



Creo NC Solutions Product Update

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Manufacturing Solutions

Goals and Strategy

- What's new for NC in Creo Parametric

- UI Modernization and usability
- Pro/Toolmaker integration
- New Toolpaths
- High Speed Machining
- More control over toolpath creation
- Perfective maintenance

- Looking forward

- Creo NC Futures

■Goals

- Extends the value of 3D product definitions by creating manufacturing deliverables directly from CAD data
 - Leverage CAD Associativity

■Strategy

- **USABILITY**
- Reliability
- Continue to invest in major industry segments
 - Automotive, Industrial equipment & A&D for OEM & Suppliers
 - Production – Part Machining
 - » Multi-function & High production Machines



Strategic Drivers Explained

■ Usability

- PTC's NC users have recognized that our solutions have a broad and strong set of functionalities.
- We have been investing in providing seamless UI and improved workflows to make our toolpaths easier to use.
- We will continue assigning development effort to automate many tasks while providing more control to the user.

■ Reliability

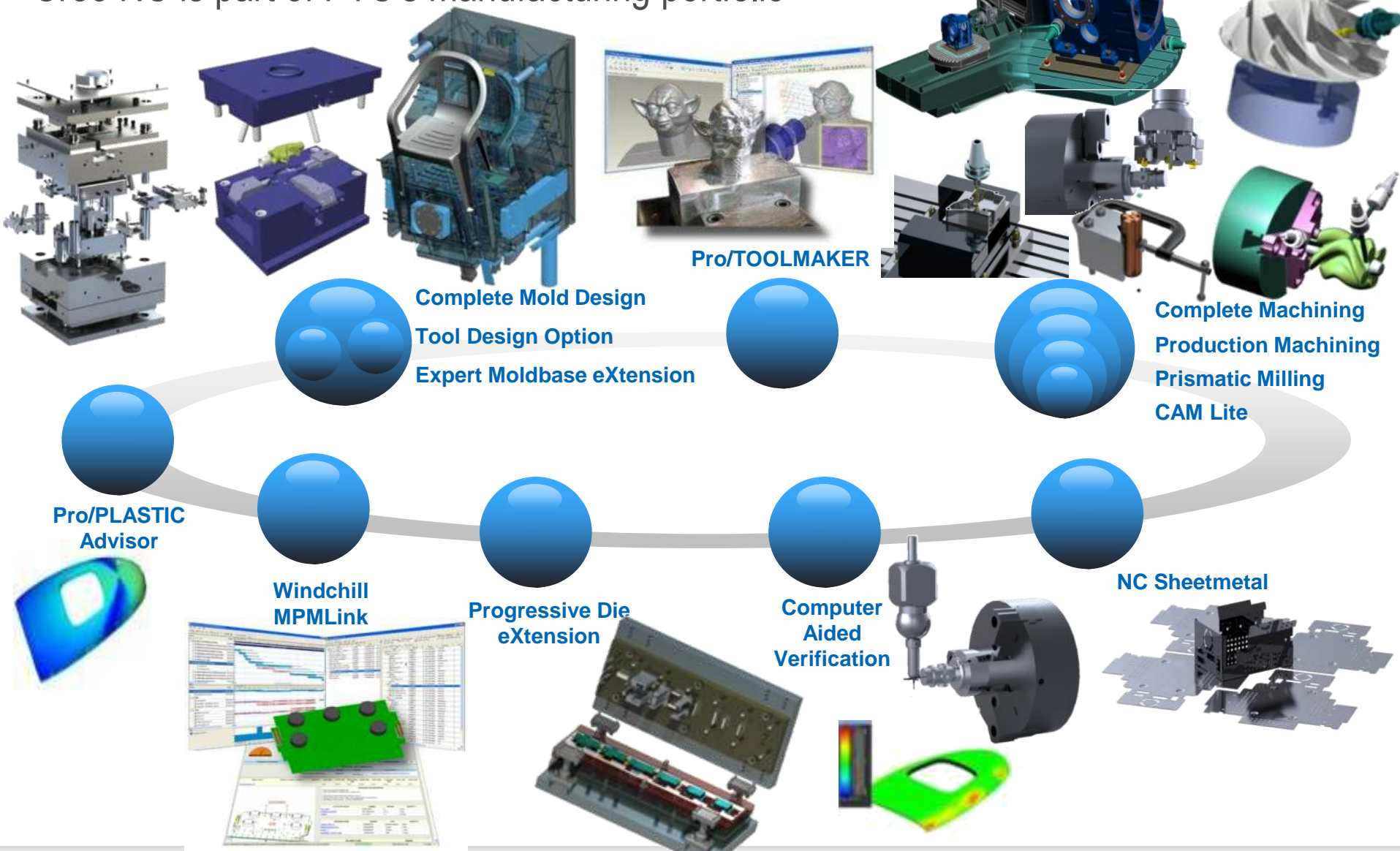
- As we are providing such a broad range of machining capabilities, in some toolpath strategies there were some use-cases not considered in the initial implementations.
- We are investing on addressing the most common use-cases that will complement and perfect our machining toolpaths.
- In Creo 2.0 we covered additional use-cases in CMM, Turning and Milling.

■ Concentration on **Production Machining**

- PTC decided to concentrate its efforts in a single market segment where our strengths are making a difference.
- Production machining is the area where we will focus the effort in the next releases.
- The functionality is related with programming multi-task machines. Like Mill/Turn, Swiss-Type, Rotary-Transfer and so on.

