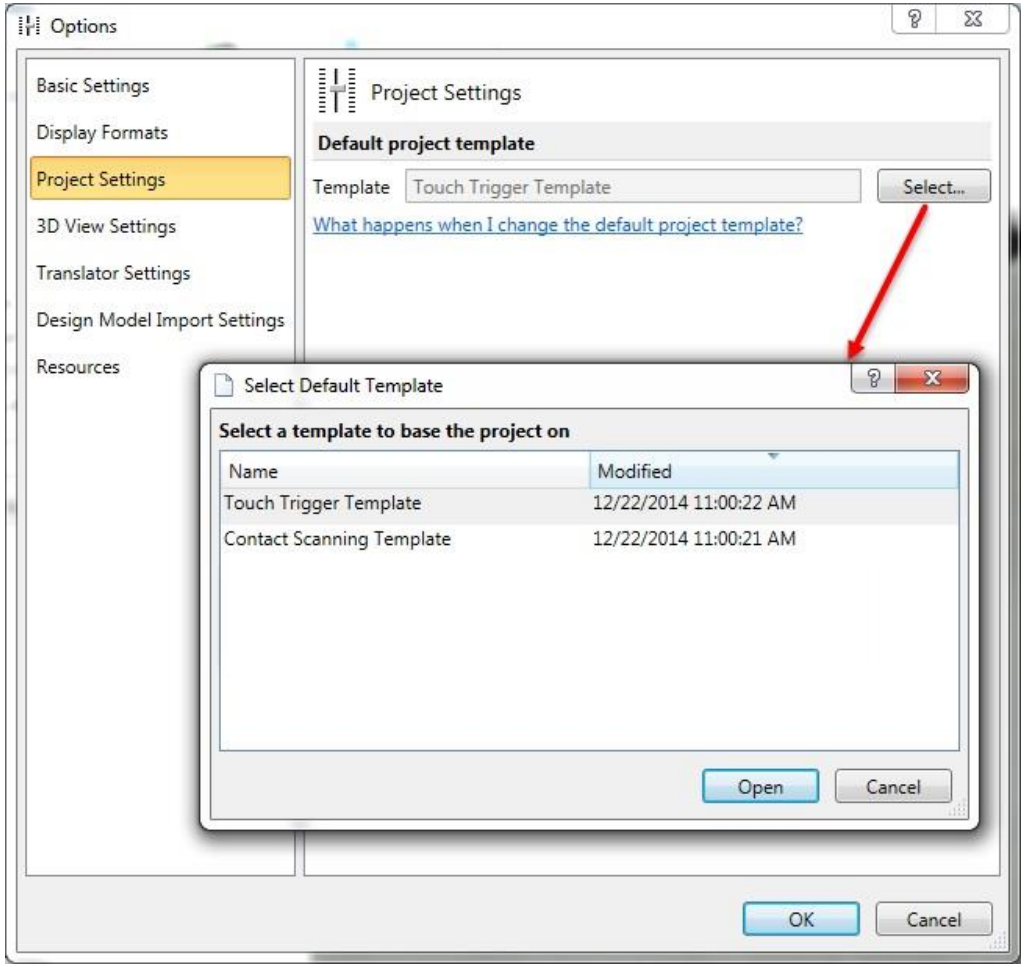




MiCAT

Defaults & Intelligence





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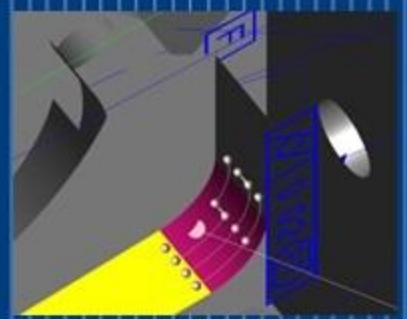

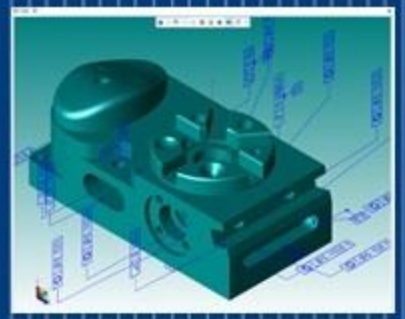

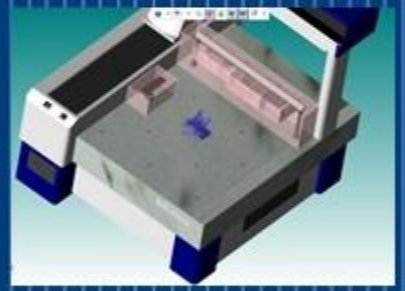

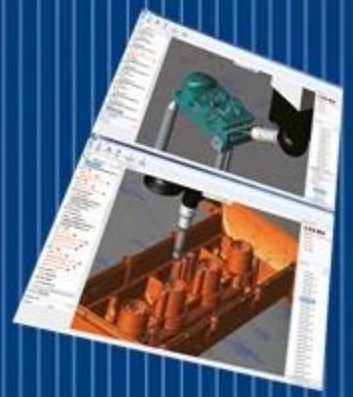

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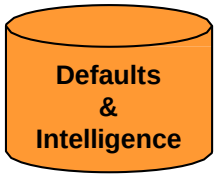
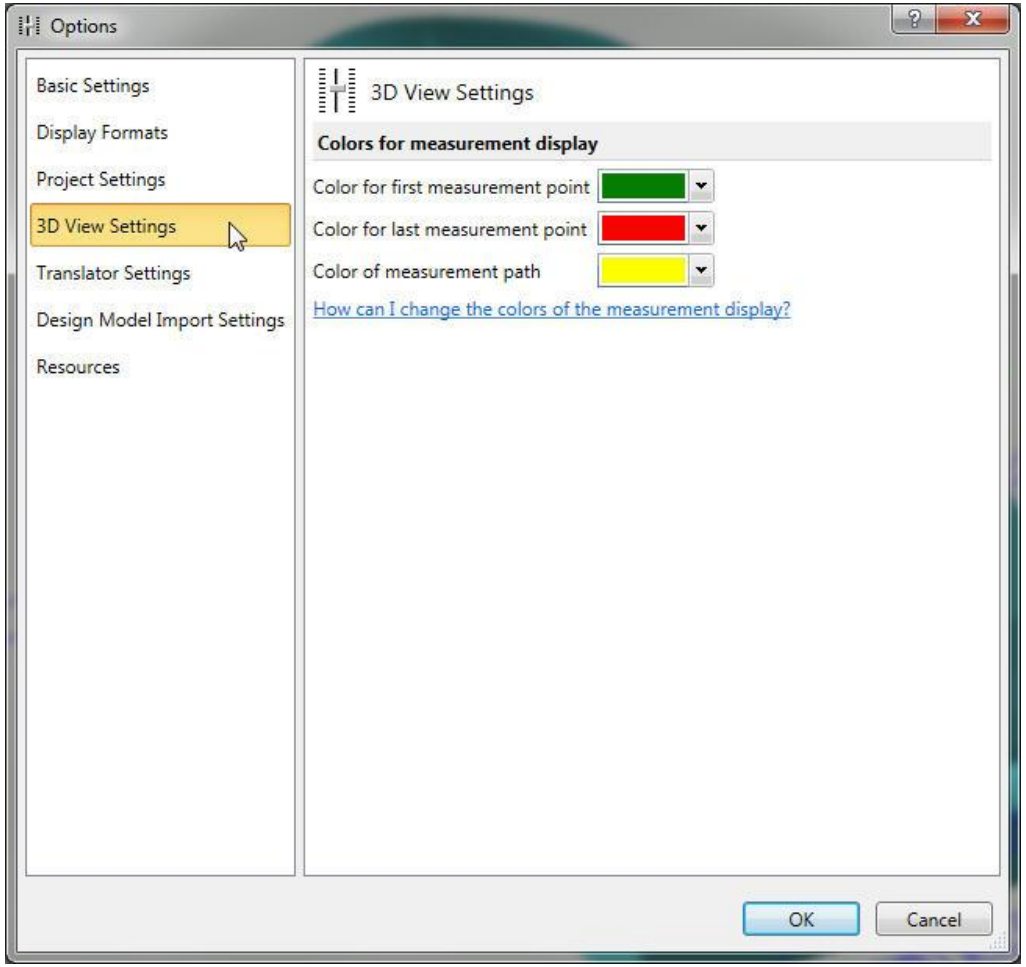
Defaults & Intelligence





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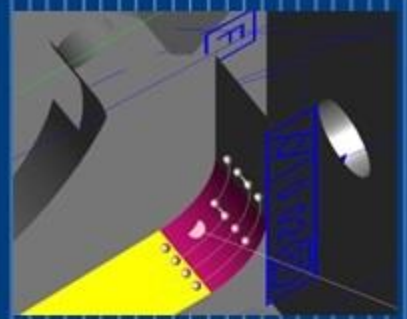

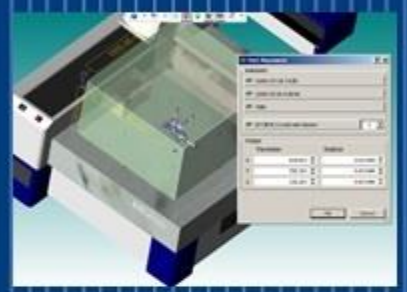

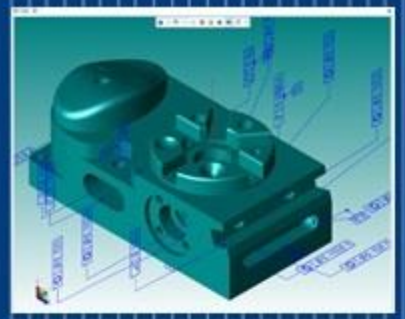

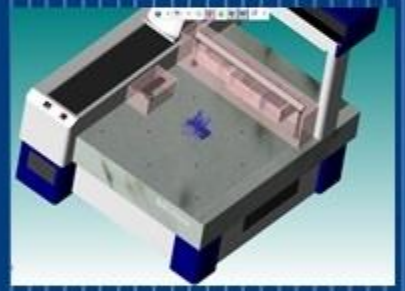

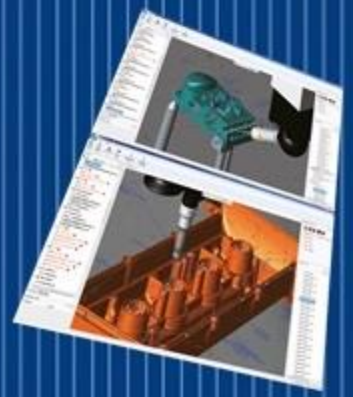

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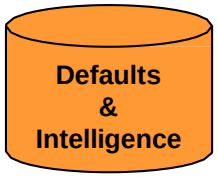

