HyGEARS® V5

HyGEARS THE GEAR PROCESSOR®

Updates / Recent Changes

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HyGEARS 5.0 ™ Updates Contents

HyGEARS update – 04 October 2021 - Build 500.00 - 464

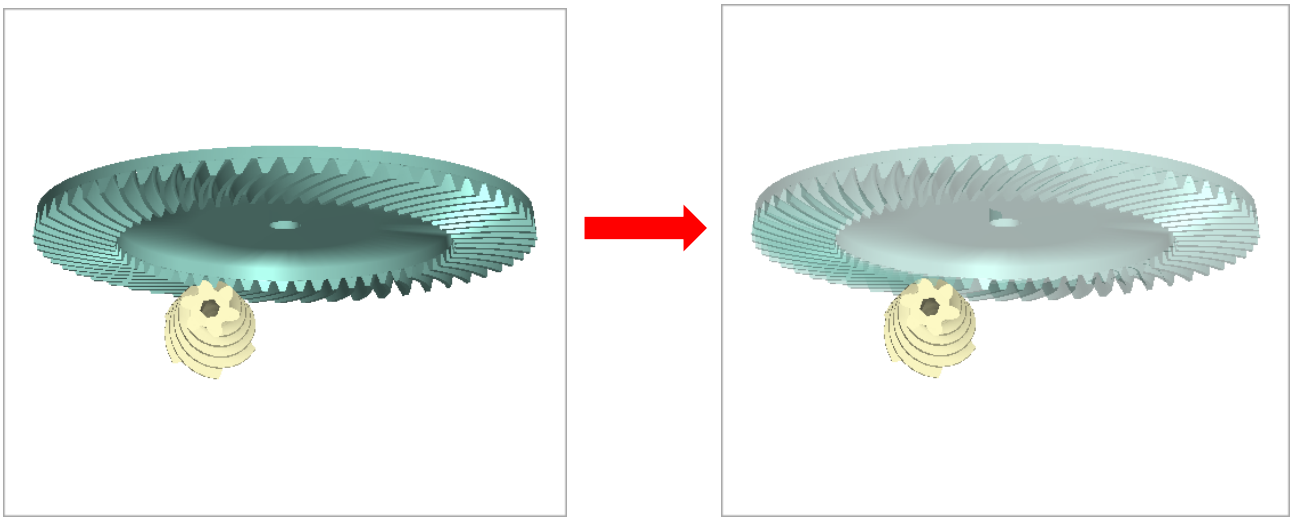
1) In HyGEARS V 5.0, the 3D graphics sub-system has been completely overhauled and is now controlled by the graphics chip on your computer. This results not only in significantly faster 3D displays, but especially in much better hidden lines removal and surface rendering. Note that this applies only to 3D Child Windows.

The paragraphs below describe the mouse and touchpad movements that can be used to control the display.

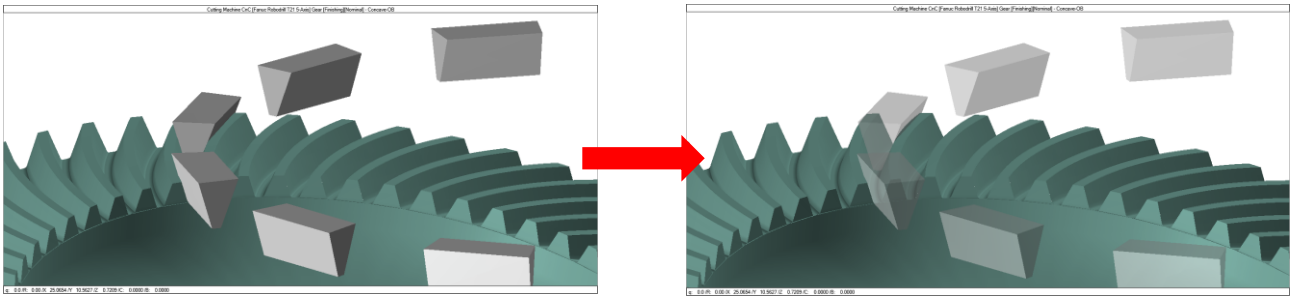
2) To render a Child Window active, you need to click in any area where no material is displayed.