PTC's Manufacturing Solutions Products Portfolio

Creo NC is part of PTC's manufacturing portfolio



Manufacturing Solutions

- Goals and Strategy

What's new for NC in Creo Parametric

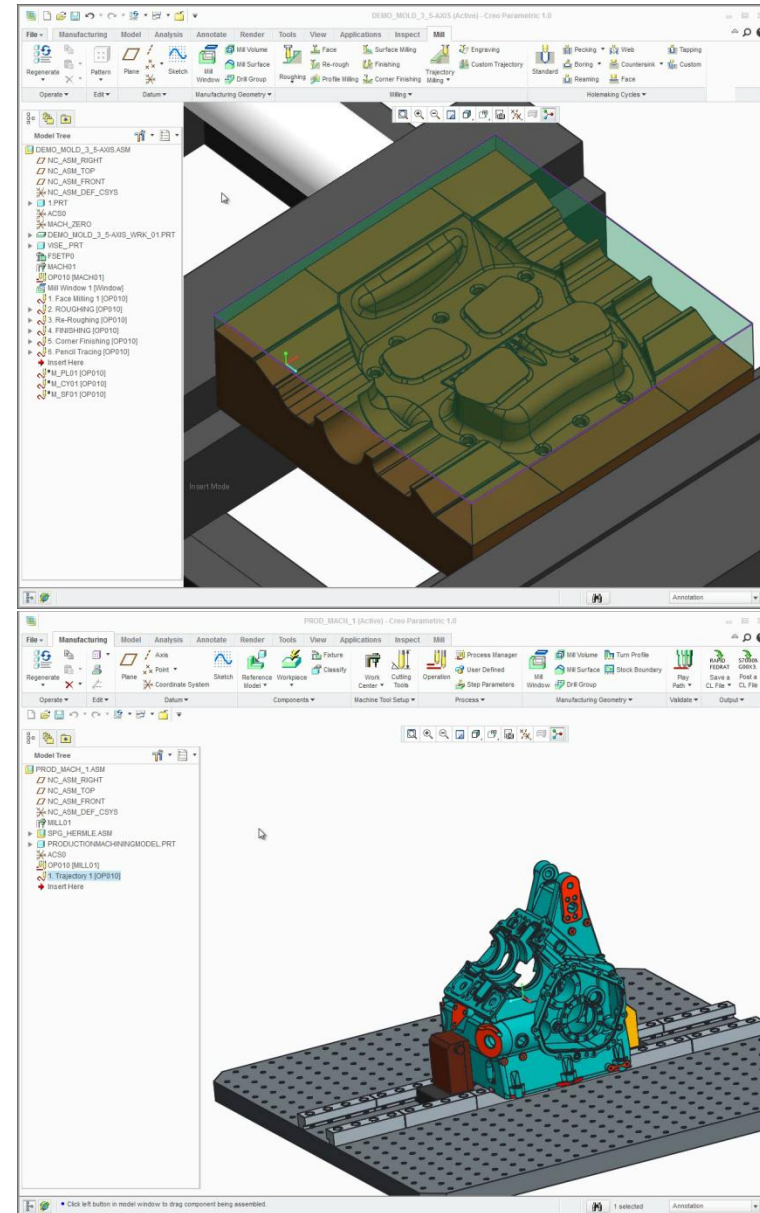
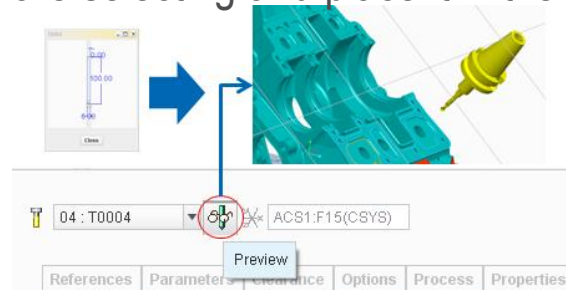
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UI Modernization and usability projects

- **Ribbon based UI**
 - Dashboard for NC Steps
 - Easy access to asynchronous MFG Features
- **Object/Action or Action/Object interaction**
 - Select the Mfg geometry reference then the NC Step tool
- **New Dynamic Preview for toolpath display**
 - A mode where you will view the toolpath updated at every modification (Tool, References, Parameters ...)
- **New Display Tool Preview**
 - Visualize the tool we are selecting and place it in the workpiece context



UI Modernization and usability projects

■ For Trajectory Step:

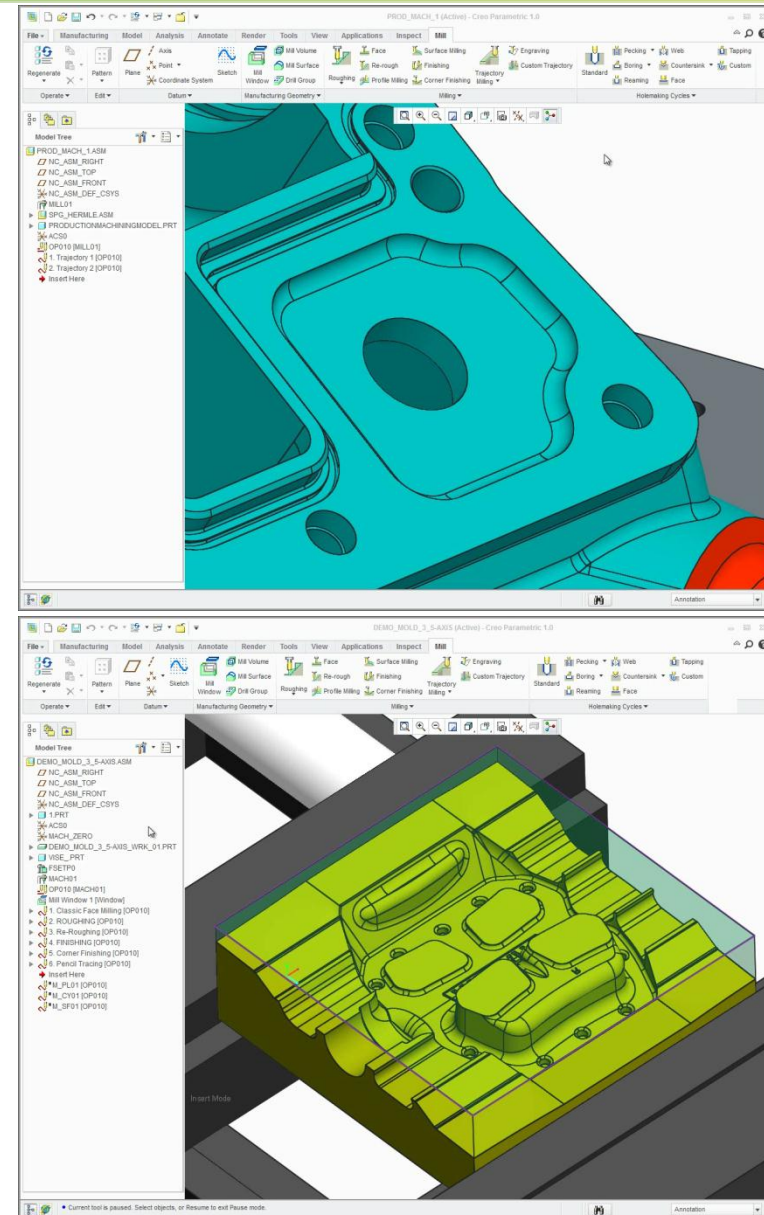
- Start point for closed loop
 - Graphically define the starting point of a closed loop (Curve Cut and Surface Cut)
- Follow cut
 - Define a portion of the cut, by defining the End 1 and End 2.

■ Leverage Pro/TOOLMAKER

- In-Process stock model

■ Creo Toolkit support for Manufacturing features

- Full support to create dashboard-based manufacturing features



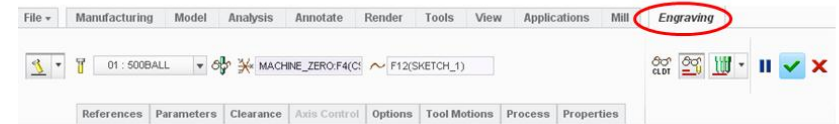
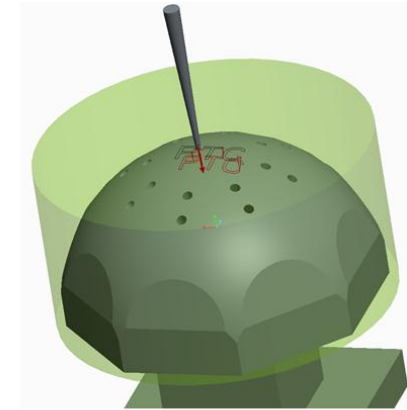
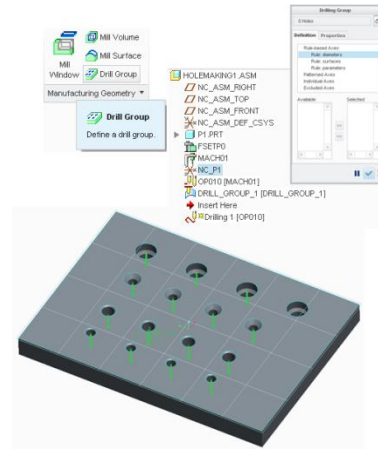
UI Modernization and usability projects

■ Cutline Milling

- Separation of Cut line Milling from Surface Milling.
- Dashboard-based for 3 Axis. (4-5 Axis in Creo 3)

■ Drill Group Definition

- Update Drill Group Definition to reflect Hole Set Definition in Creo 2.0
- Modernize user interaction to use new approaches

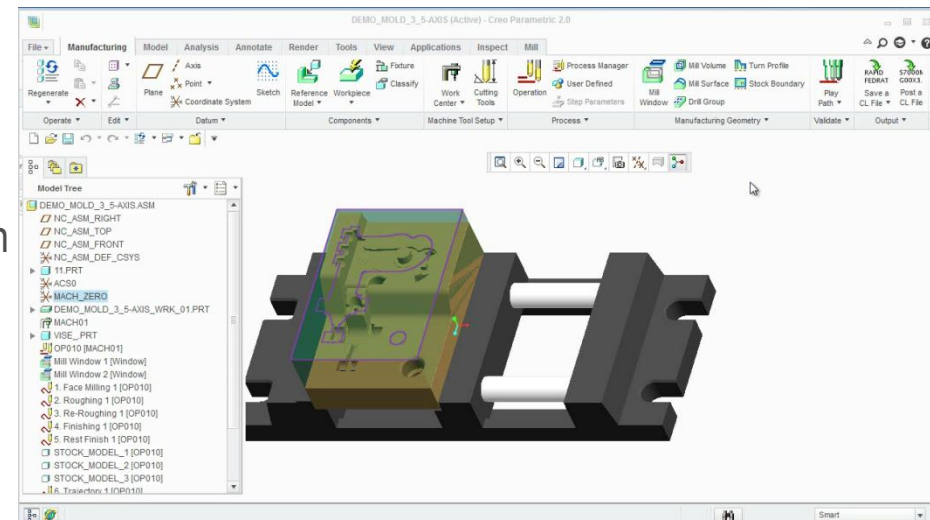


■ Engraving

- Modernization to dashboard

■ RMB

- To provide access to edit step using RMB when working on process manager.
- Start material removal (e.g. Vericut) with RMB, also available from process manager



New algorithms for better toolpaths

■ Cutline:

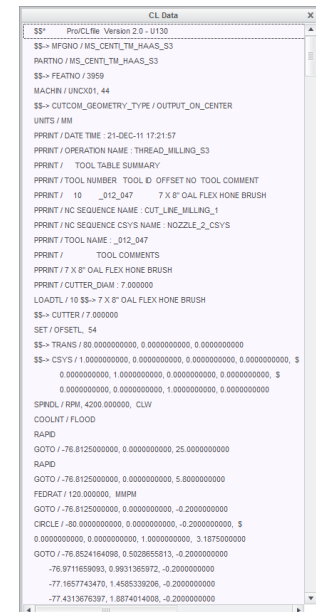
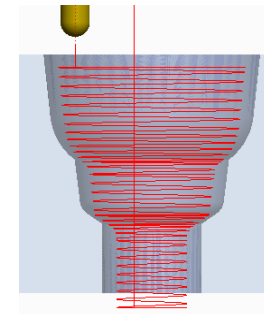
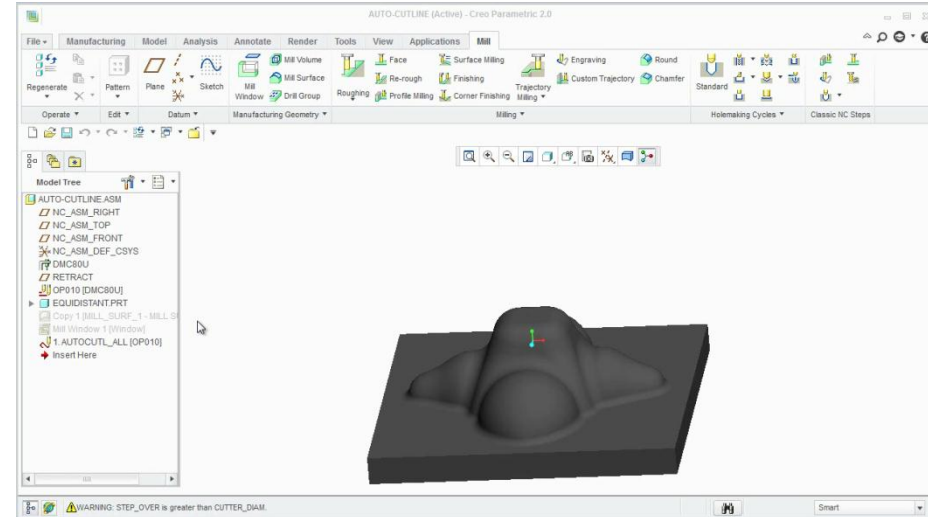
— Auto-Cutline creation

- For TYPE_HELICAL scan type, no cutline needed using this option, just select the surface.

- Two options available: OFFSET and CIRCLE

— Circular output while machining complex holes

- Circular output support for helical toolpaths to machine multi-diameter holes



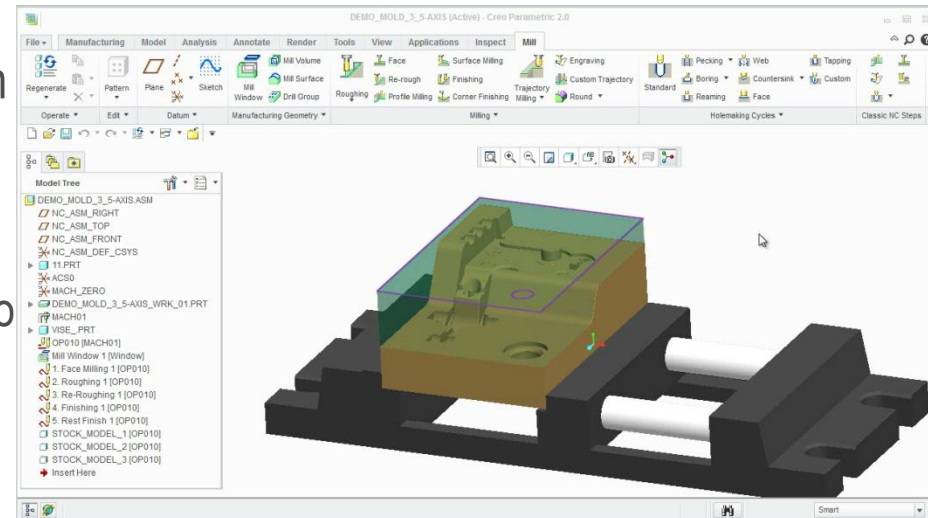
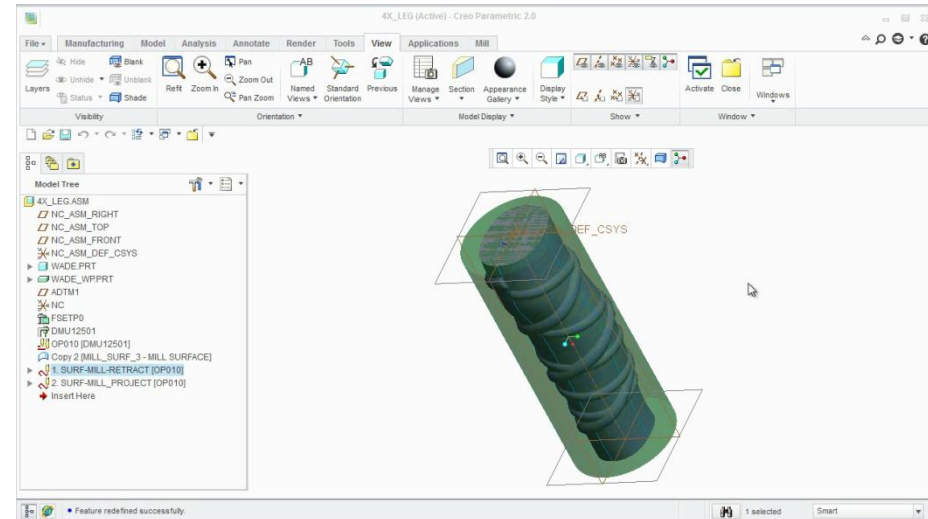
New algorithms for better toolpaths