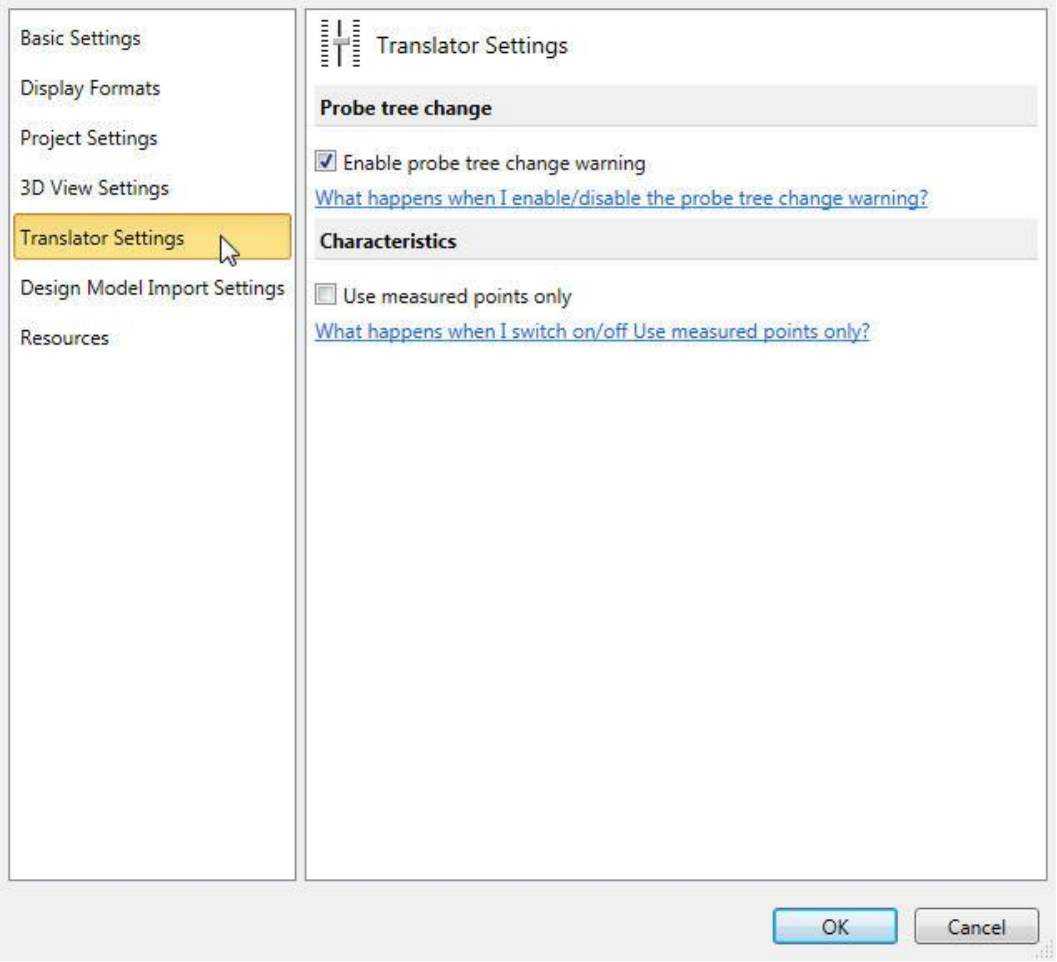

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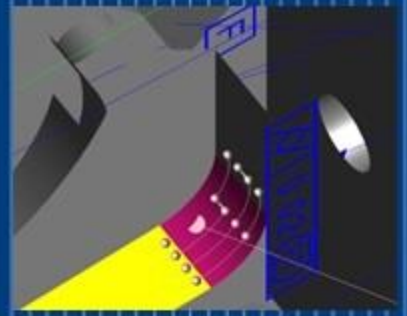

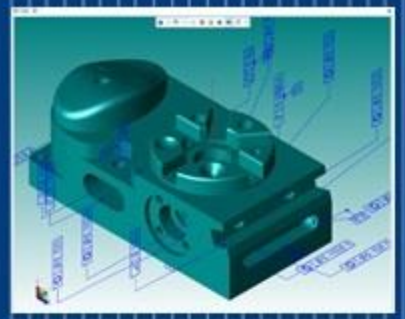

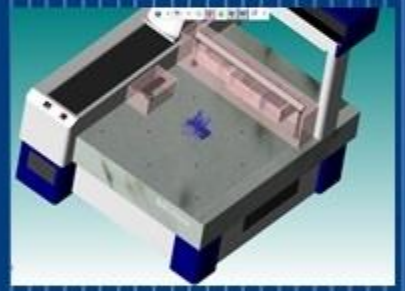

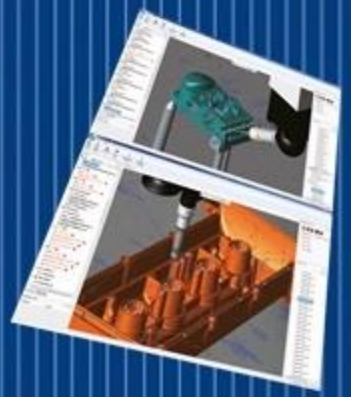

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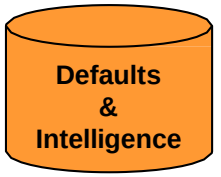
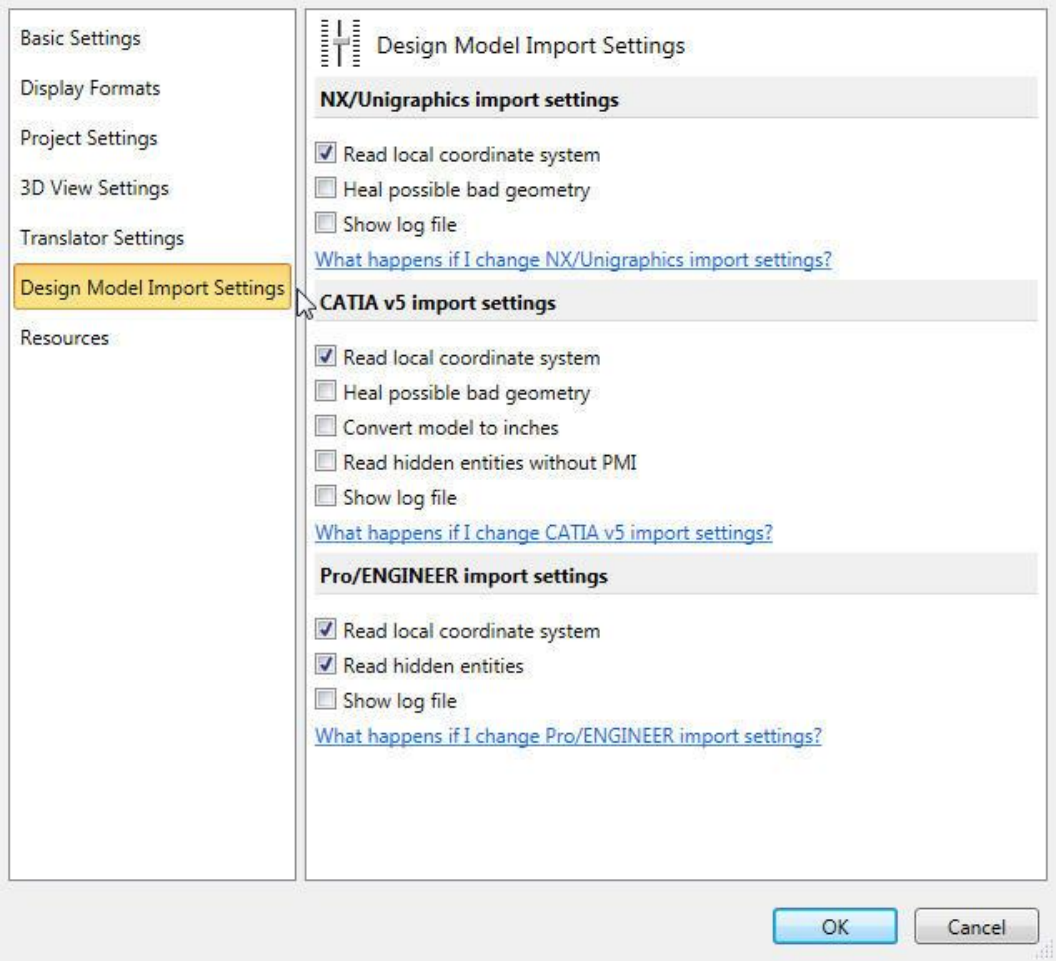
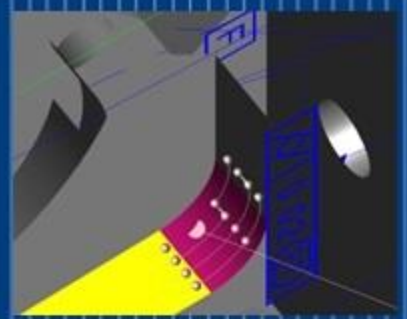
Defaults & Intelligence







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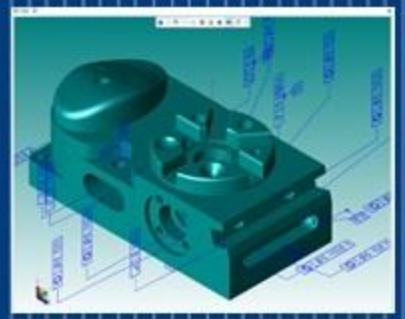

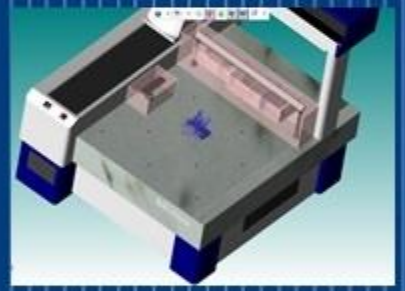

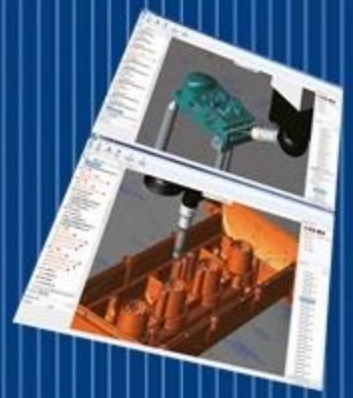

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User Parameter Settings

Program Generation Options

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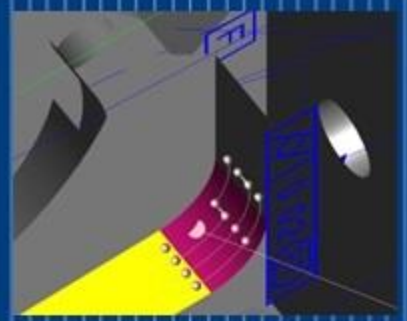