3) Clicking on any element of the display in a 3D Child Window, the element becomes semi-transparent. This is very useful to allow seeing some details that would otherwise not be visible.

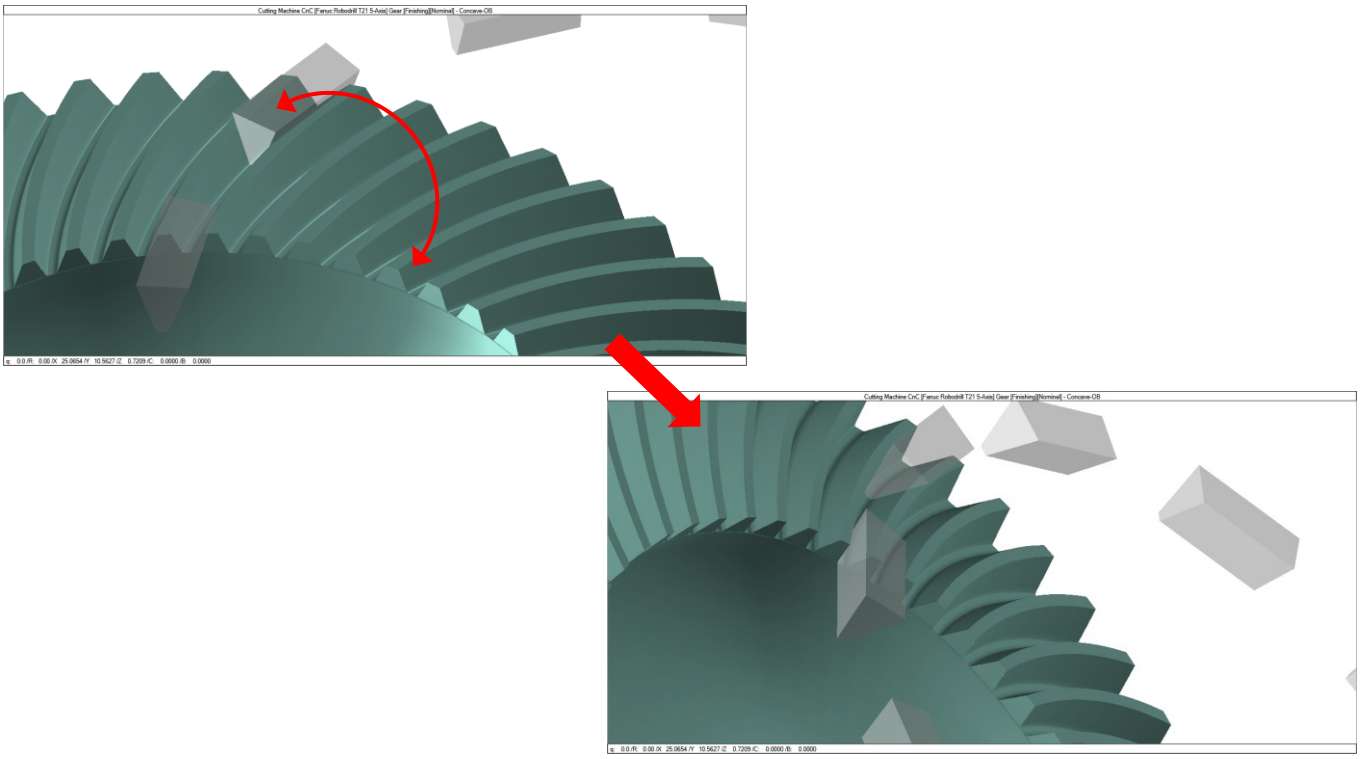
For example, figure below, seeing through the gear member.



