



# On Machine Probing in NX

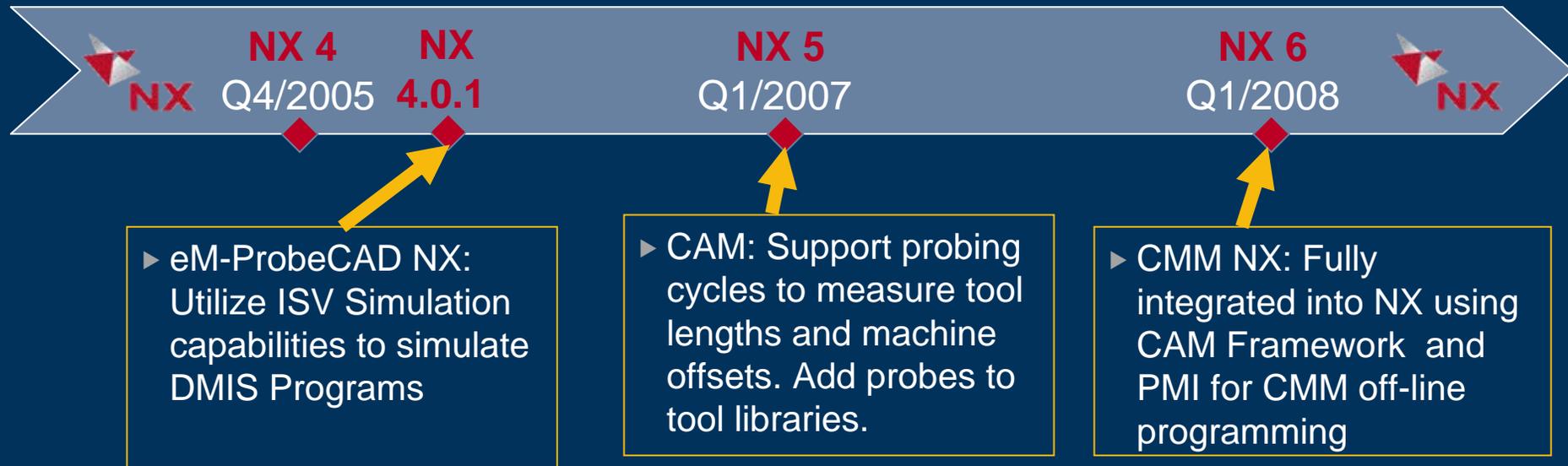
Bob Sammut  
Directors Product Development



- ▶  Probing Roadmap
- ▶ NX 5 On Machine Probing
- ▶ NX6 CMM Programming
- ▶ New Inspection Technology
- ▶ eM-Measure



# Probing in NX Road Map



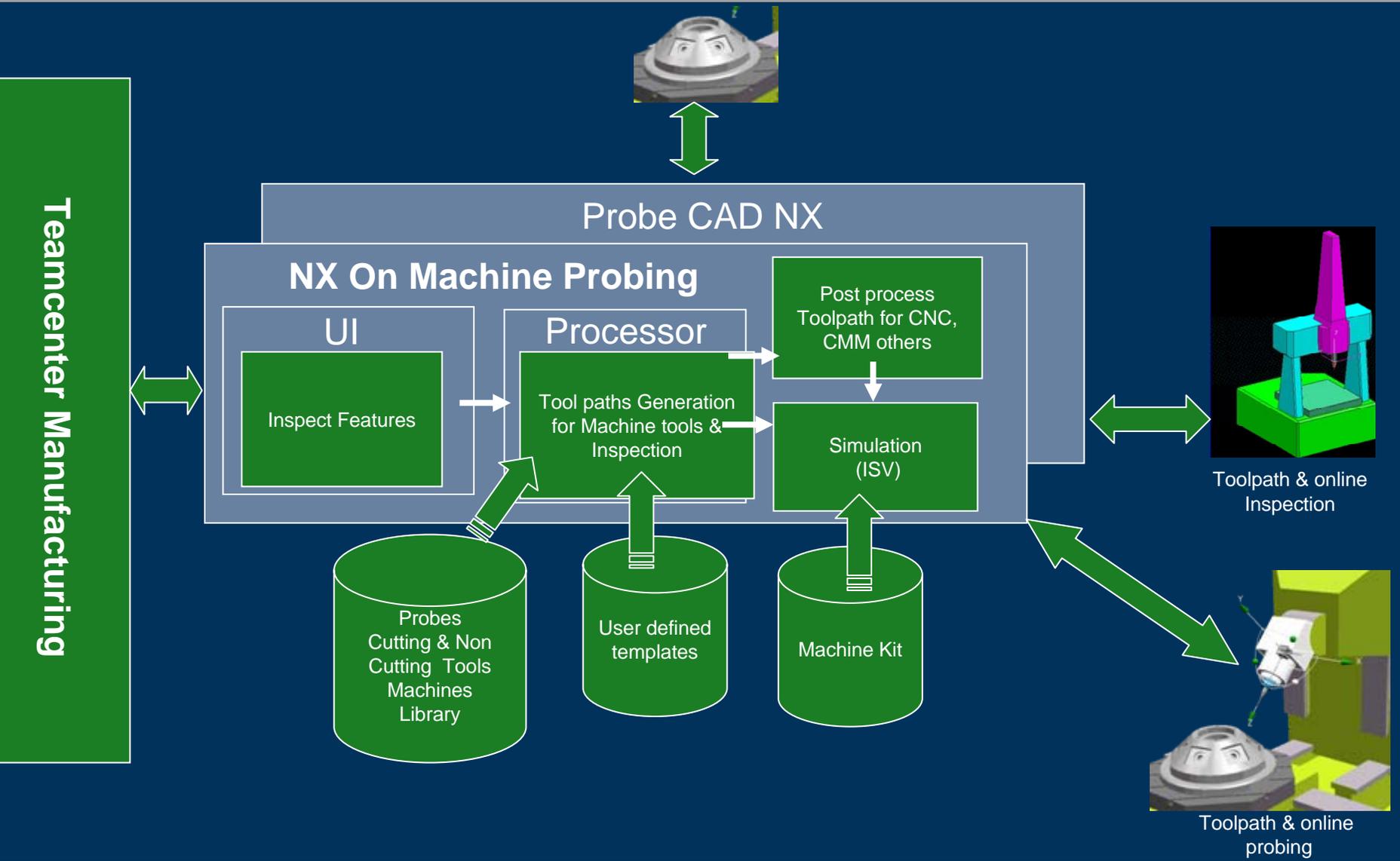


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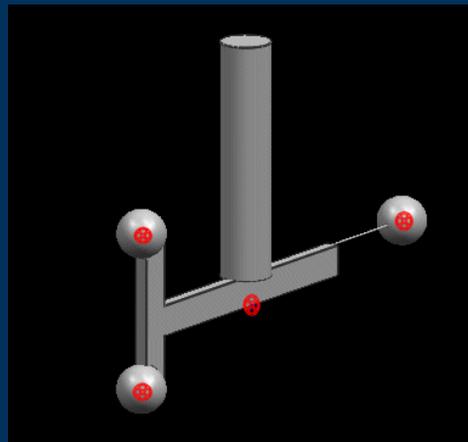
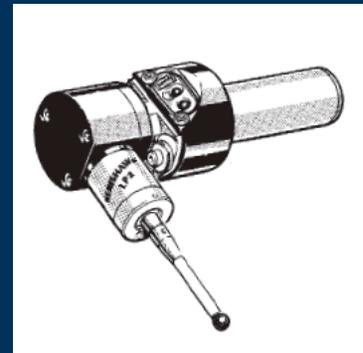