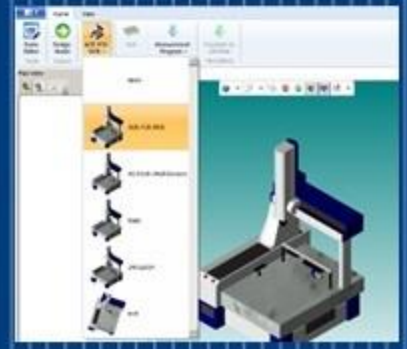

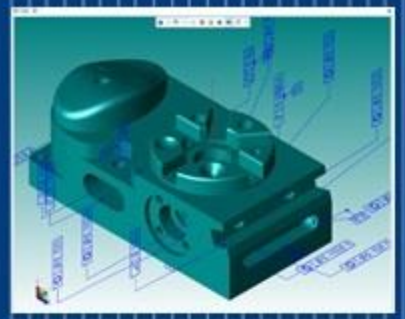

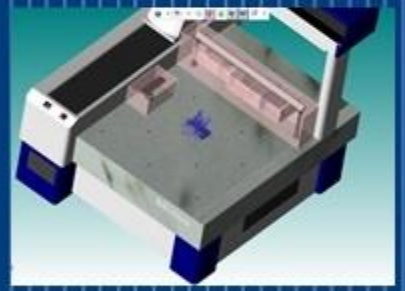

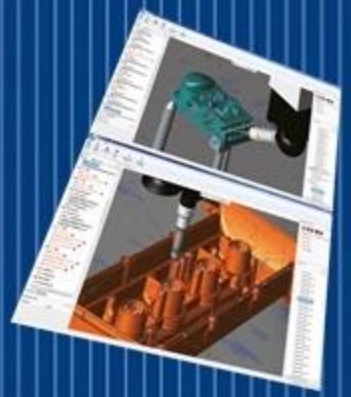

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Program Generation Options

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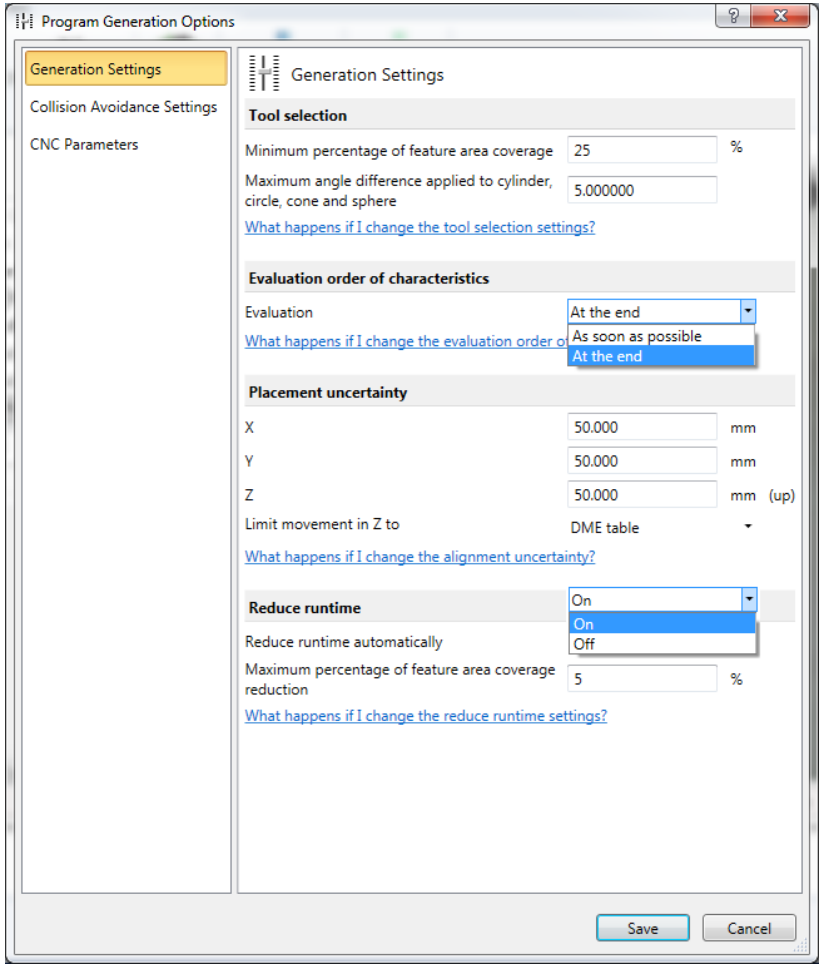

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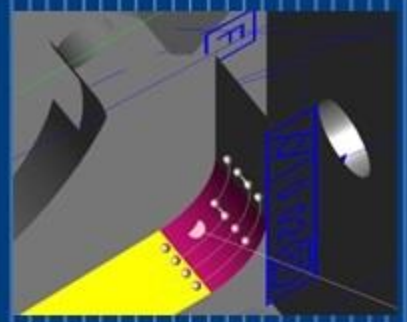

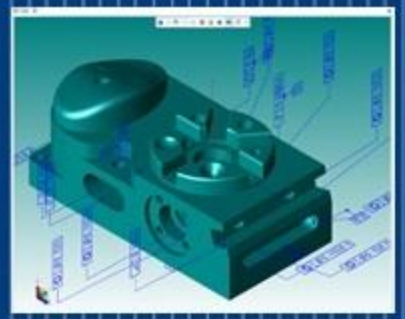

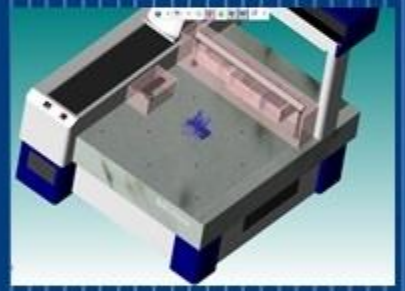

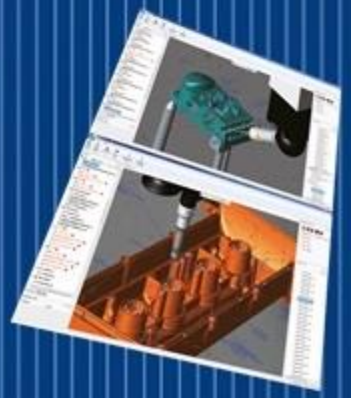

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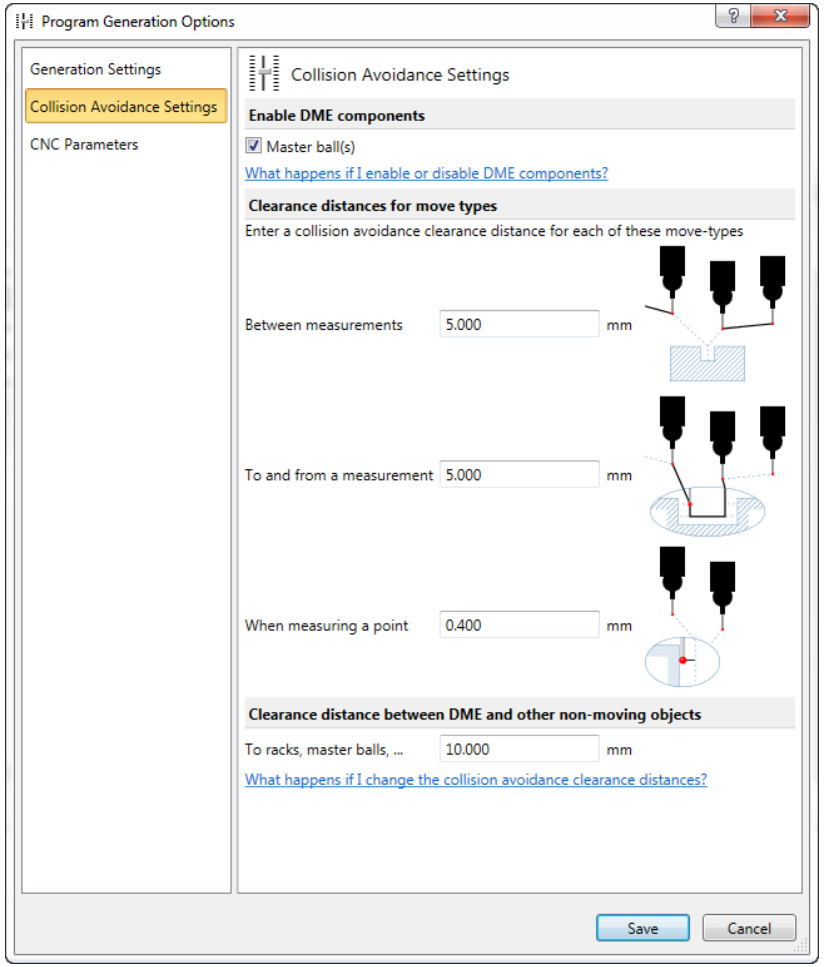

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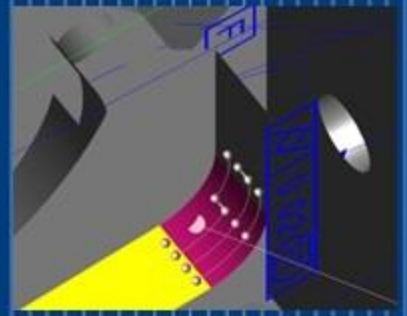