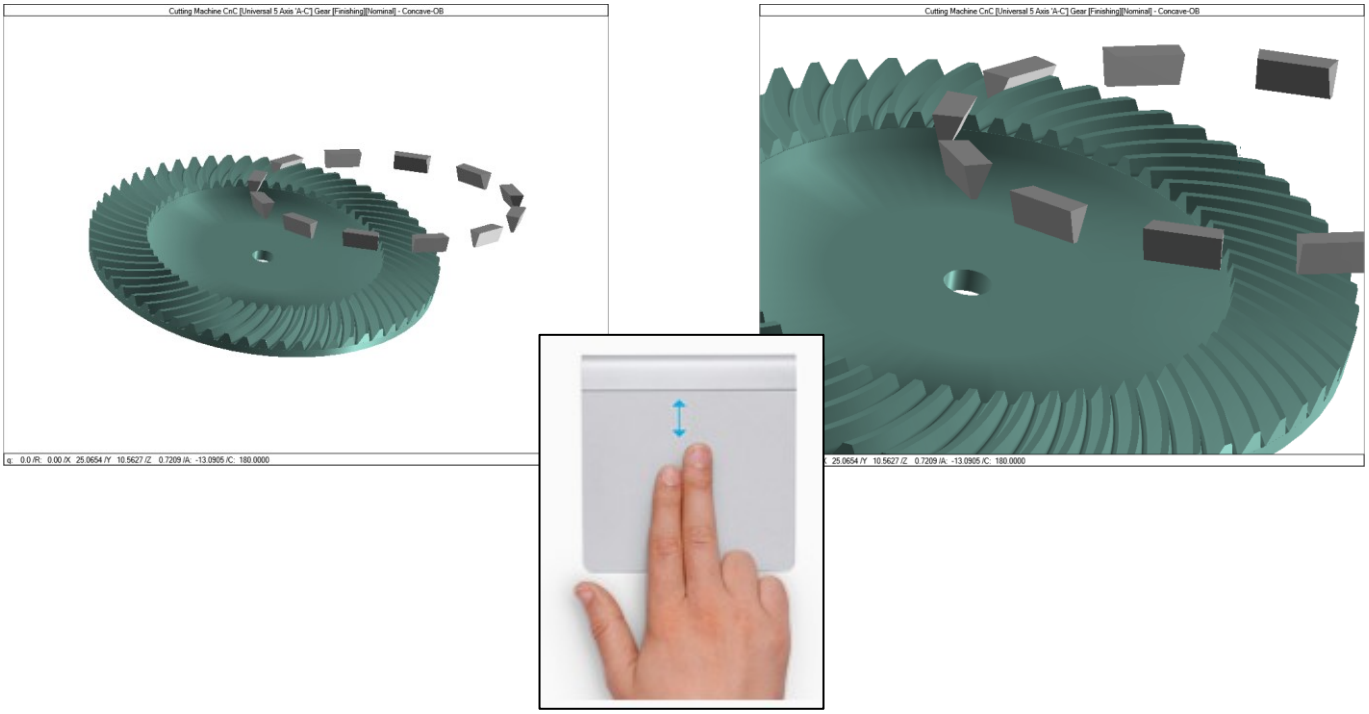
As another example, figure below, seeing through the Face Mill cutter blades.