# NX 5 On Machine Probing Project



- ▶ Solid Model
- ▶ Contact Probes
- ▶ Non Contact Probes
- ▶ Non –Cutting Tools
- ▶ User Defined Tools
- ▶ Use of Tracking Points
- ▶ Supported in Resource Manager

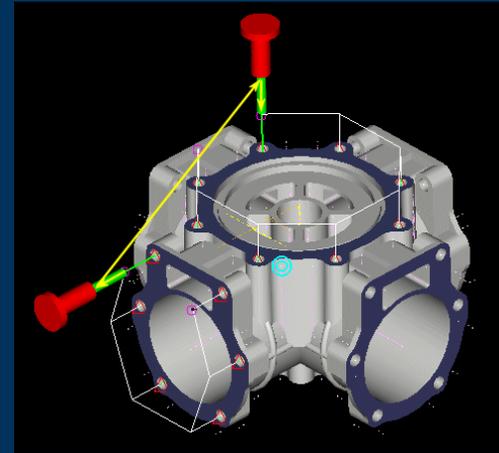




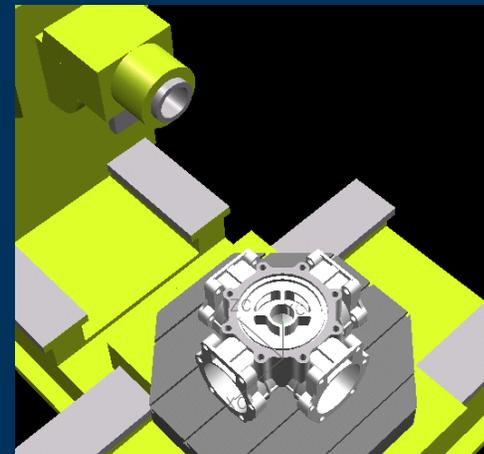
# Probing on Machine Tools



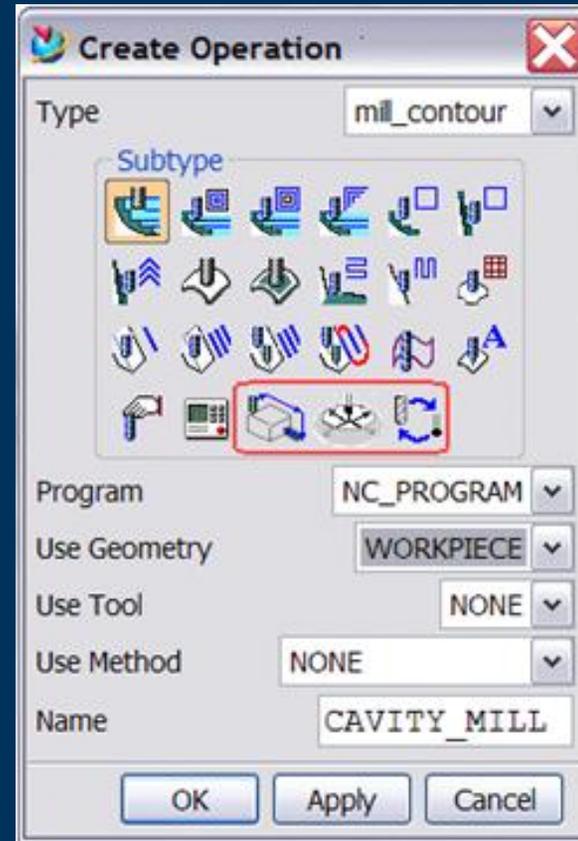
- ▶ Motion without a Machine tool



- ▶ Motion with a Machine tool



- ▶ User defined motion control operations.
- ▶ Tools for higher automation

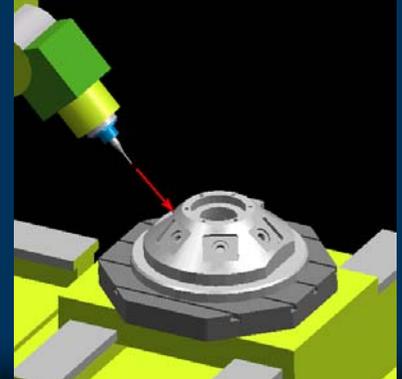
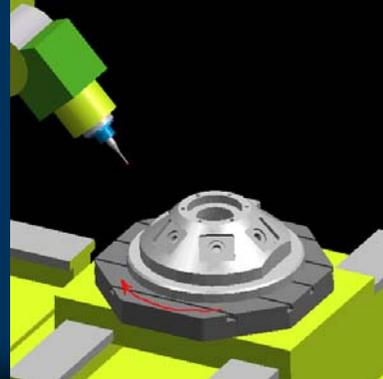
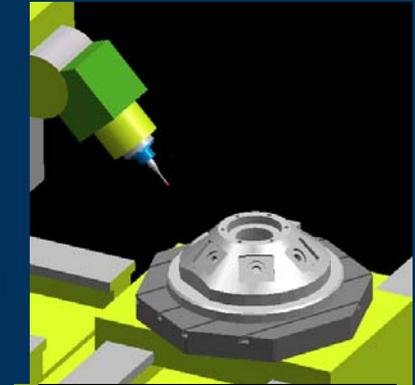
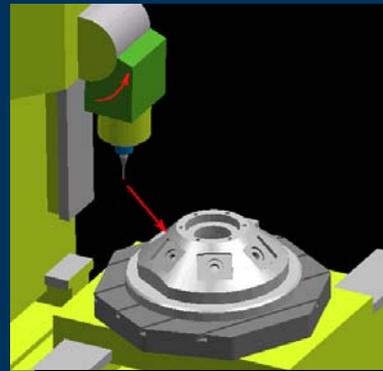
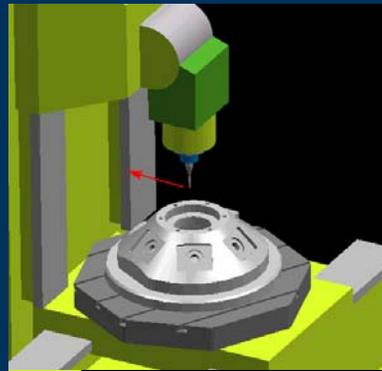
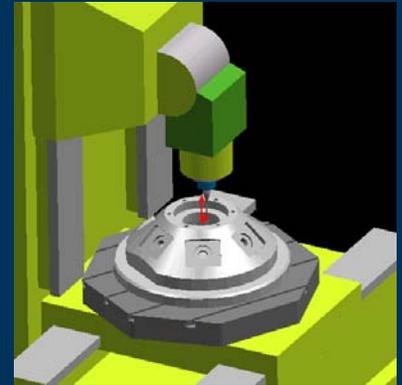
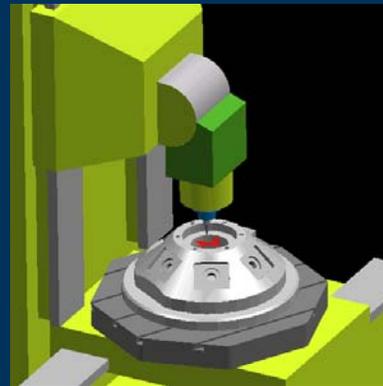
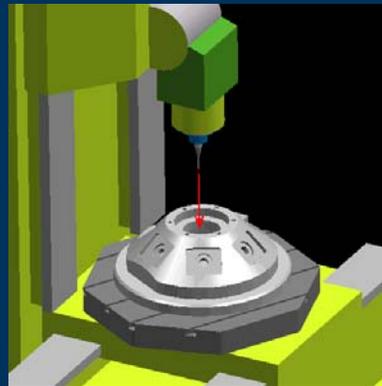