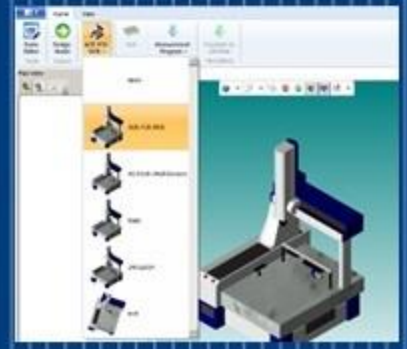

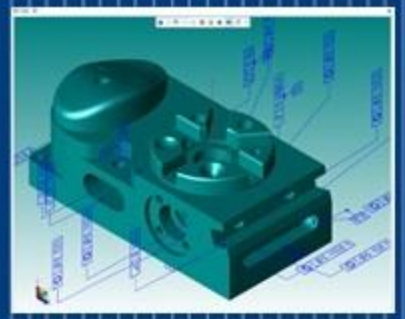

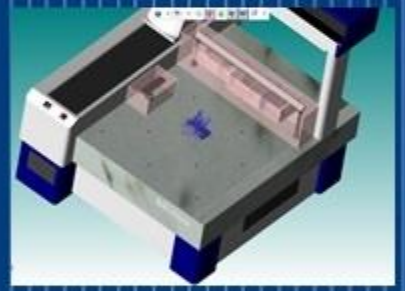

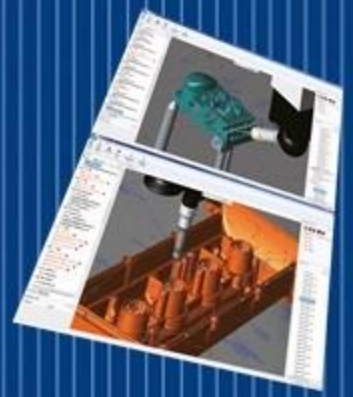

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Program Generation Options

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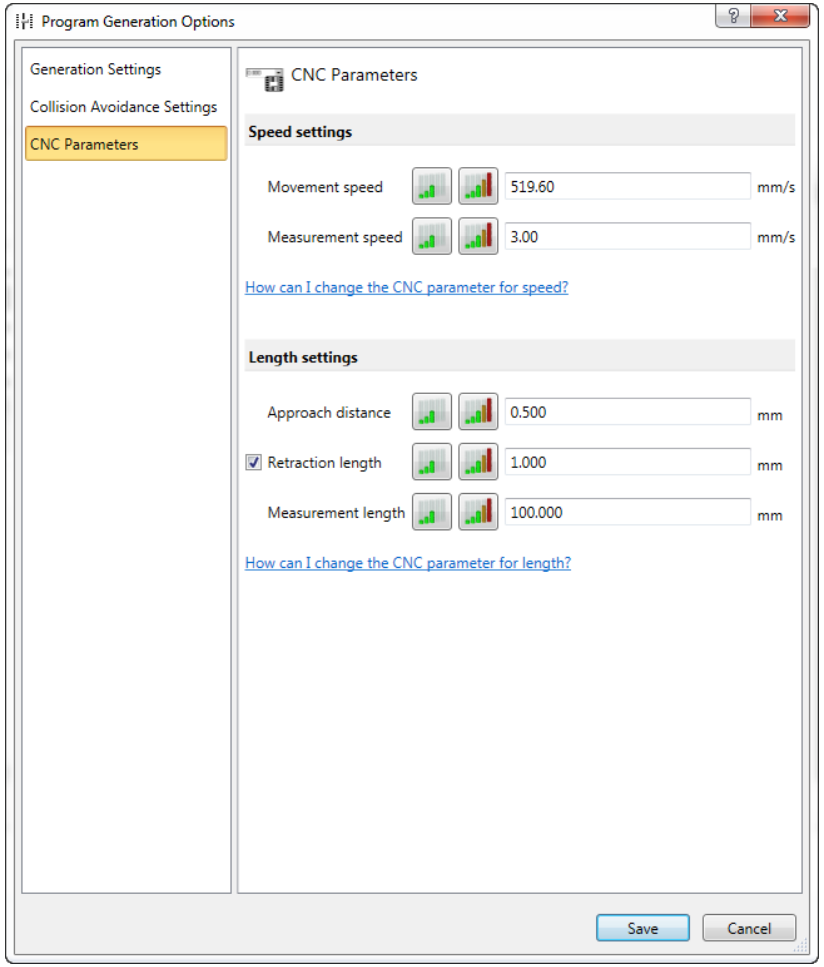

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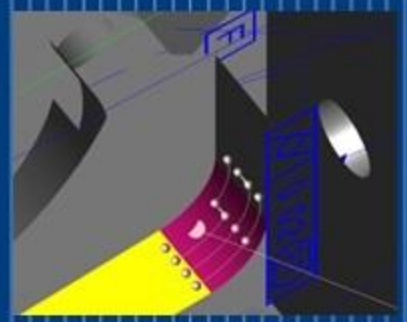

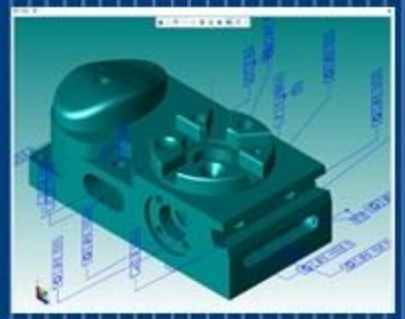

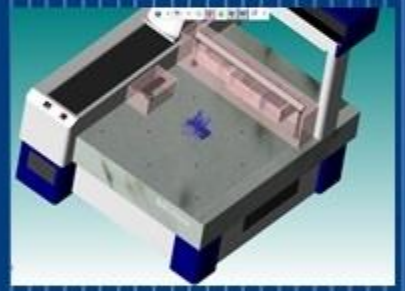

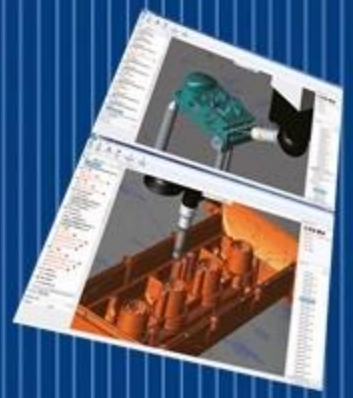

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User Defined Rules

User Defined Rules

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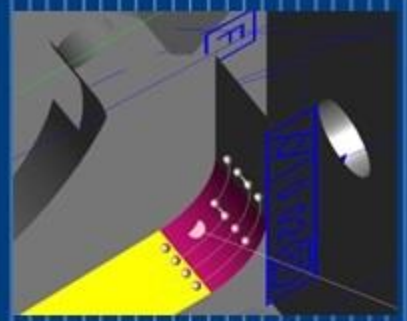

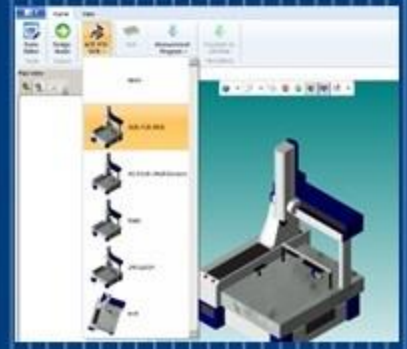

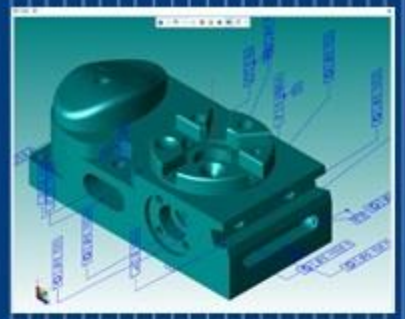

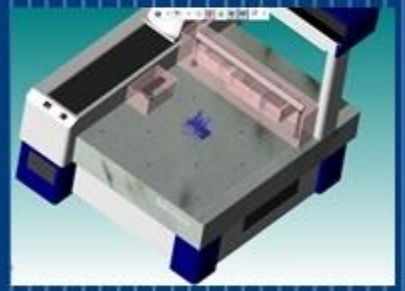

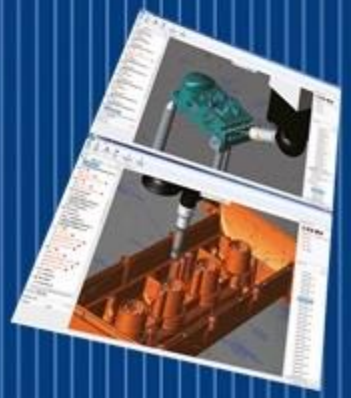

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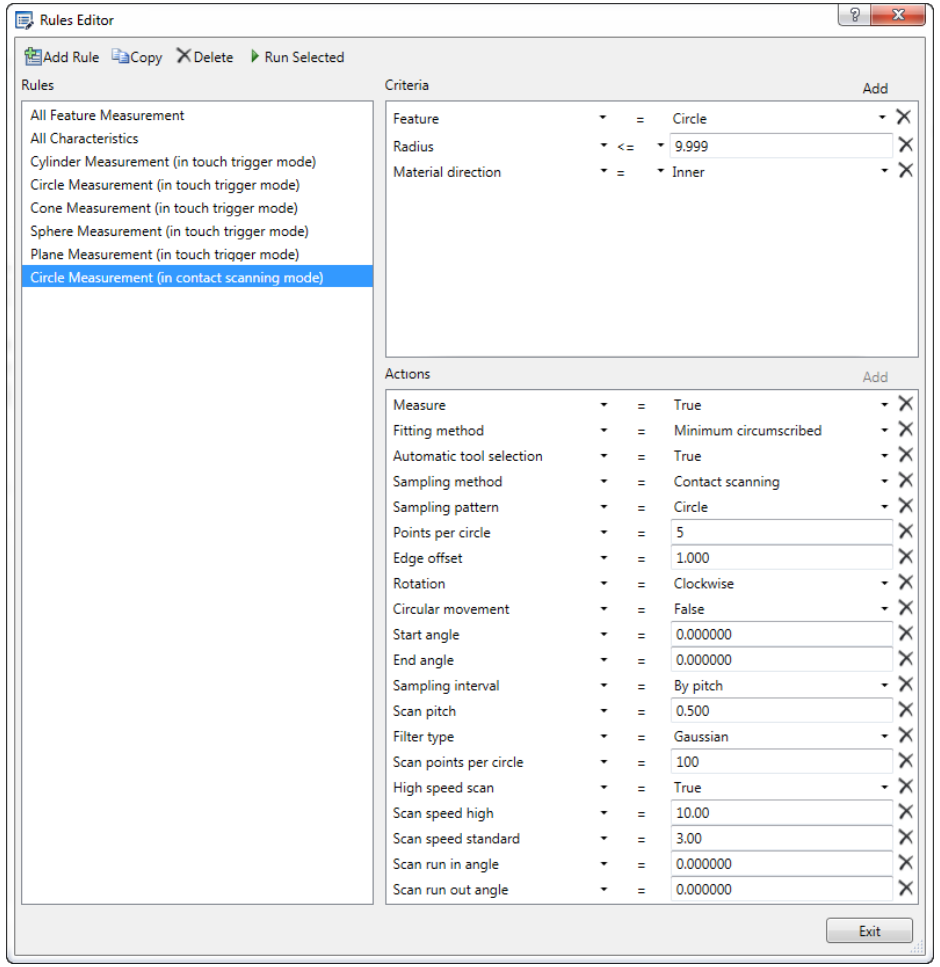
Rules Editor

User Defined Rules



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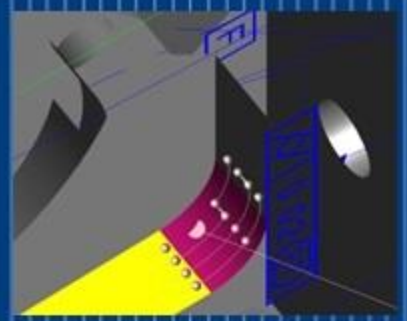