■ Cutline (Cont...):



- Projected toolpath for 4-5 axis cut line using pivot axis/pivot point
 - A blend of Trajectory and Cutline for efficient machining of core and cavities

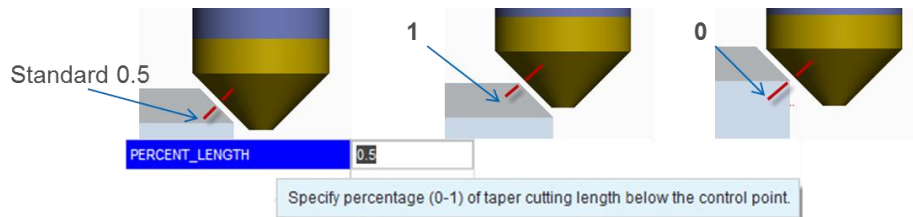
■ Helical 3 axis Trajectory


- A specialized toolpath to create a helical cut motion with a start/end depth or from a surface, then use:
 - a) a controllable ramp option or
 - b) the pitch between each helical cut, to define the helix.

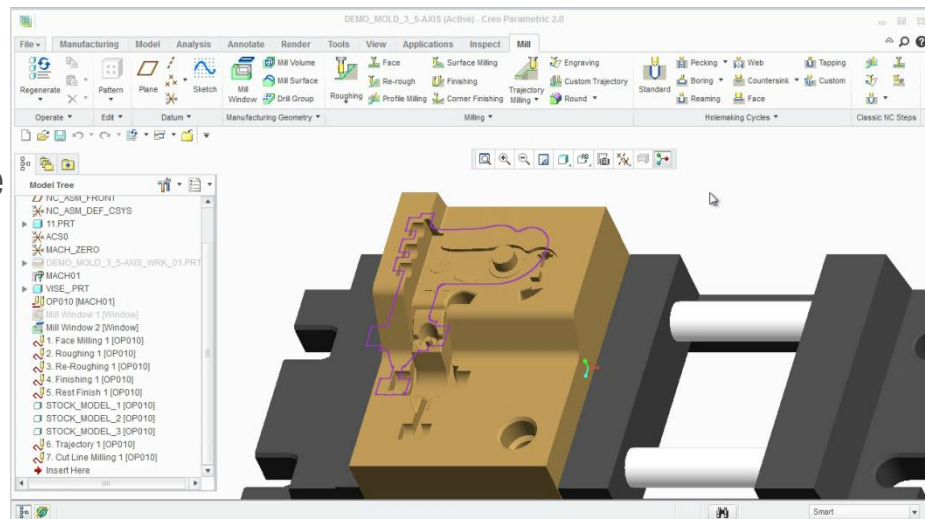
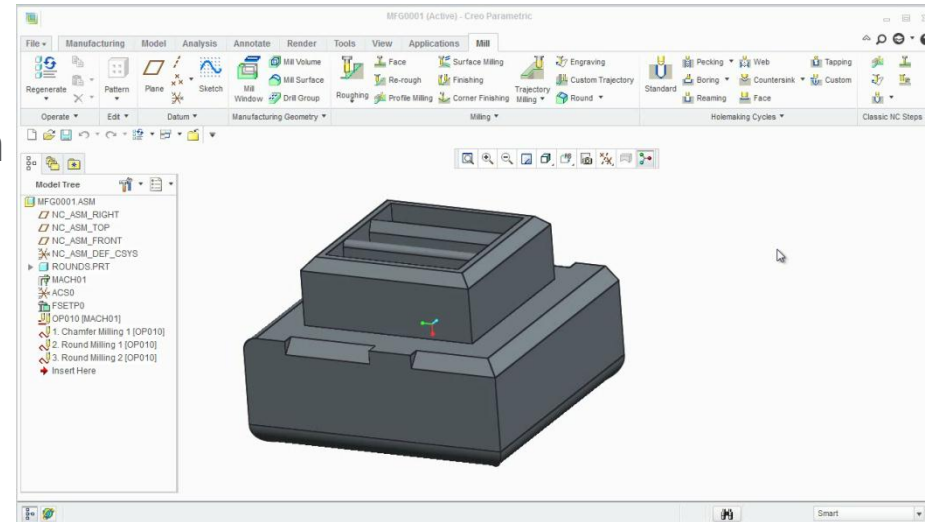
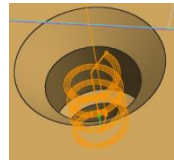


New algorithms for better toolpaths

- **Chamfer and Round milling**


 - Two new buttons “round” and Chamfer” open two new sequences
 - Enhanced chamfering toolpath, with controls for positioning the tool and cl data output