# Sample Motion



- ▶ Support the Kinematic motion of the machine tool
- ▶ Collision Detection
- ▶ Dynamic Motion

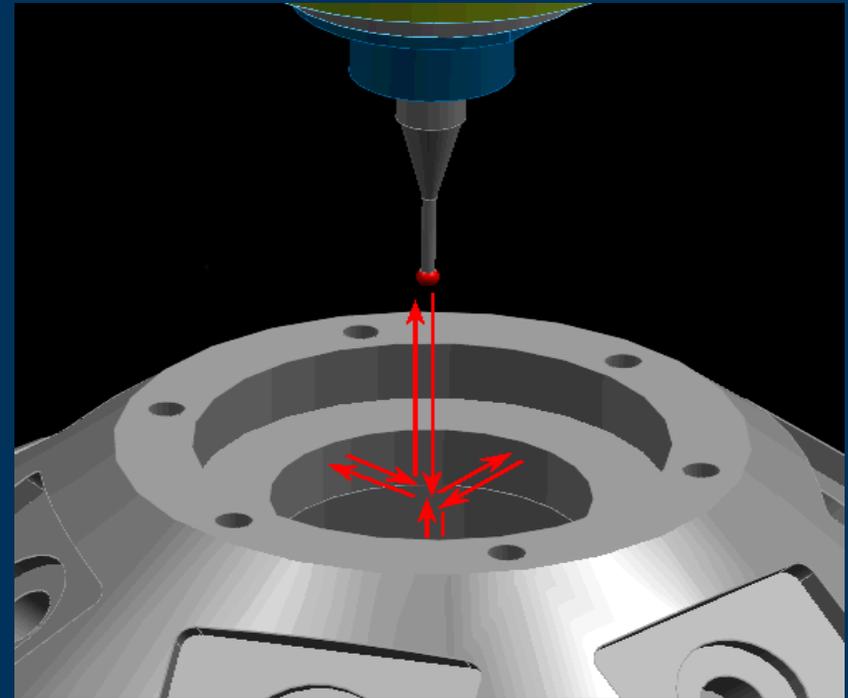




# Probing as a Standard Operation



- ▶ Support of operation and sub operations for reuse
- ▶ Support for Renishaw Probing Cycles
- ▶ Output in standard NC format in Post-processors

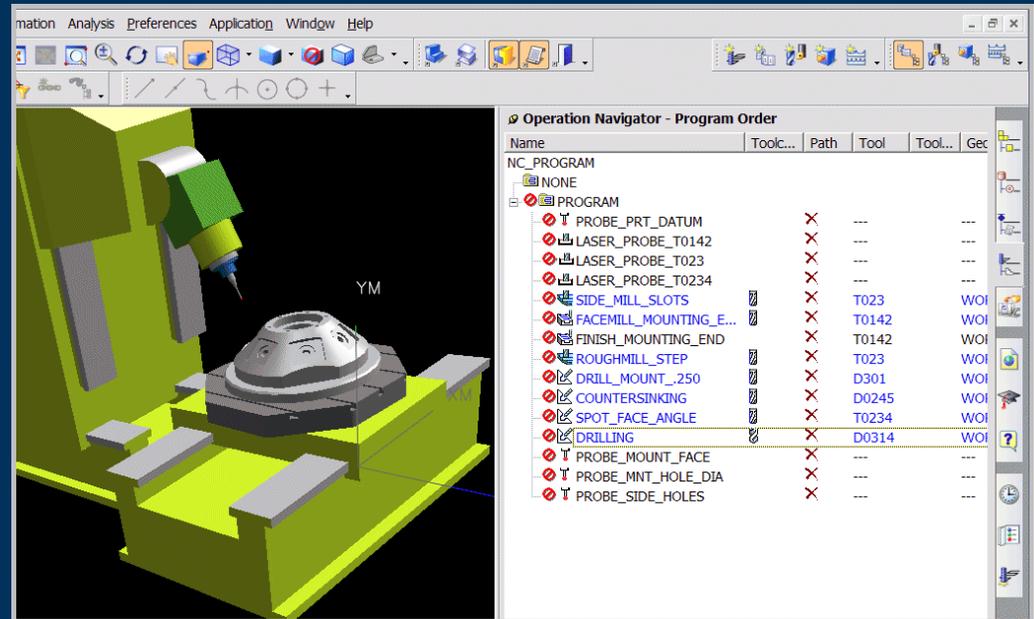




# Operation Management



- ▶ Management of operations through a navigator

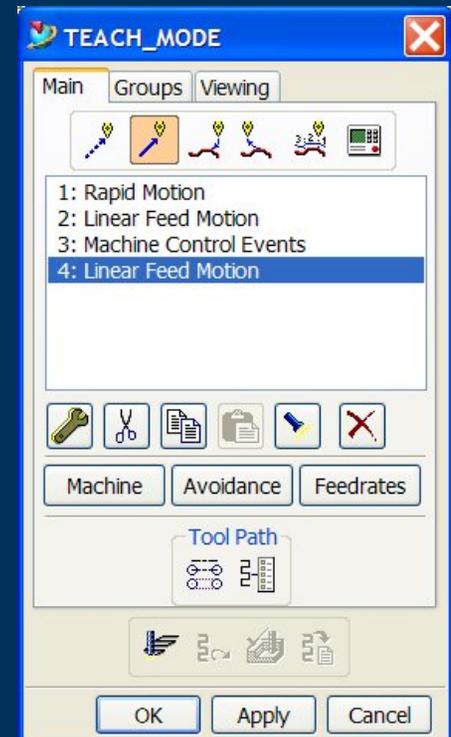
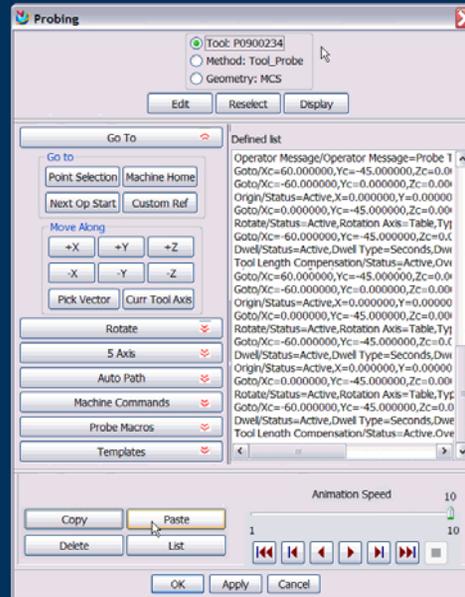