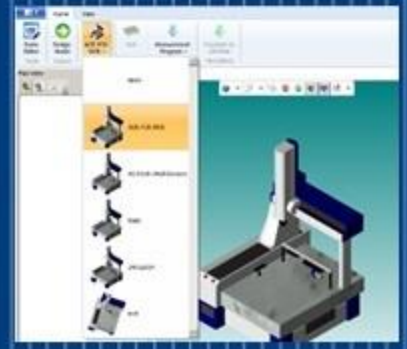

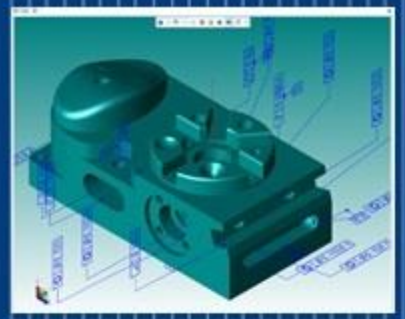

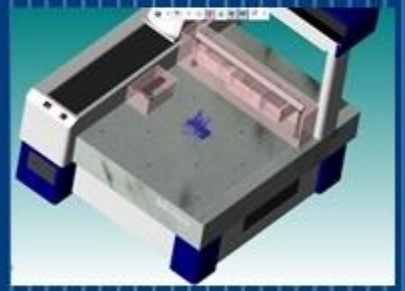

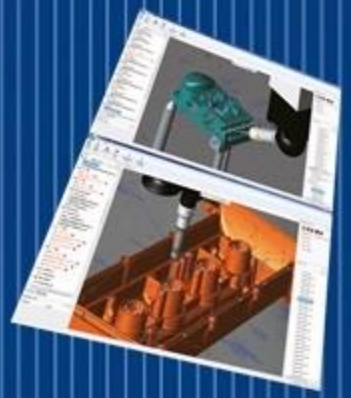

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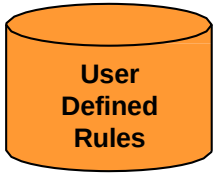
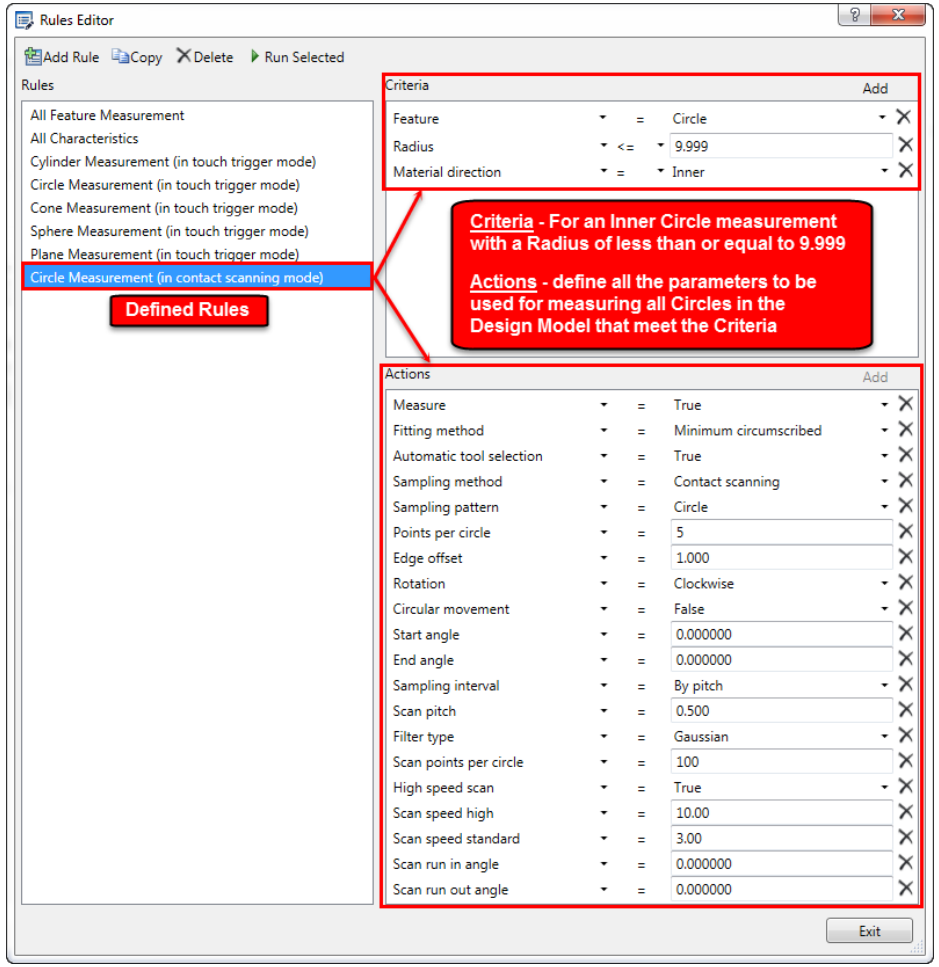
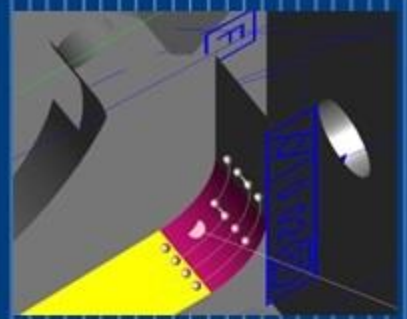
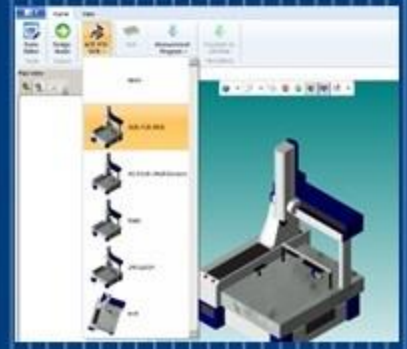
User Defined Rules









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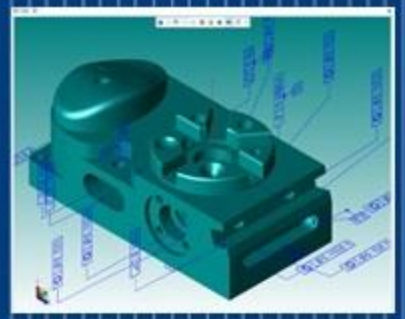

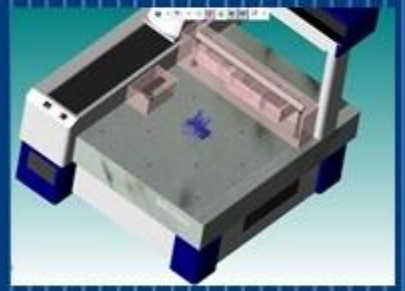

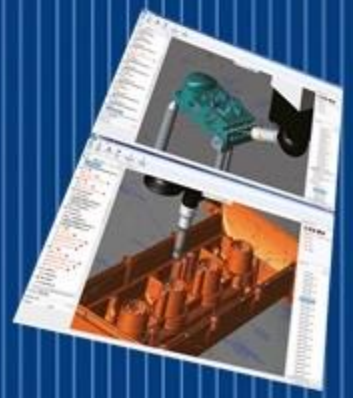

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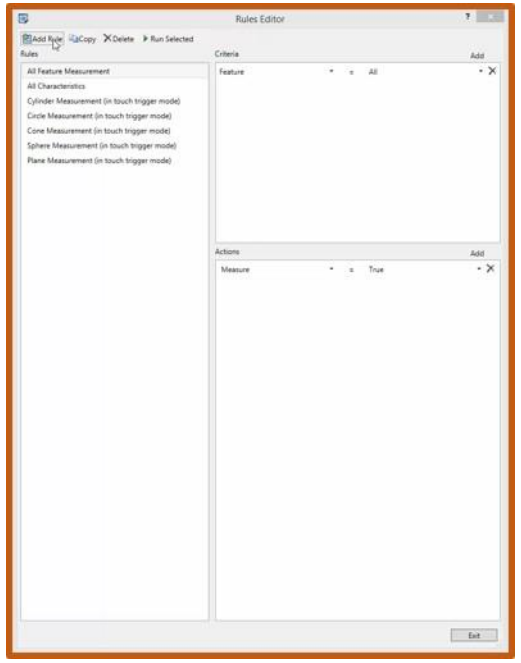
Adding a Rule



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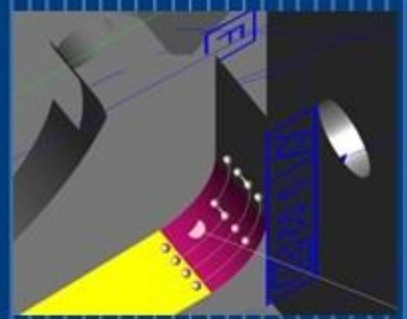
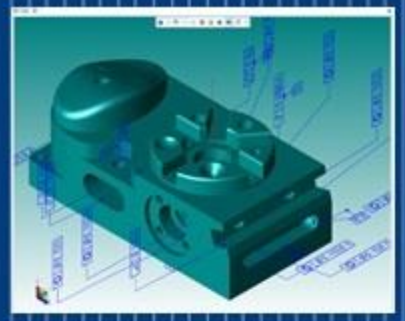
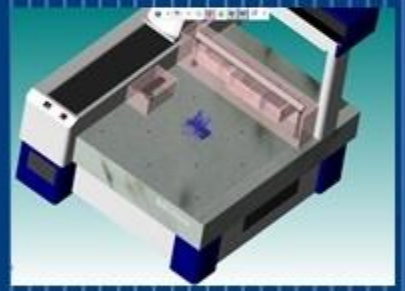
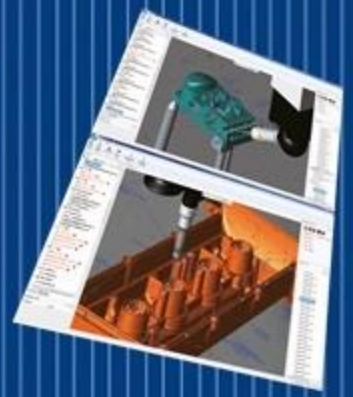
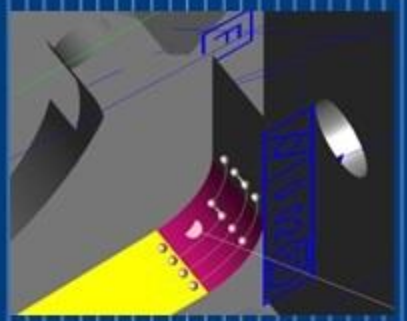


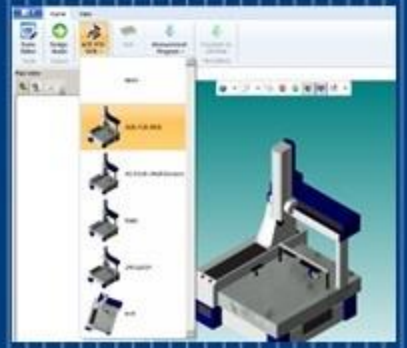




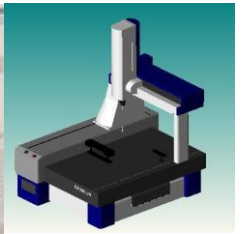


MiCAT Planner Work Flow under 6 Minutes

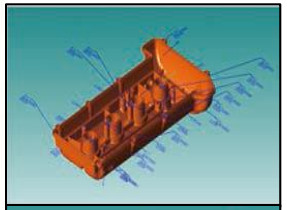


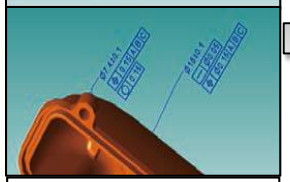


DME Configuration



PartManager
(On-line/Off-line)





CAD Model
with PMI

MiCAT Planner

Defaults & Intelligence

User Parameter Settings

User Defined Rules

Measurement Plan

Plane – A –
Align Plane – A –
Circle – B –
Origin Circle – B –
Circle – C –
Axis Circle – B –
…..