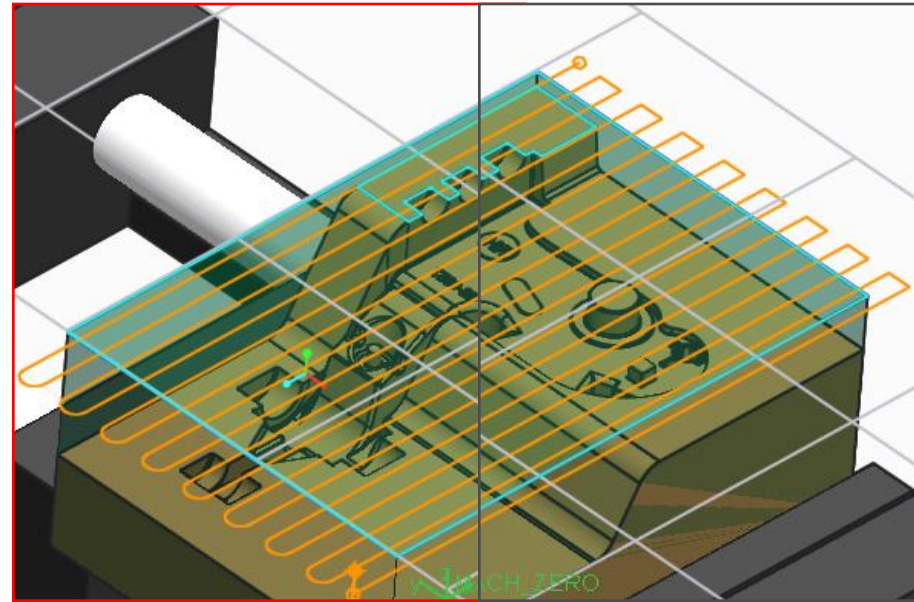
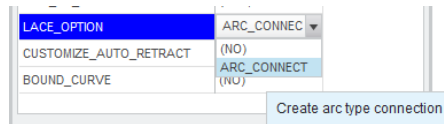
- **Multi-pass thread milling**
 - Create in one definition, roughing, finishing and spring passes. With independent spindle and feeds.
- **Rest finishing**

 - Additional toolpath specialized on rest finishing, leveraging Pro/Toolmaker IP.



Optimizing transitions, plunging and ramps

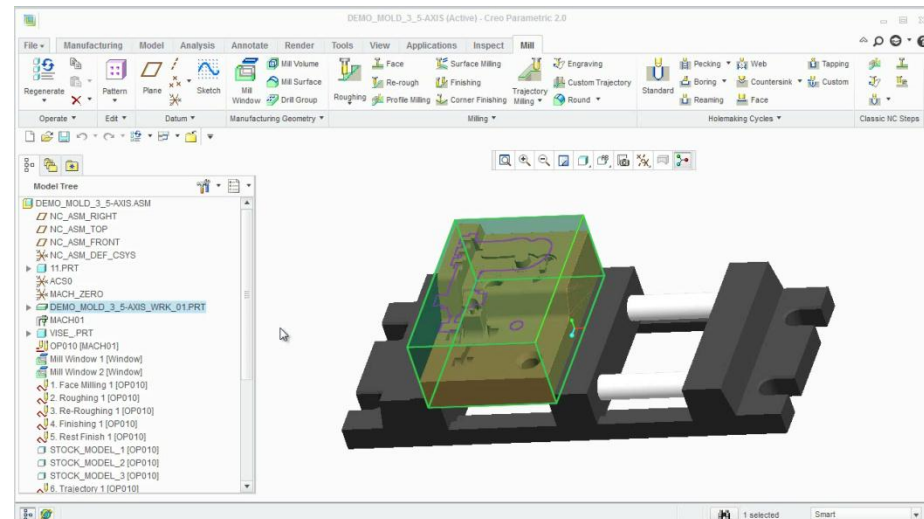
■ Arc Connections in Face Milling

- Arc moves between each cut for higher feedrates and smooth entering into the material



■ Finishing:

- Minimize sharp corners in Finishing
 - For higher feedrates and better surface quality
- Additional bottom clearance for profile portion
- Optimize approach/exit for profile moves



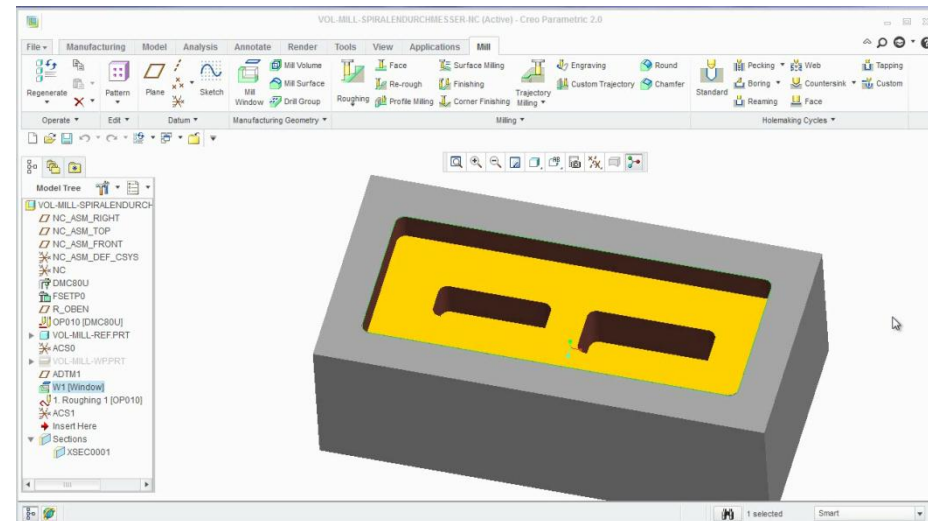
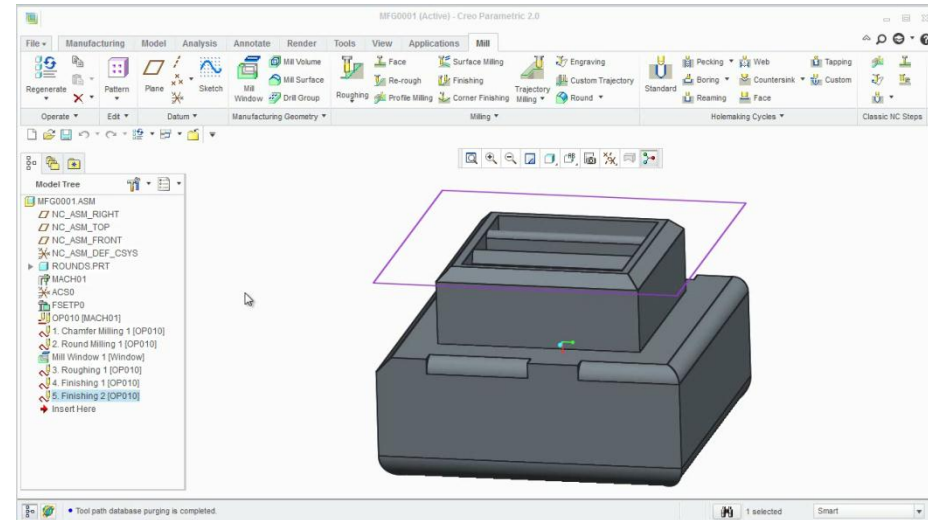
Optimizing transitions, plunging and ramps