# Editing



- ▶ Editing
- ▶ Teach Mode

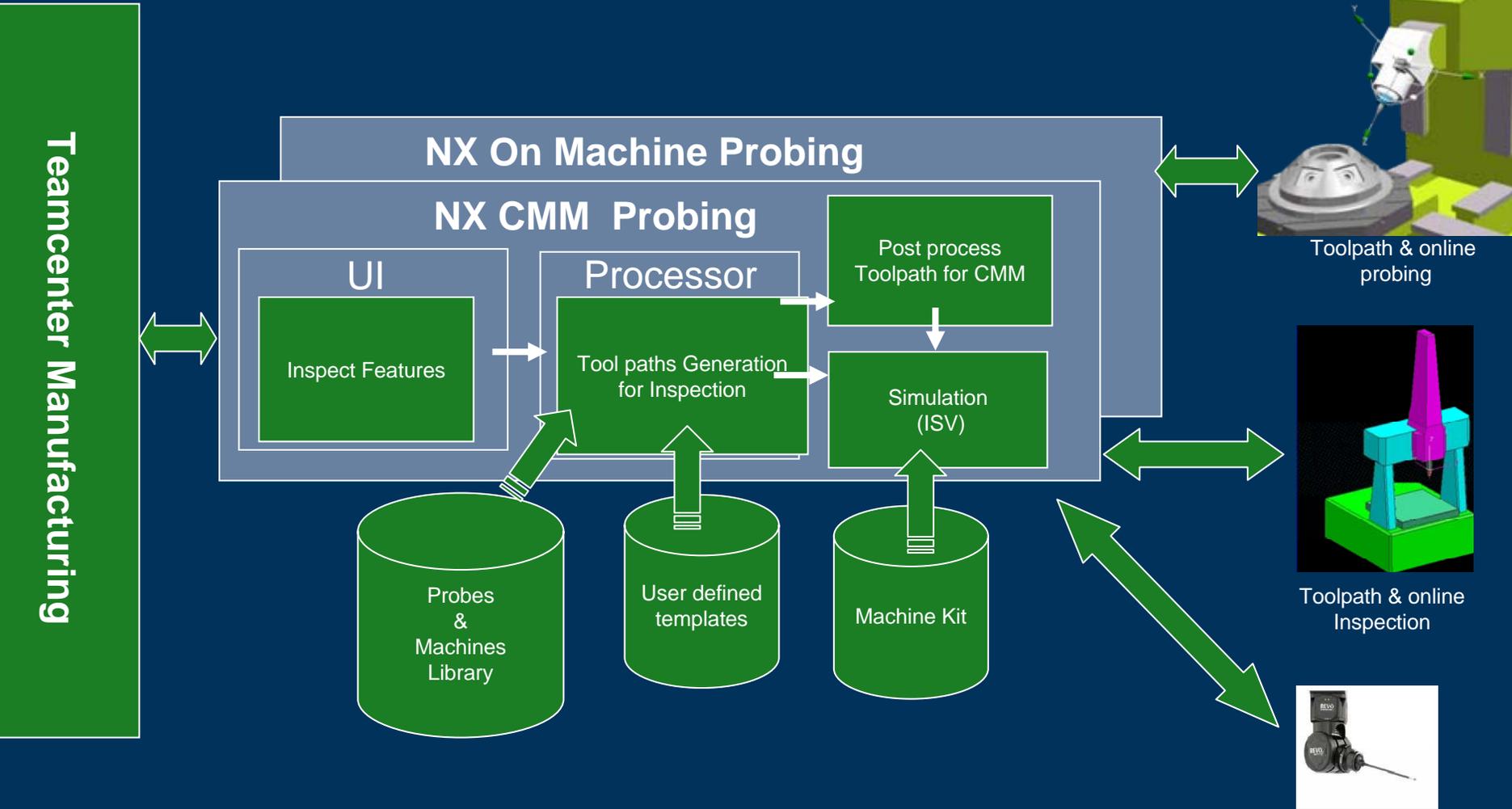




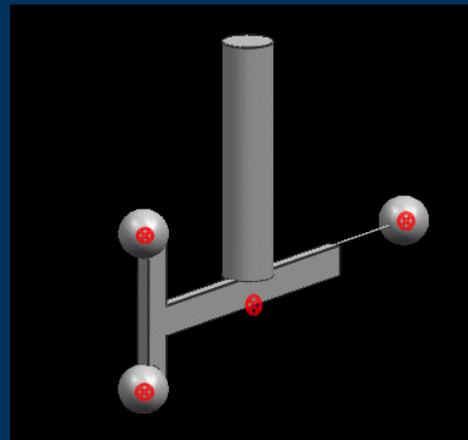
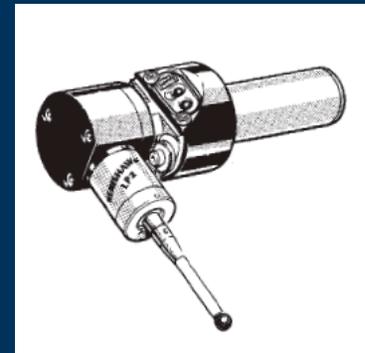
- ▶ Probing Roadmap
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# NX 6 CMM Project



- ▶ Solid Model
- ▶ Contact Probes
- ▶ Non Contact Probes
- ▶ Use of Tracking Points
- ▶ Supported in Resource Manager