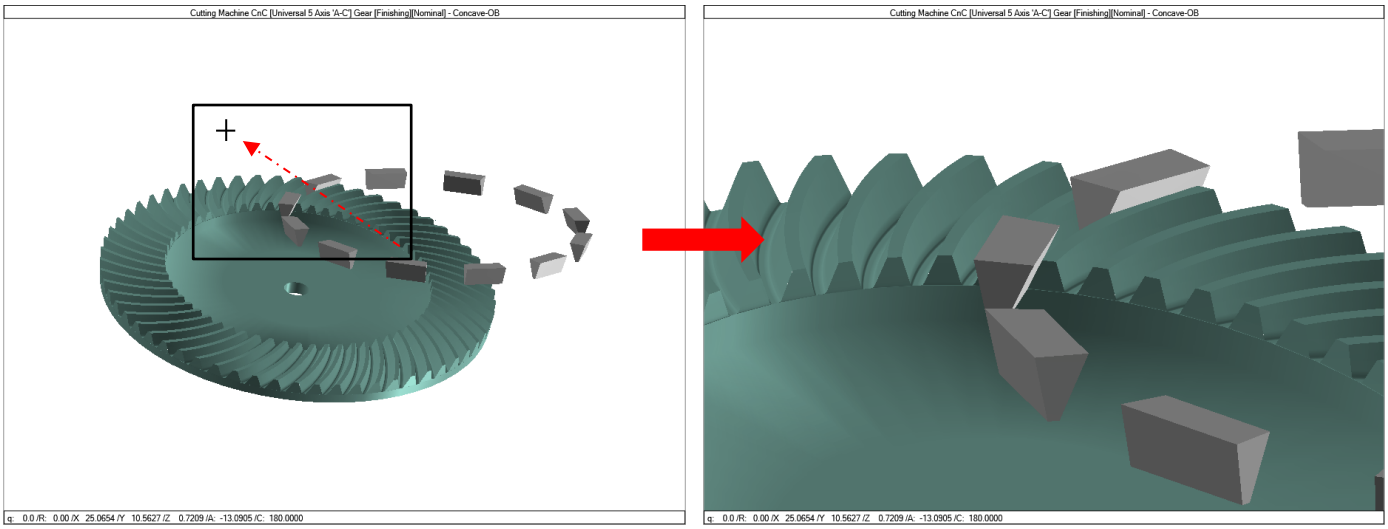
4) In 3D Child Windows, to ***rotate the display***, the left mouse button is clicked while moving the mouse. Note that to rotate the display, HyGEARS requires a ***pivot point*** attached to the model; this means that there must be part of the model sitting at the center of the Child Window.



5) In 3D Child Windows, to ***Zoom In / Out the display***, the mouse scroll wheel is rotated or, on a touch pad, two fingers are slid up (Zoom In) or down (Zoom Out). The In / Out zooming movement depends on how your computer is configured for scrolling actions.