■ Roughing

- Consistent distribution of the z-constant slices on vertical walls

■ Volume and roughing

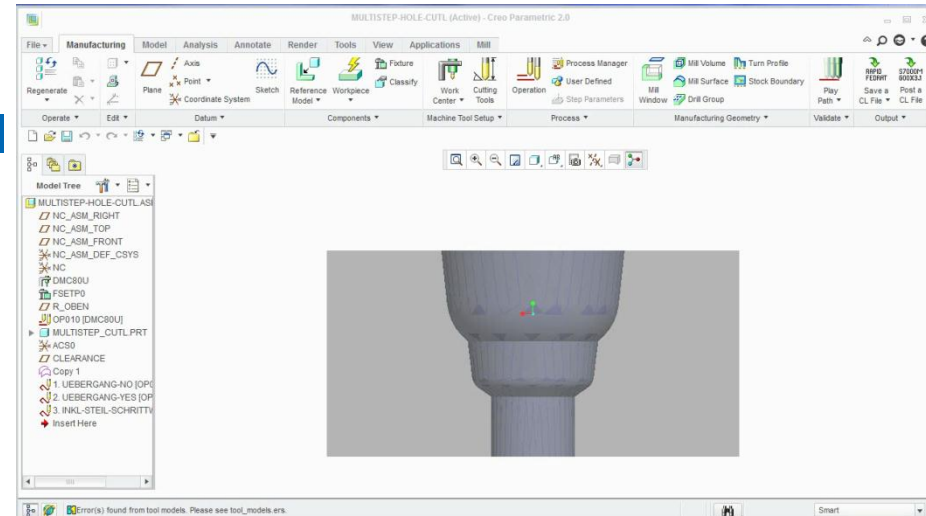
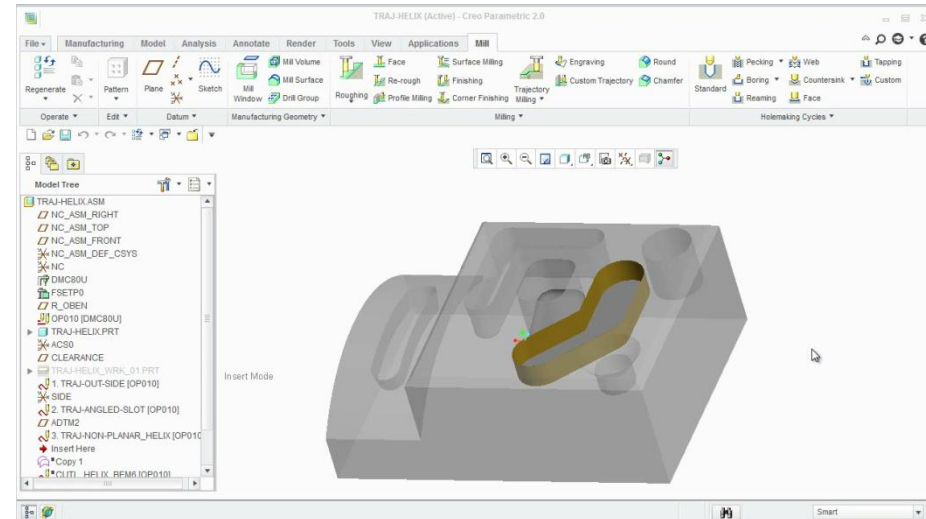
- Helical Plunge automatic adjustment
- Ramp Motion Optimization
 - Output CIRCULAR statements for ramp moves where possible



More control over toolpath creation

Increased options to define the right NC step

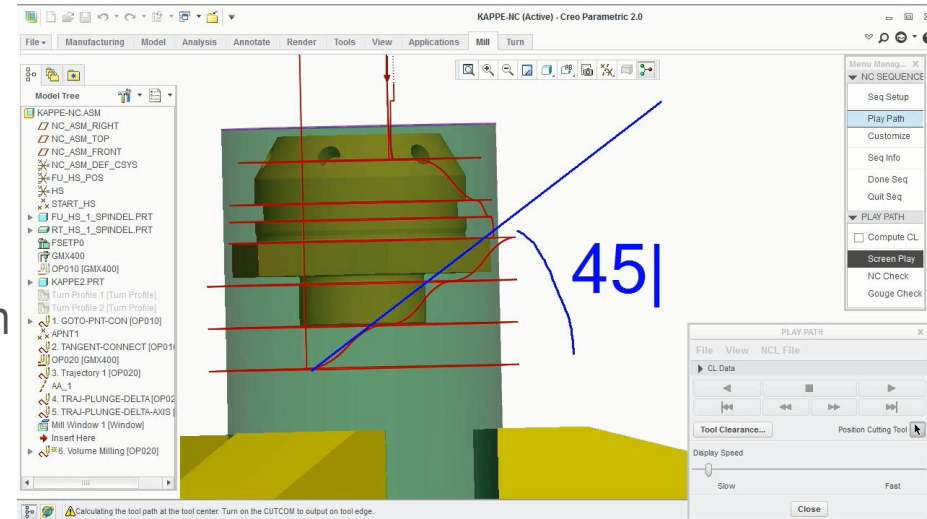
- Open tool motions for all sequences in dashboard
 - For roughing; re-roughing; finishing; corner finishing; rest finishing; 2x trajectory; round and chamfer
- Enable manual cycle for Turning
- Cutline milling. Extra slices for helical toolpath on non-tangential sections
 - Now is possible to have a toolpath following only one helix for surfaces with non-tangential sections