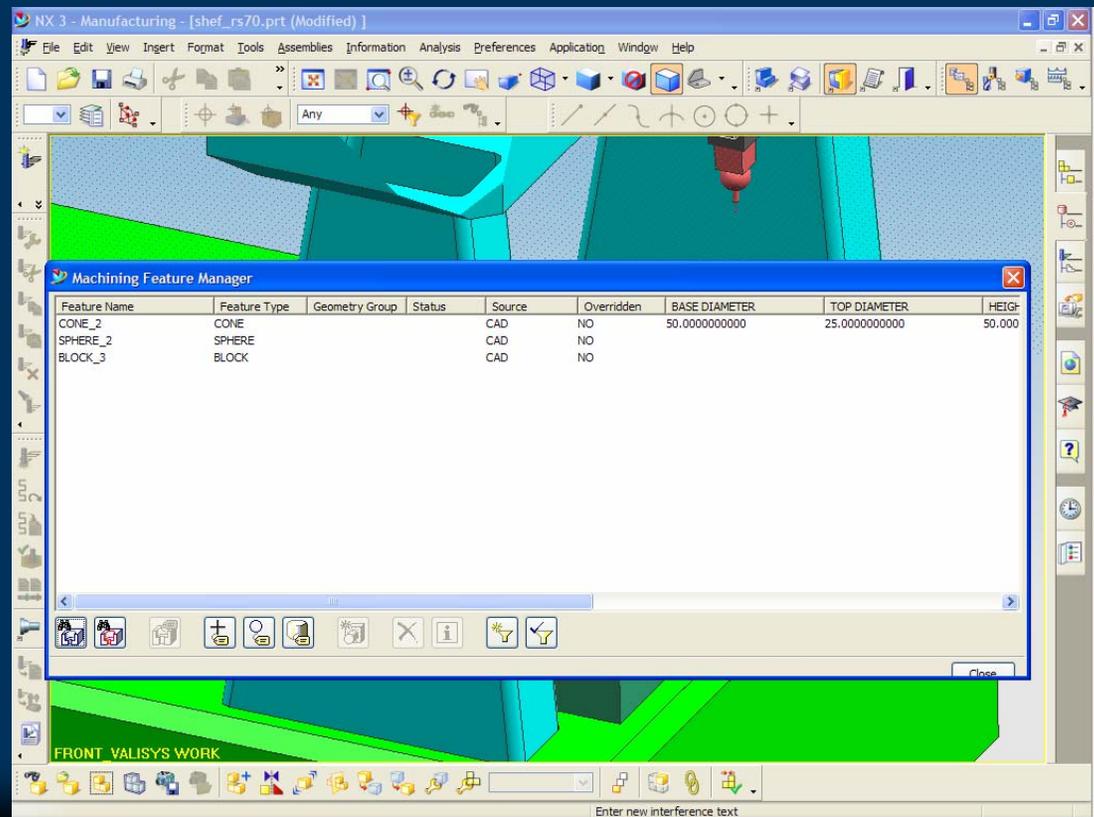




# Inspection Features Integrated with CAM Features



- ▶ Use CAM features directly
- ▶ Import Modeling features
- ▶ Support for constructed features
- ▶ Import PMI





# Integrated with Knowledge Fusion



The screenshot displays the NX 3 Manufacturing interface. The main window shows a 3D model of a part with a cylindrical feature. The Knowledge Fusion Navigator is open, showing the 'Add Attribute' dialog box. The dialog box contains the following information:

**Add Attribute**

Name: num points

Type: Number

Formula:

```
If ( length > 50 )  
Then ( nbpts = 16 )  
Else ( nbpts = 24 )
```

Options:

- Input Parameter
- Modifiable
- Uncached
- Method
- Evaluate It

Buttons: OK, Apply, Cancel

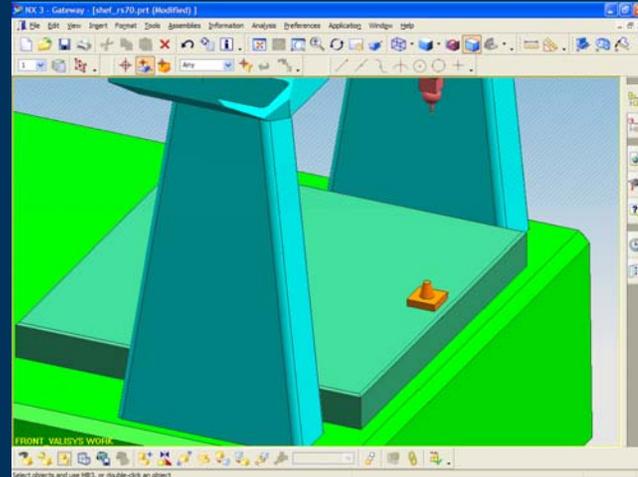
Below the dialog box, the Knowledge Fusion Navigator shows a tree view with the following items:

- saveClassList (List) List of 0
- saveClassMixins? (Boolean)
- saveValue (List) List of 0

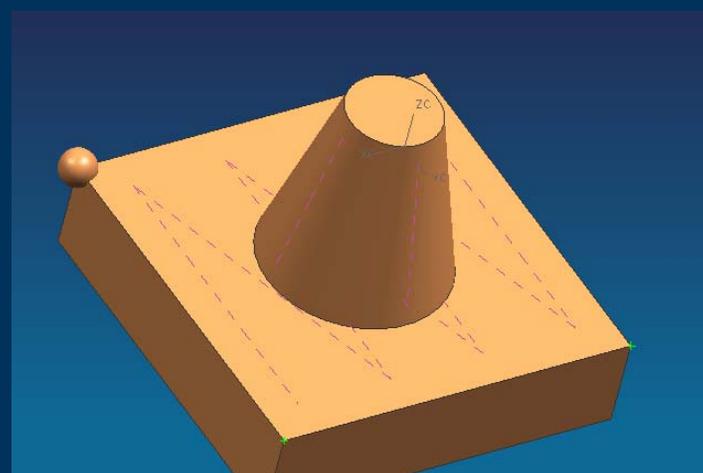
The status bar at the bottom of the window displays the text: "Enter attribute name and formula"