Inspection Program Generation

Geopak Part Program

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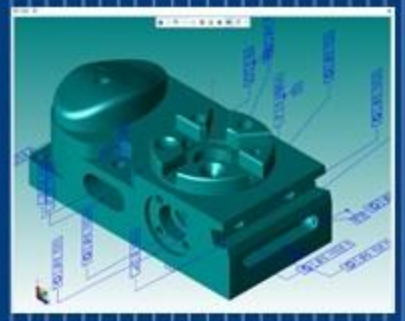
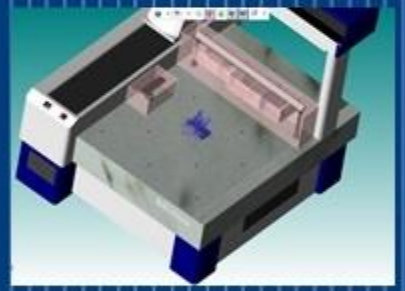
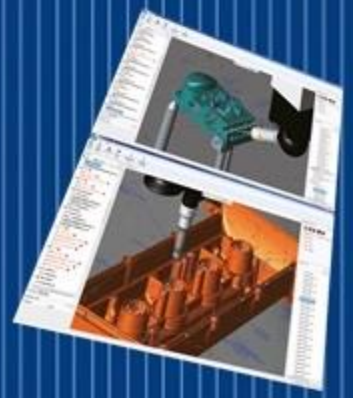
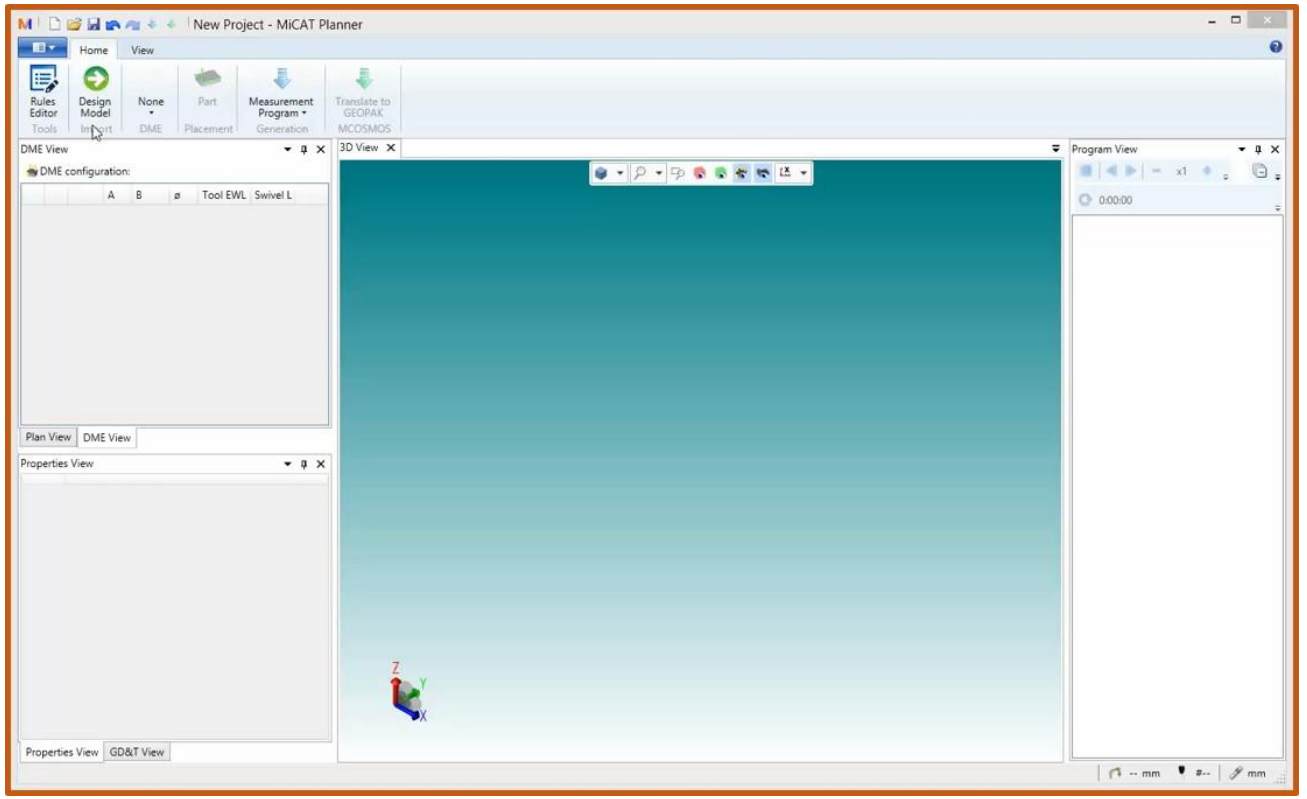






MiCAT Planner Work Flow under 6 Minutes



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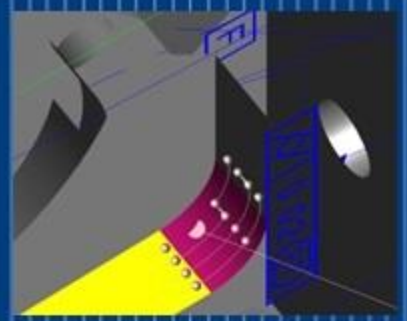

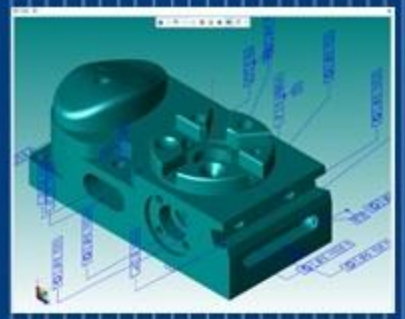

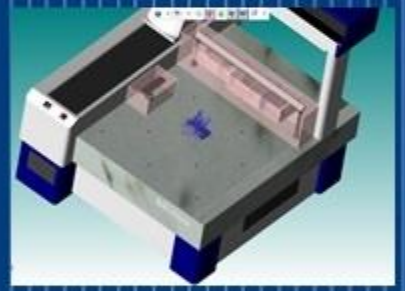

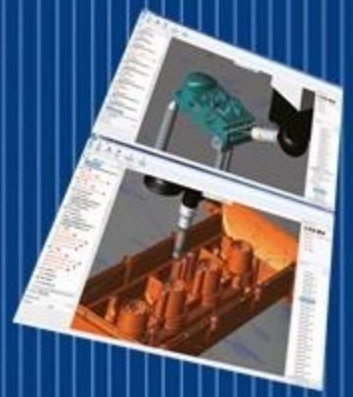

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Part Program Tasks Automatically Completed by MiCAT Planner

- 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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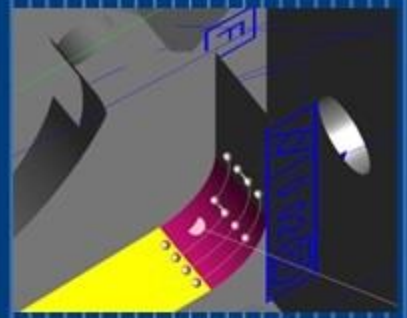

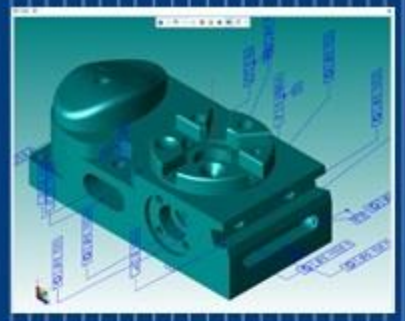

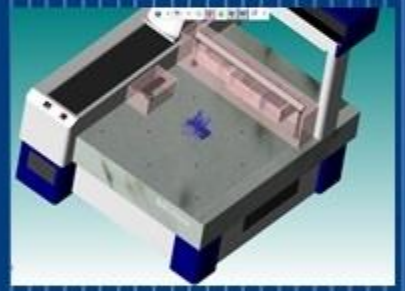

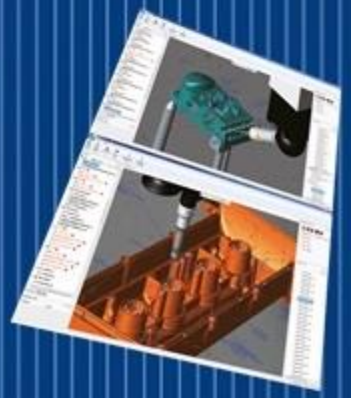

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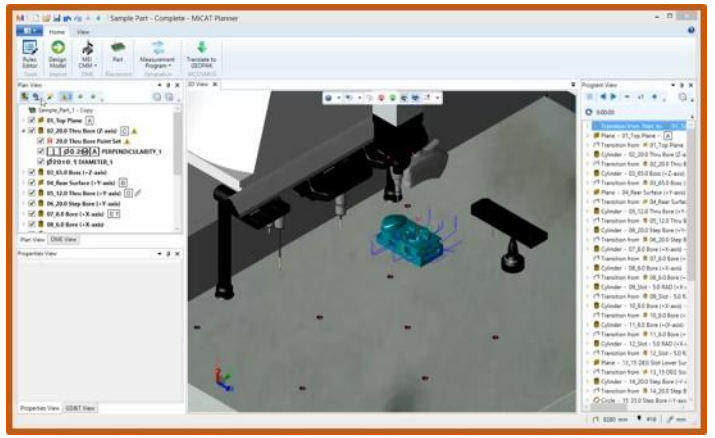
Managing Projects



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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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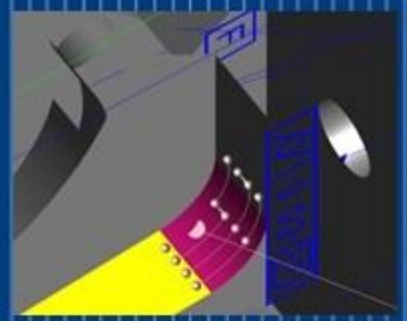