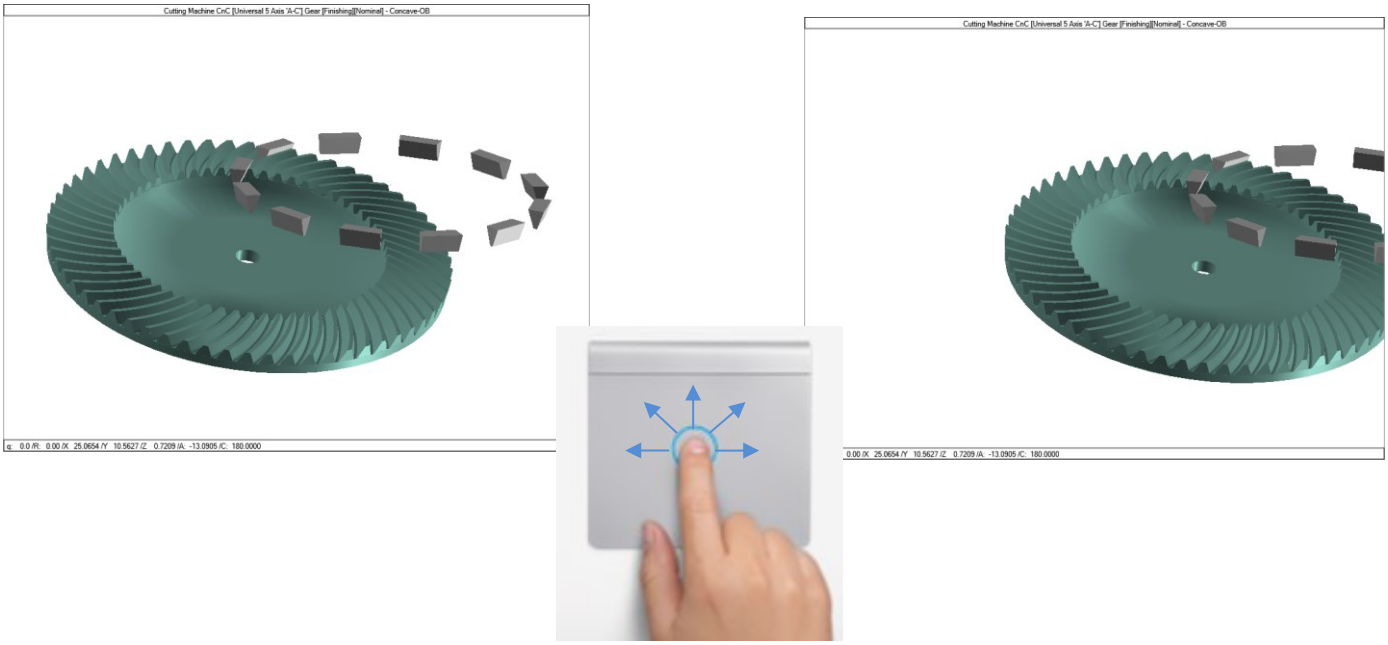


Alternately, the Zoomed area may be selected by drawing a ***zooming rectangle*** around the region of interest. The ***zooming rectangle*** is initiated by clicking the left mouse button and holding the Ctrl key at the same time. The mouse pointer then changes to a + and the *zooming rectangle* is displayed in solid lines as the mouse is moved.

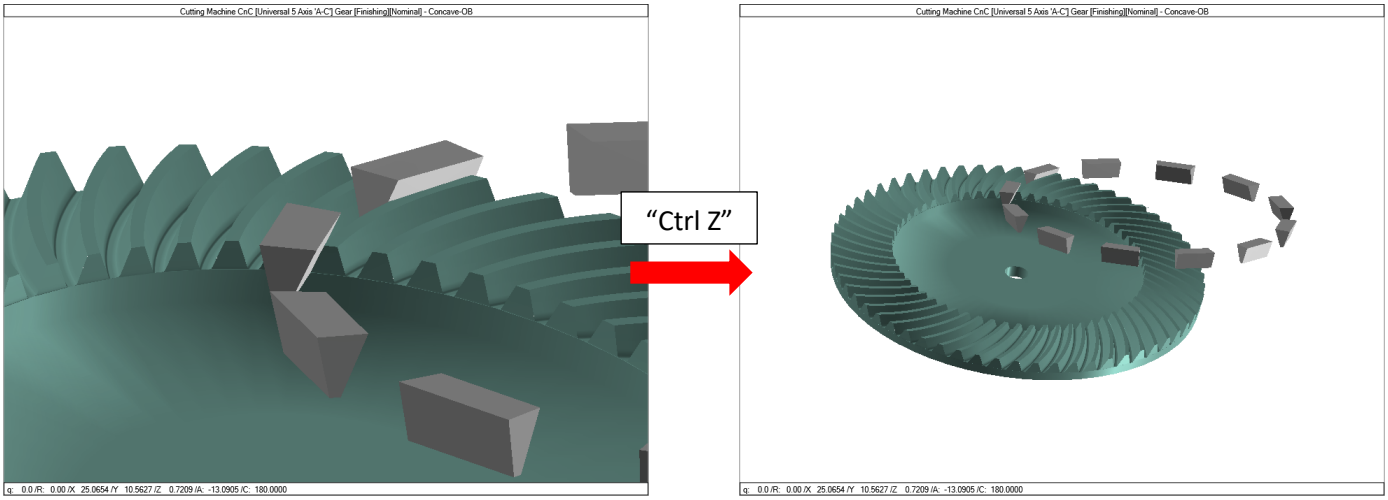


Finally, the “Ctrl +” or “Ctrl I” keyboard combinations ***Zoom In*** the display by 20%, while “Ctrl -” or “Ctrl U” keyboard combinations ***Zoom Out*** the display by 20%.

6) In 3D Child Windows, to ***Pan the display***, the center mouse button is clicked while moving the mouse in any direction.