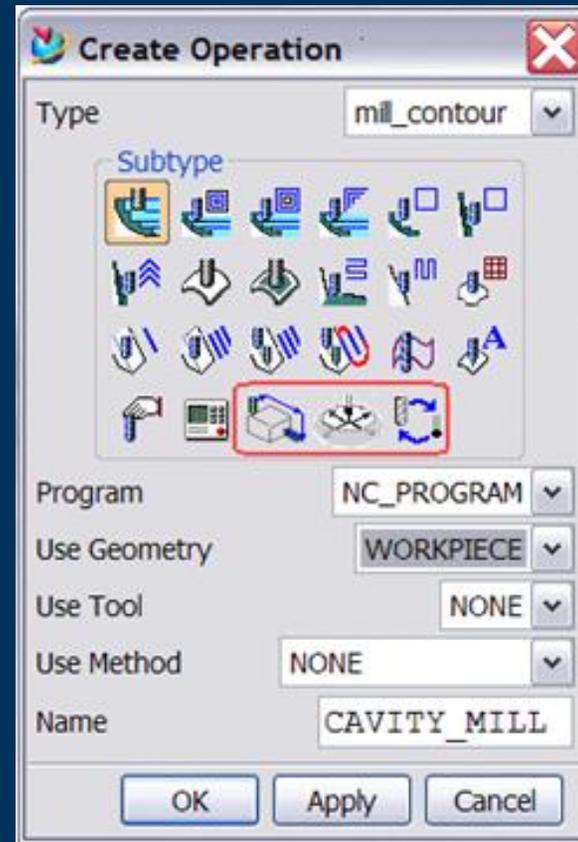
- ▶ Motion with a CMM



- ▶ Motion without a CMM



- ▶ User defined motion control operations.
- ▶ Tools for higher automation

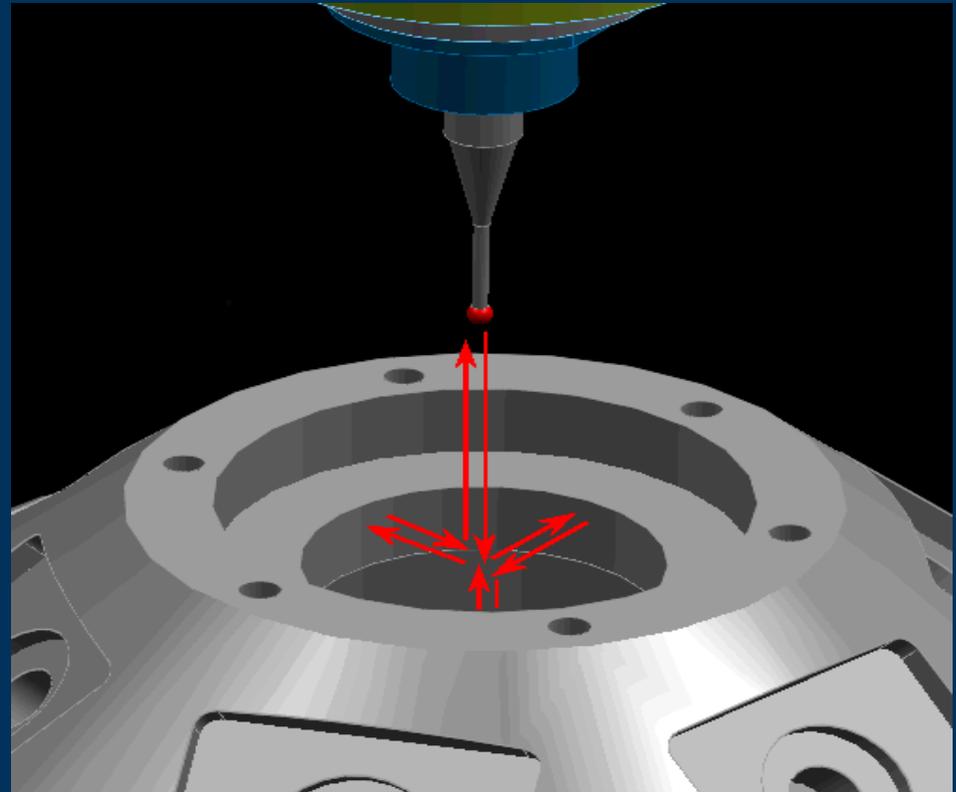




# CMM Probing



- ▶ Support of operation and sub operations for reuse
- ▶ Output in standard DMIS format
- ▶ Other formats supported by post-processors

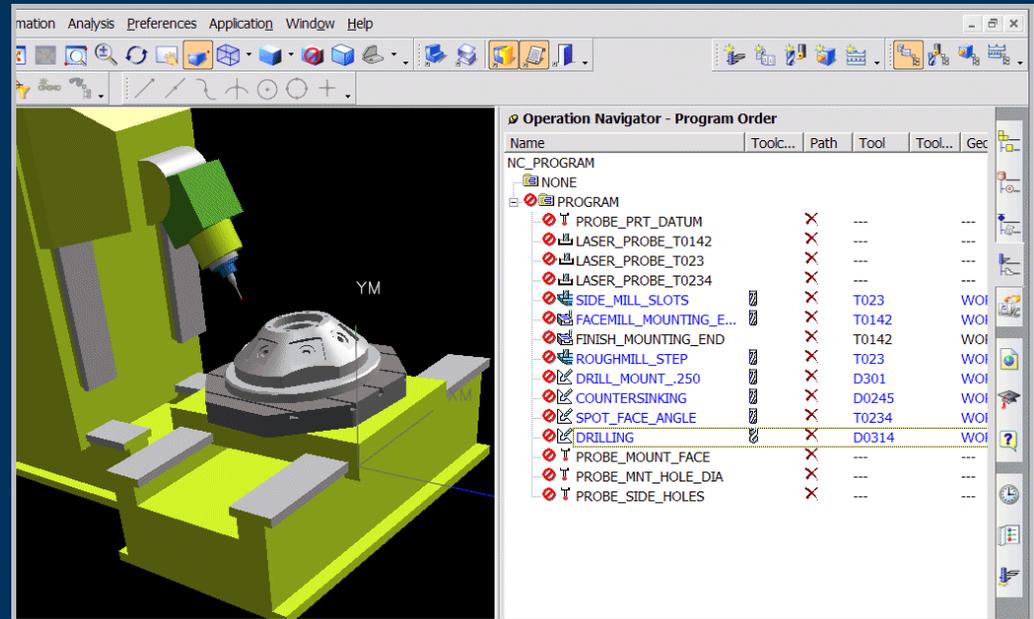




# Operation Management



- ▶ Management of operations through a navigator

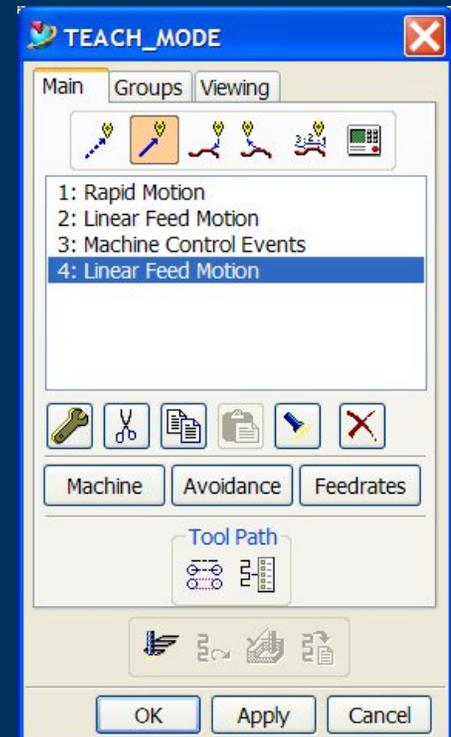




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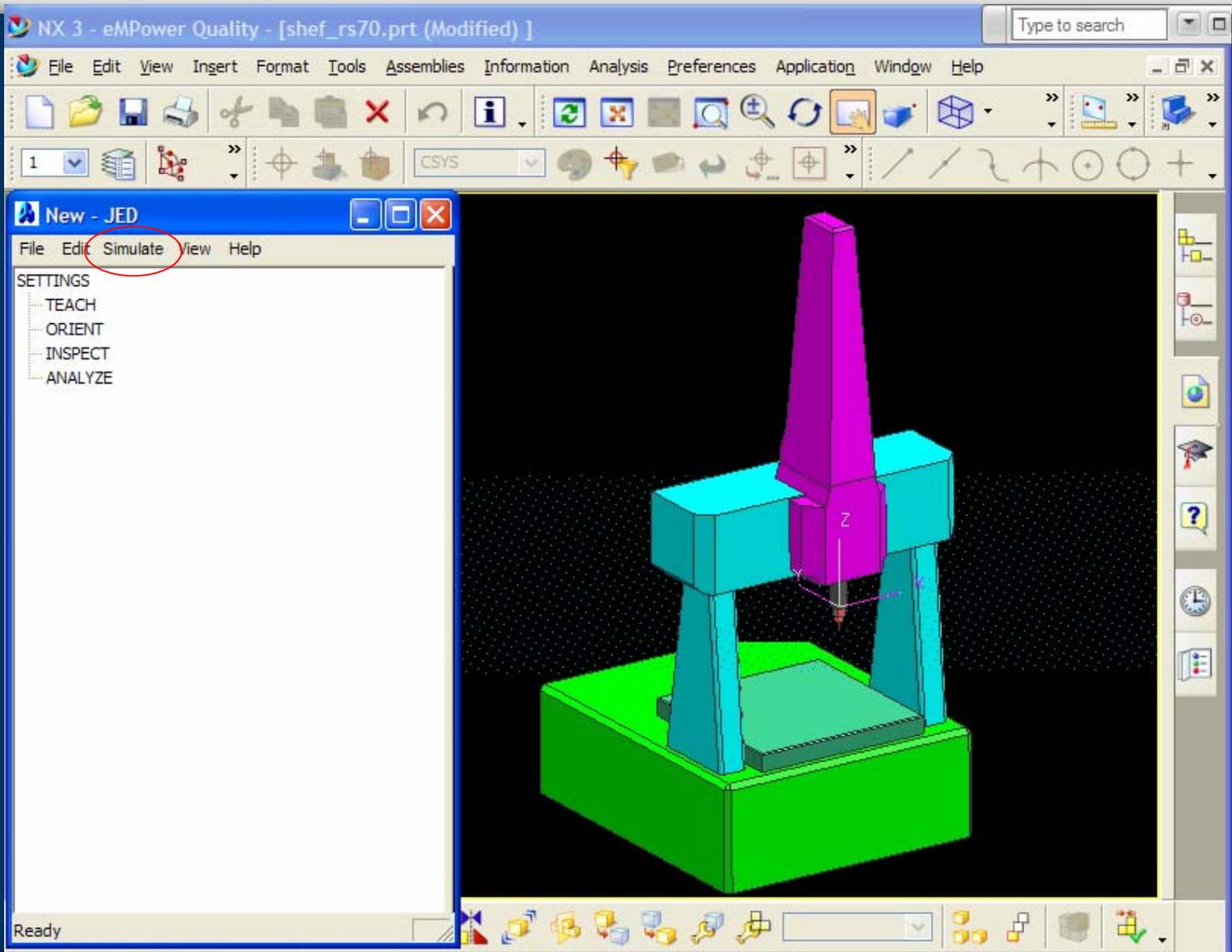