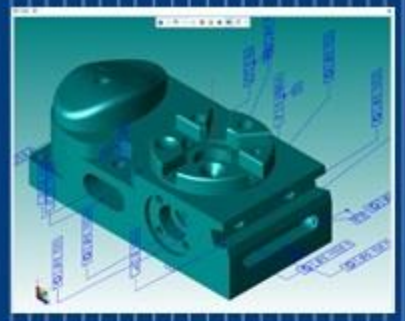

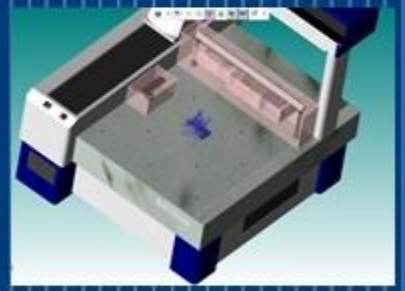

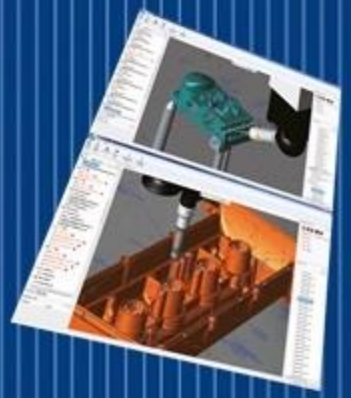

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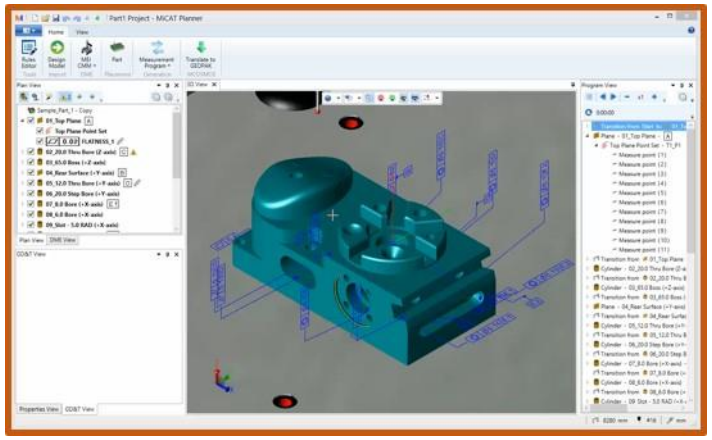
Associativity



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

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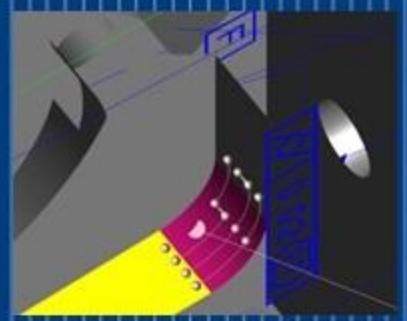

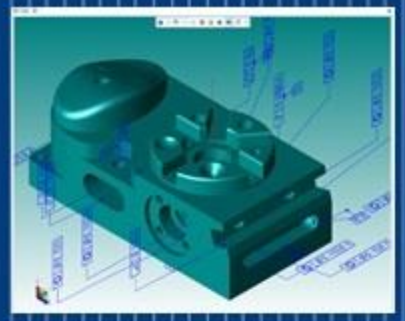

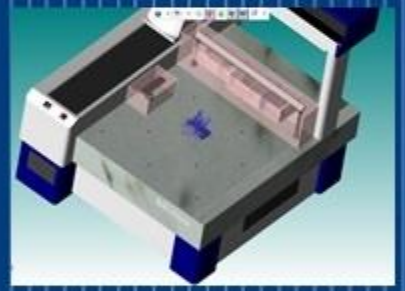

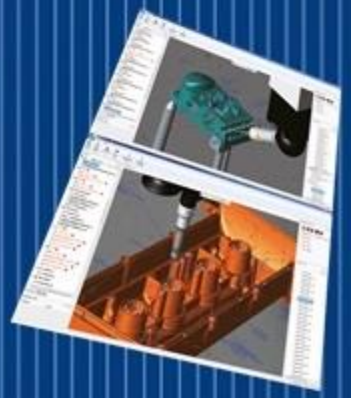

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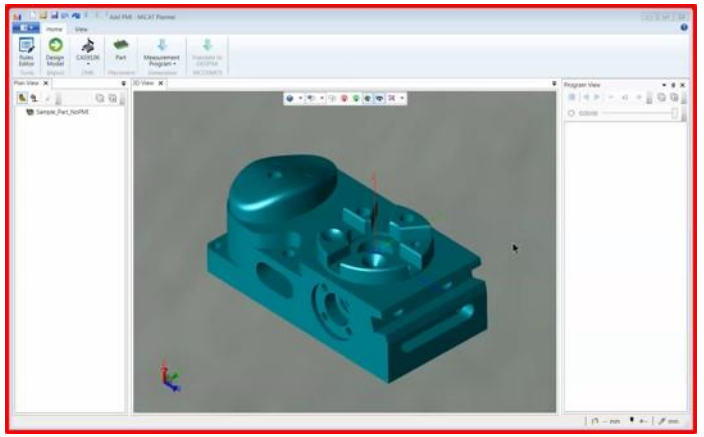
Adding GD&T



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

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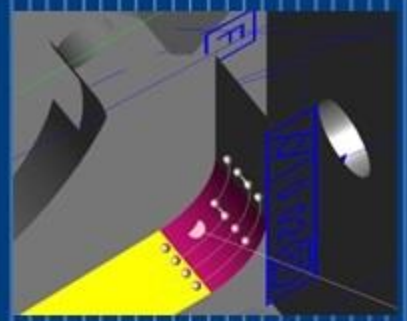

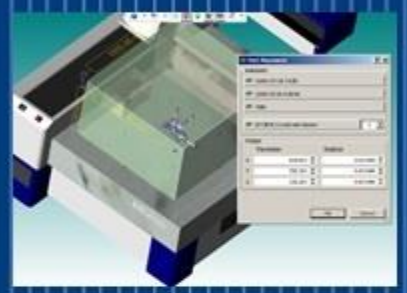

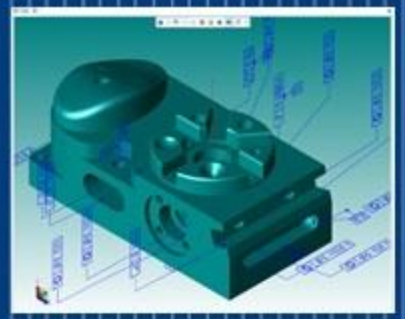

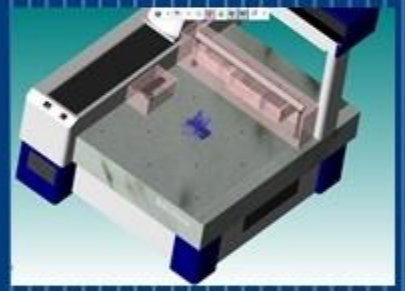

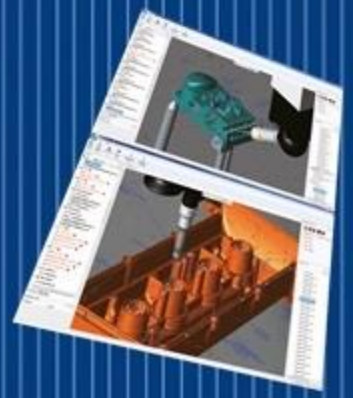

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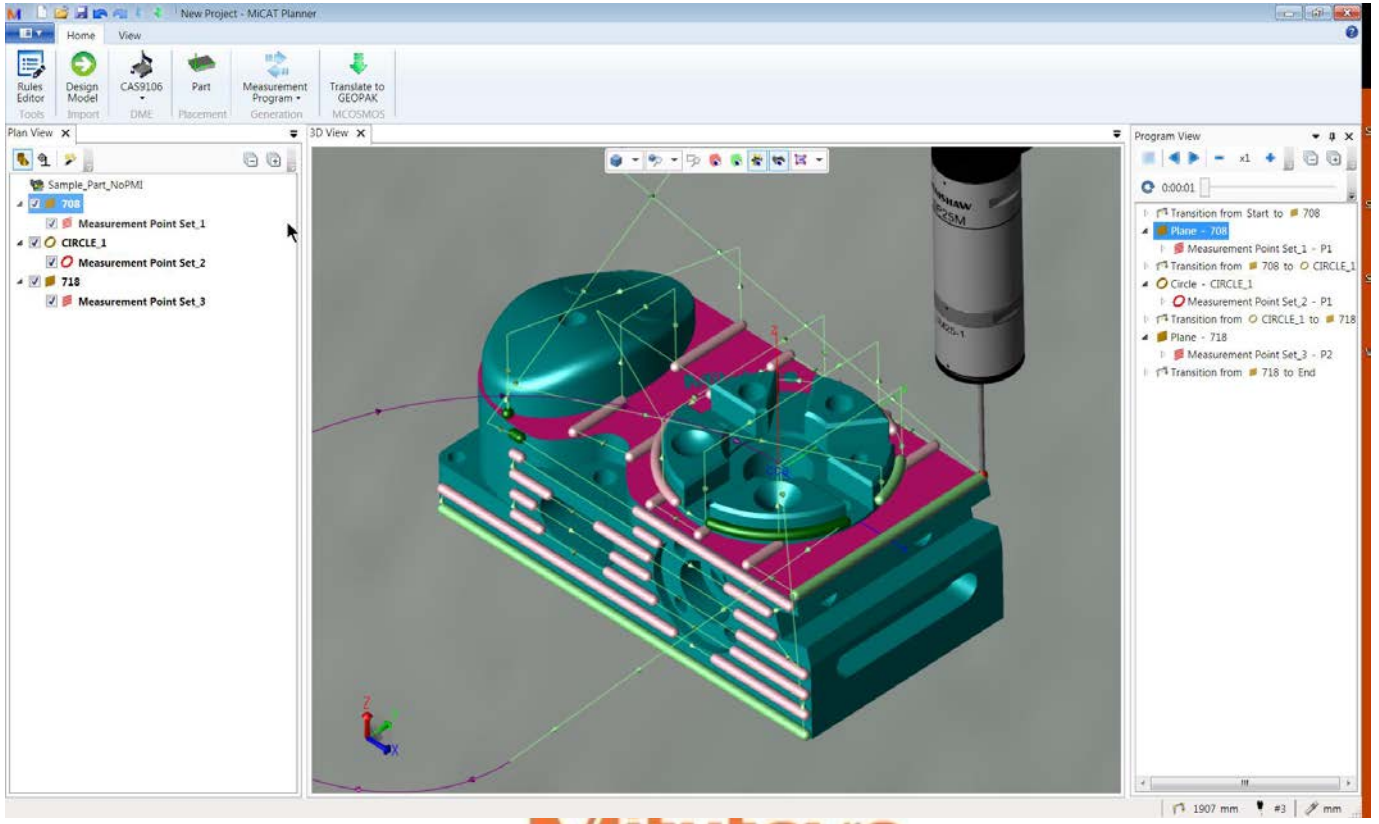
Models (ex. Prototypes) without PMI?