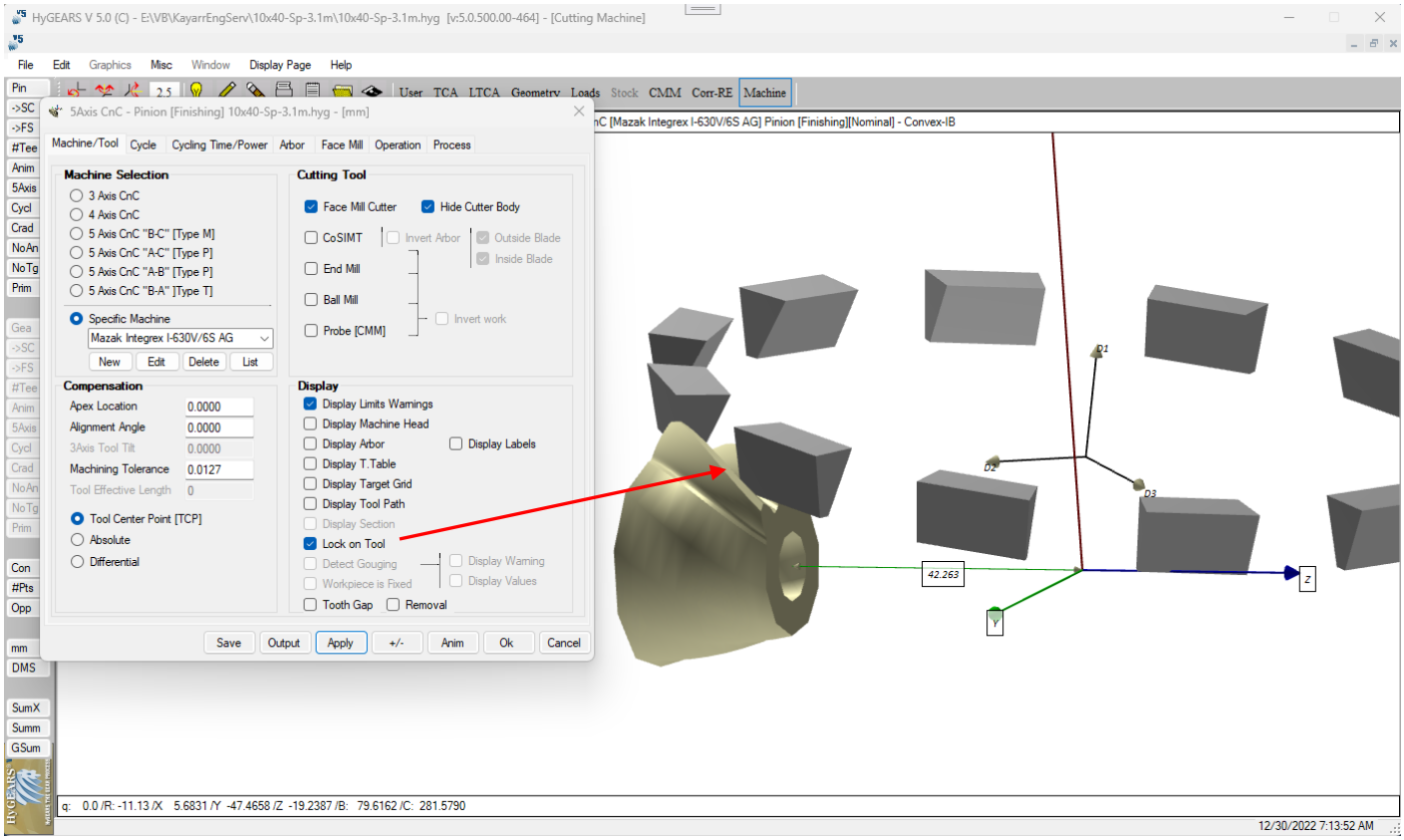


7) In 3D Child Windows, to ***Reset the display***, i.e. to center the model in the Child Window and fit it within the Child Window borders, the Ctrl Z (^Z) keyboard combination is used.


Cutting Machine CnC [Universal 5 Axis 'A-C'] Gear [Finishing][Nominal] - Concave-OB
q: 0.0 /R: 0.00 /X 25.0654 /Y 10.5627 /Z 0.7209 /A: -13.0905 /C: 180.0000
“Ctrl Z”
Cutting Machine CnC [Universal 5 Axis 'A-C'] Gear [Finishing][Nominal] - Concave-OB
q: 0.0 /R: 0.00 /X 25.0654 /Y 10.5627 /Z 0.7209 /A: -13.0905 /C: 180.0000