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# Machine Simulation





# Machine Simulation



NX 3 - eMPower Quality - [shef\_rs70.prt (Modified)]

File Edit View Insert Format Tools Assemblies Information Analysis Preferences Application Window Help

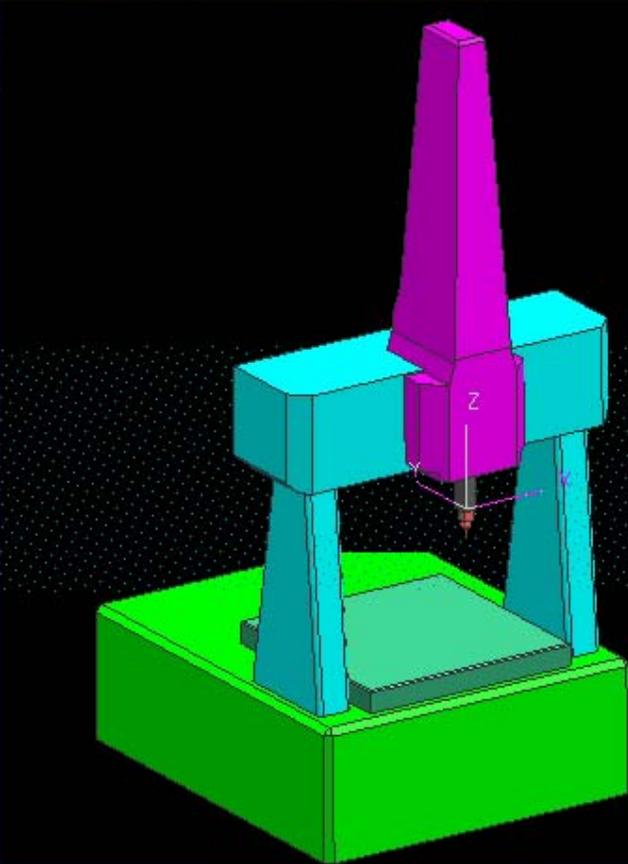
1 CSYS

New - JED

File Edit Simulate View Help

SETTINGS

- TEACH
- ORIENT
- INSPECT
- ANALYZE



Simulation Control Panel

Tool

0 rpm 0.0 ipm

Time 00:00:00.0 Coolant Off

Display Coordinates

Tool  Machine Axes

Z 0.0000

Y 0.0000

X 0.0000

NC Program

Message Window

In-Process Workpiece

Show 3D Material Removal

Analyze

Save as Component

Single Step Block

Animation Speed/Factor

5

1 10

Options Reset

OK Cancel

Ready

Drag cursor to pan view



# eM-Measure Support for Revo



- ▶ Project underway to support the Revo head and UCC2 controller
- ▶ First implementation will support “scan on curve” functionality
- ▶ Initial testing took place at Renishaw in February
- ▶ Commercial Release in Q3



# Revo Head



- ▶ Renscan5™ is only available using the Renishaw UCC2 Universal CMM Controller and forms the basis for Renishaw's future high speed scanning products. Revo™ is the first in a range of developing products and will pave the way for ultra high speed, high accuracy scanning.
- ▶ This new technology is major change to probing technology
- ▶ Benefits
  - ▶ 5-axis style scanning
  - ▶ Fast as non contact laser's
  - ▶ High degree of accuracy
  - ▶ More Data Points

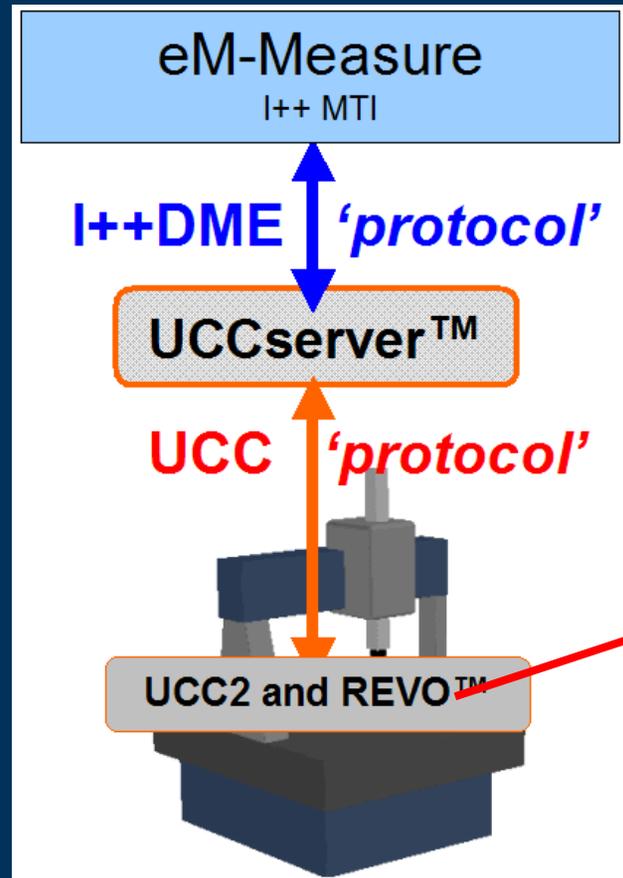




# Renishaw Revo Probe



- ▶ REVO is a dynamic new measuring head and probe system from Renishaw. A revolutionary new product designed to maximize CMM throughput while maintaining high system accuracy.