- Just select the features to be measured…



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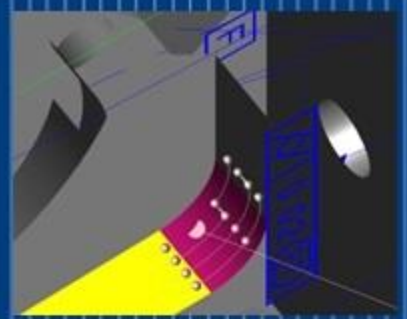

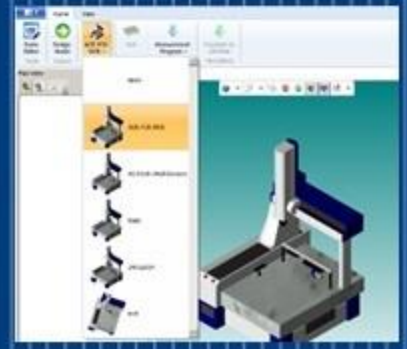

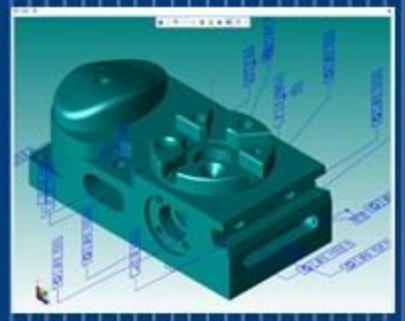

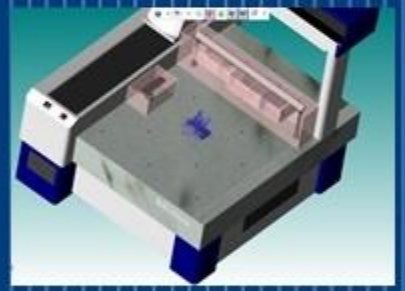

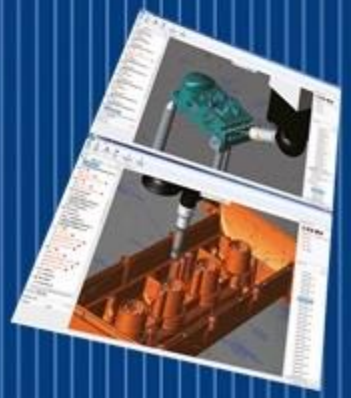

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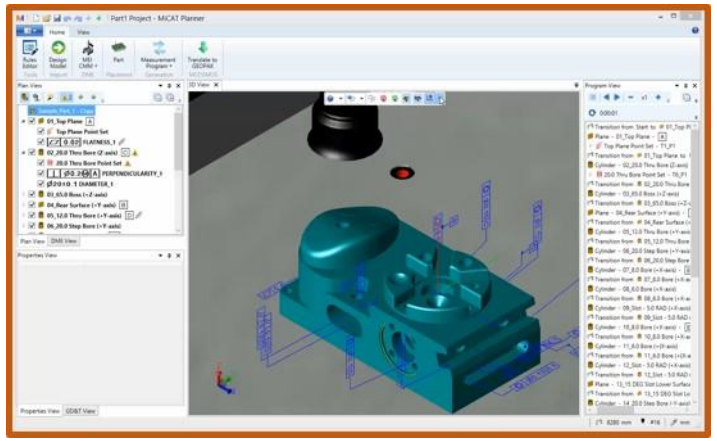
Animating a Selection



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

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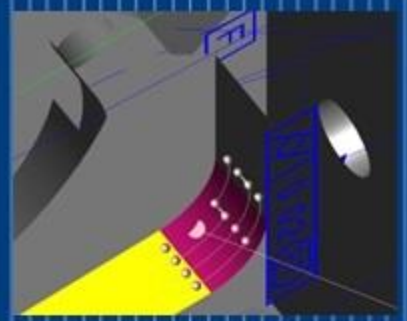

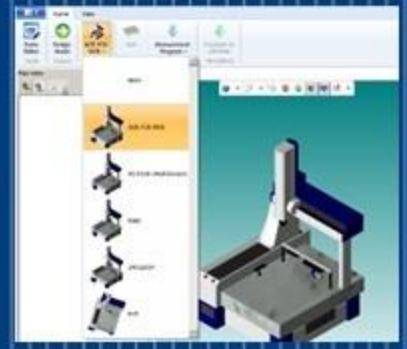

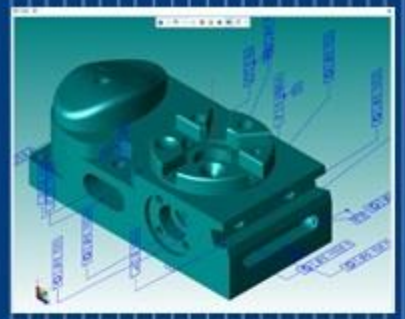

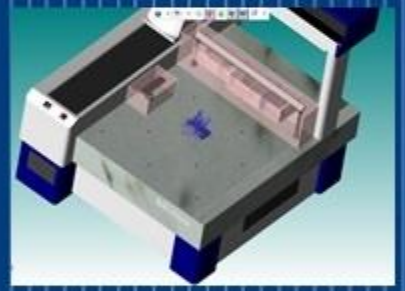

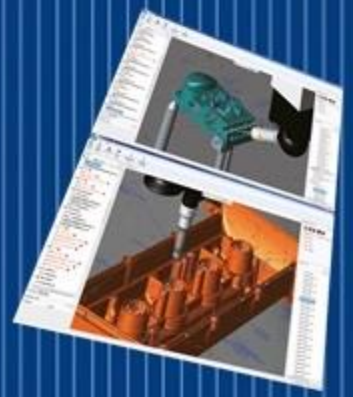

MiCAT

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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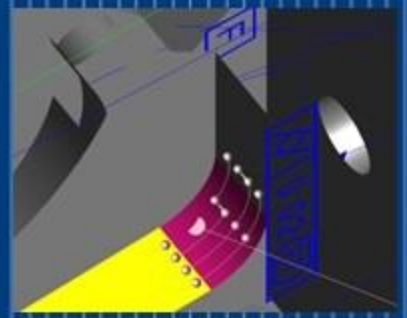
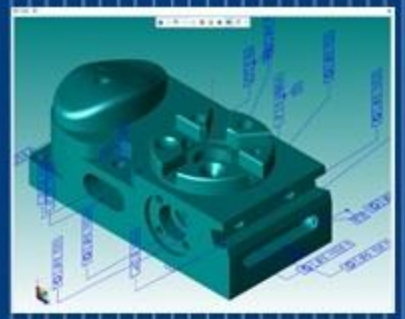
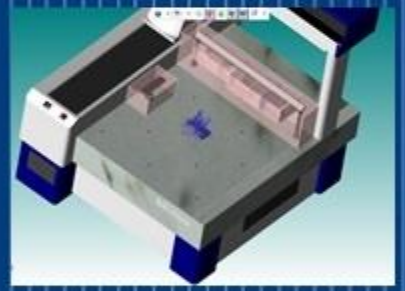
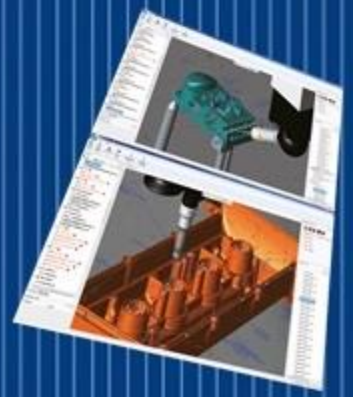




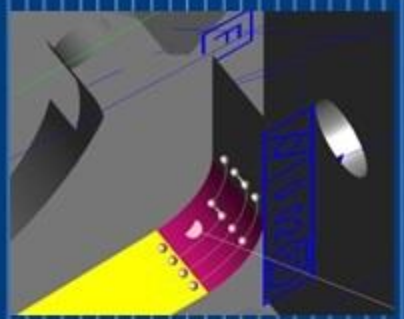




MiCAT

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



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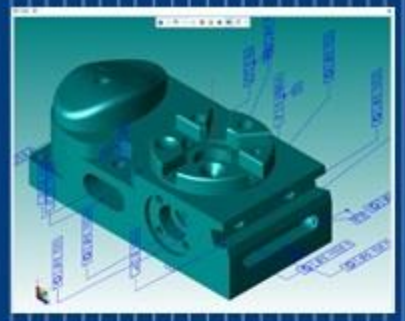

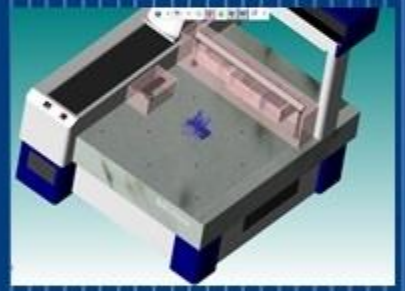

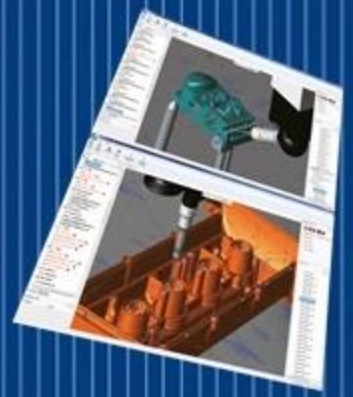

MiCAT

Additional Information

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Product Demo Request

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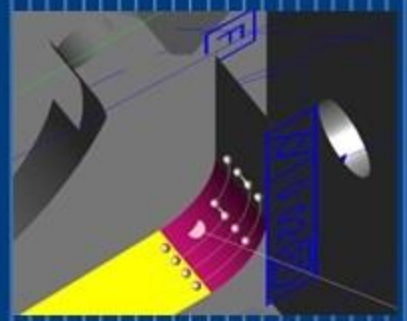
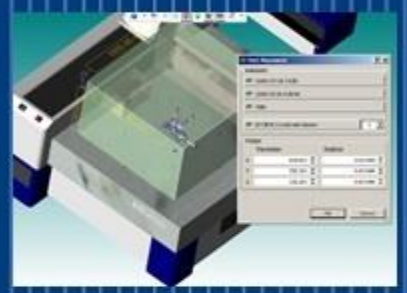
Thank you…

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