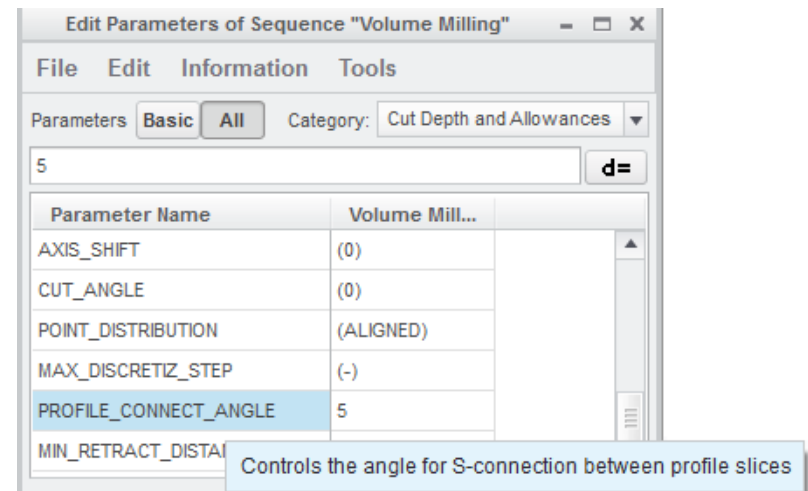
More control over toolpath creation

Increased options to define the right NC step

- **Volume Milling. Variable S-Connections for CONSTANT_LOAD scan, PROF_ONLY**
 - Control the S-Connection inclination between slice (previously was hard coded to 45 degrees)



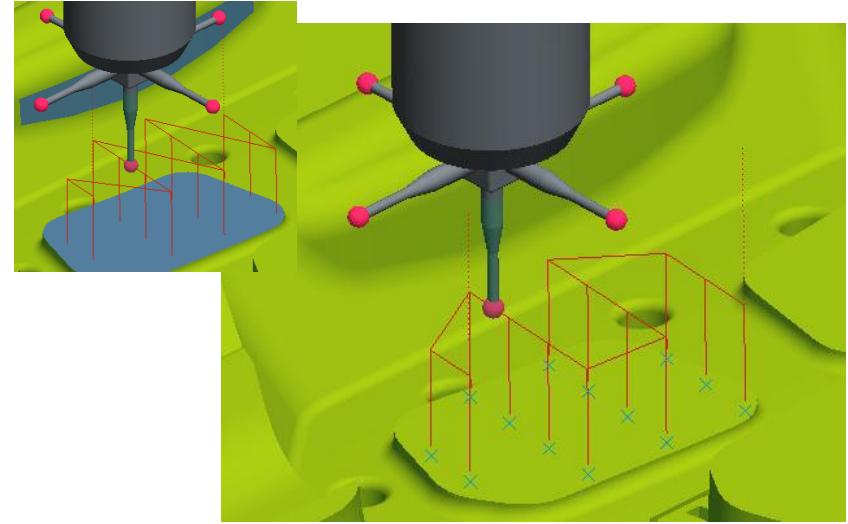
- **CL Data Window**
 - By displaying CL Data while defining/editing a toolpath, the user will know where exactly an inserted command is.



Reliability on toolpath creation

■ CMM Scan Type_1 for planar surfaces

- When scanning a plane, using automatic point creation, the probe path was always in “Zig/Zag” Sweep. Now we have available Scan_Type_1

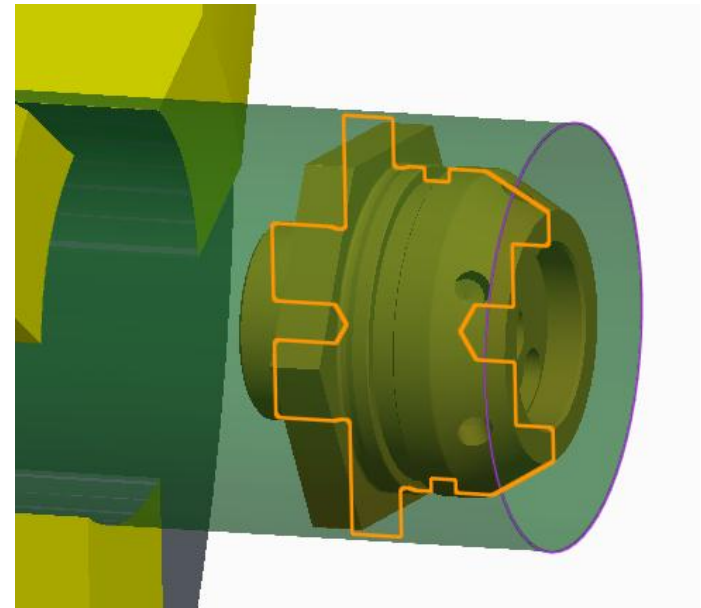


■ CMM Steps

- Re-design of CMM measure steps (internal algorithm only, not UI) to provide more reliable CMM operations
 - Related with interchange assemblies
 - Consistency in UI for usability

■ Turning envelope

- Increased reliability



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Thank You