# Machine types – Collect large point cloud data



CMM



Arm



Laser tracker



FM laser radar



Camera



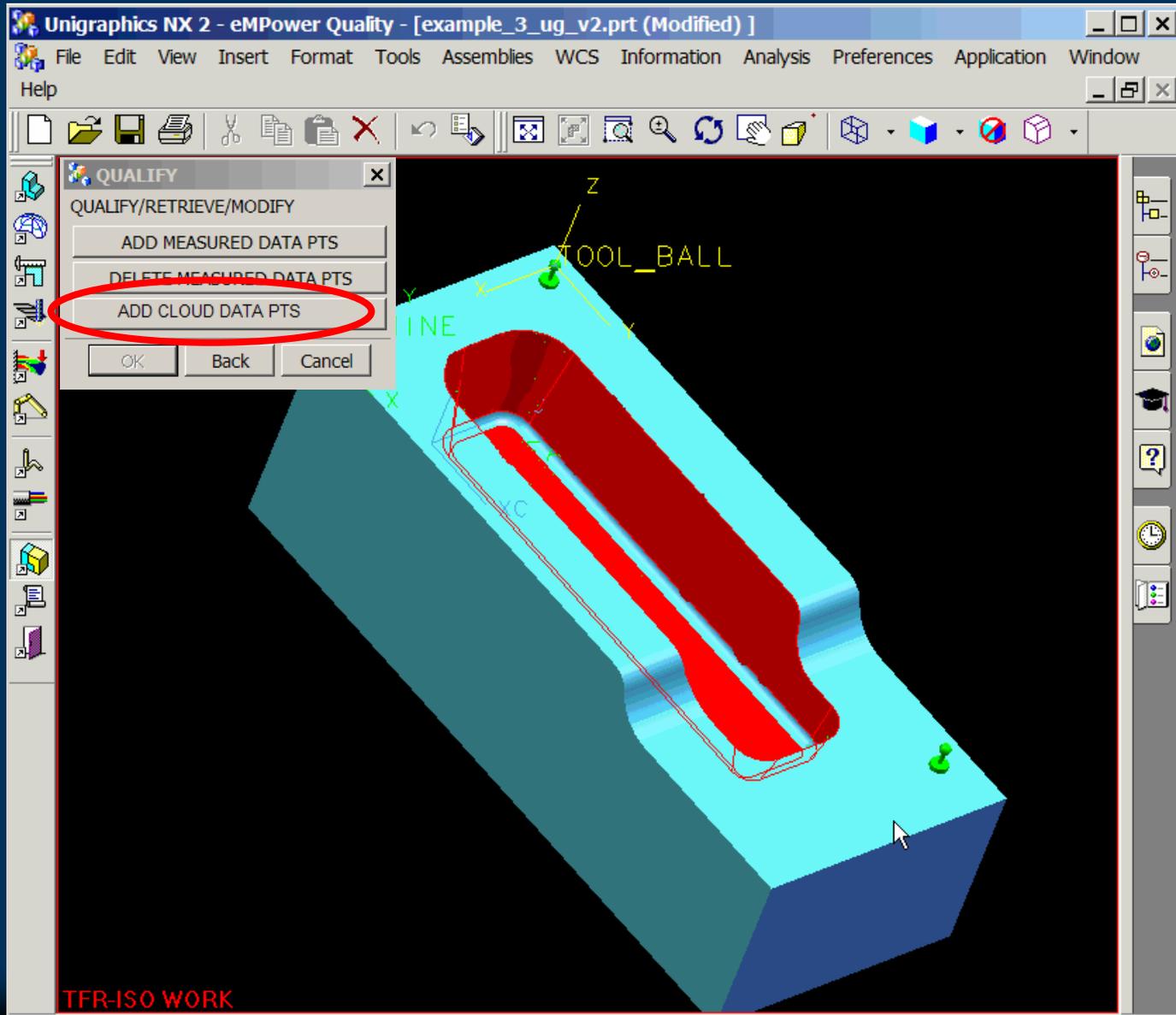
GPS



- ▶ Integration with Imageware
  - ▶ Align LARGE clouds of points with CAD model using Imageware best fit
  - ▶ Utilize Imageware point reduction algorithms to enable Qualify analysis
  - ▶ Benefits
    - ▶ Allow manufacturers to reduce measurement speed with scanning device
    - ▶ Improve geometry representation and accuracy of physical part by collecting large point cloud data: > 1,000,000 points
    - ▶ Analyze large point cloud data with full GD&T analysis to solve manufacturing problems.



# Point Cloud Data Analysis





# Point Cloud Data Analysis



The screenshot displays the Unigraphics NX 2 interface for point cloud analysis. The main window shows a 3D model of a part with a red point cloud overlaid on a cyan mesh. The point cloud is labeled 'TOOL\_BALL' and 'MACHINE'. The model is oriented with X, Y, and Z axes. A 'Point Cloud Data Reduction' dialog box is open in the foreground, showing the following settings:

- Scan File: [Browse]
- Projection Tolerance: 1 mm
- Data Reduction Method:
  - Point Distance: 1 mm
  - Number of Points: 500
- Feature List:
  - Dat\_B
  - Dat\_C
  - Z-Plane1
  - Z-Plane2
  - Z-Plane3
  - Z-Plane4
  - Z-Plane5
  - Z-Plane6
  - Z-Plane7
- Cloud Features: [Empty list]
- Buttons: Add All, Remove All, Add, Remove, OK, Cancel



# Point Cloud Data Analysis



The screenshot shows the Unigraphics NX 2 interface with a 3D model of a part. A red point cloud is overlaid on the model, representing the scanned data. The model is labeled with 'MACHINE' and 'TOOL\_BALL'. The 'Point Cloud Data Reduction Preview' dialog box is open, showing a table of features and their corresponding point counts.

Feature	Cloud Points	Projected Points
703 Tooling Ball 3	3594	430
704 Surface 1	4500	98
705 Surface 2	200	85
706 Surface 3	187	77
707 Surface 4	2999	105
708 Surface 5	95	45
709 Surface 6	3888	505
710 Surface 7	8059	330



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# Integrate eM-Measure with TeamCenter Engineering for “Jobs”



- ▶ A new .Job document type will be supported in TeamCenter Engineering. The Valisys programmer will then be able to upload a “package” of files as an inspection Job into TeamCenter.
- ▶ The CMM operator at the shopfloor will be able to:
  1. Launch eM-Measure from local PC
  2. Click on the “Download” button.
  3. User logs into TeamCenter Engineering
  4. User navigates inside of TeamCenter Engineering to select a .Job package.
  5. User then downloads the inspection .Job which gets automatically unpacked into the correct directories on the local PC.
  6. User then selects Job in eM-Measure and executes inspection Job on the CMM.
  7. Inspection results are viewed locally on the PC



# TeamCenter integration for inspection results (DML)



- ▶ Inspection result (DML) files will be stored in TeamCenter Engineering in the same location as the .Job package.
- ▶ User will be able to view the results by clicking on the DML and then be presented with a readable and printer-friendly HTML format. This is similar to the eM-Measure HTML file today.
- ▶ User can also access the DML data from TeamCenter in eM-Qualify
- ▶ Deliver December 2006



Thank You