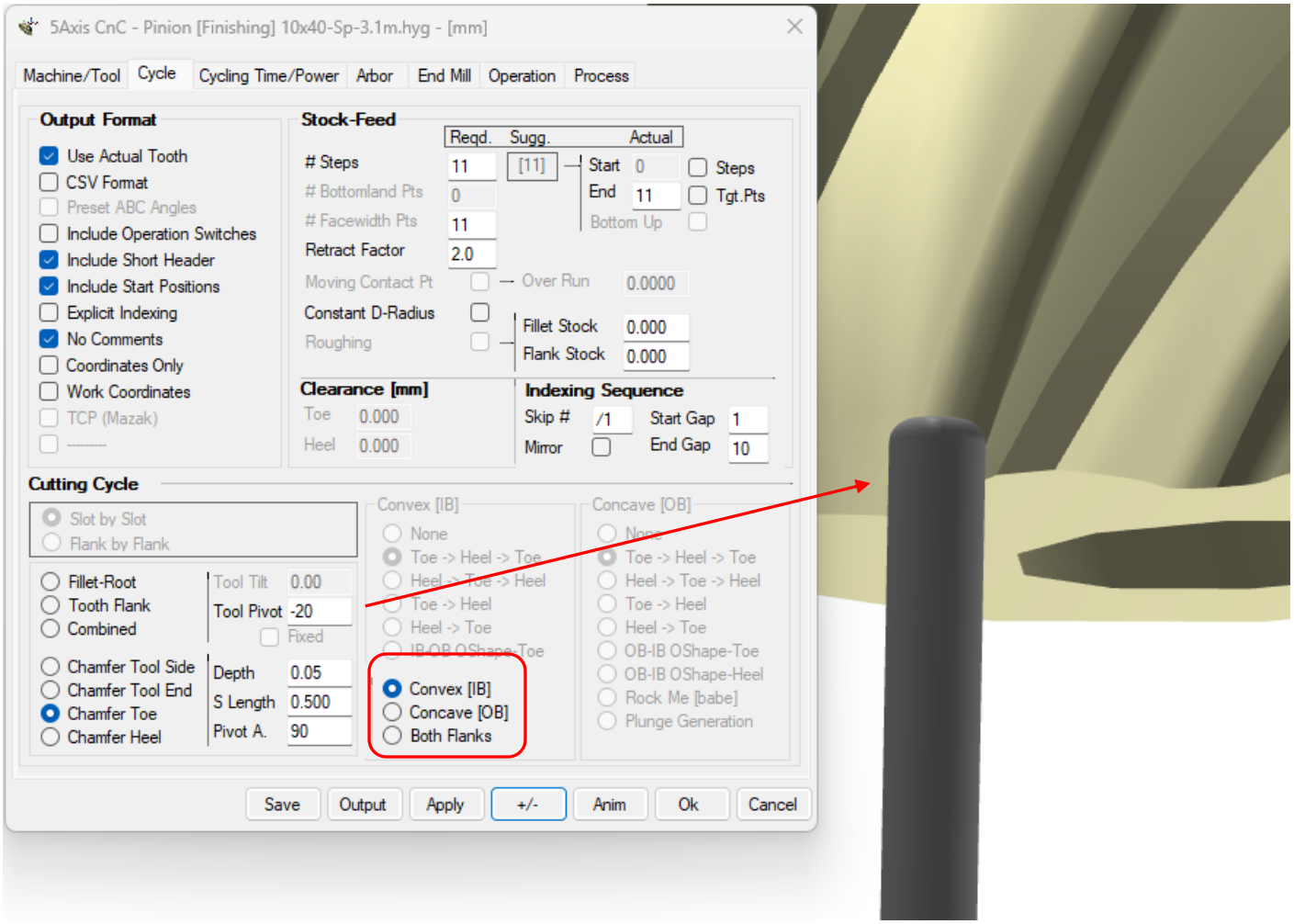
HyGEARS update – 09 January 2023 - Build 500.10 - 465

1) In 5Axis, the Lock on Tool (^L) option is now available for Face Milling and Coniflex tools. When this feature is selected for these tools, HyGEARS will focus on a point at tooth mid-face width.



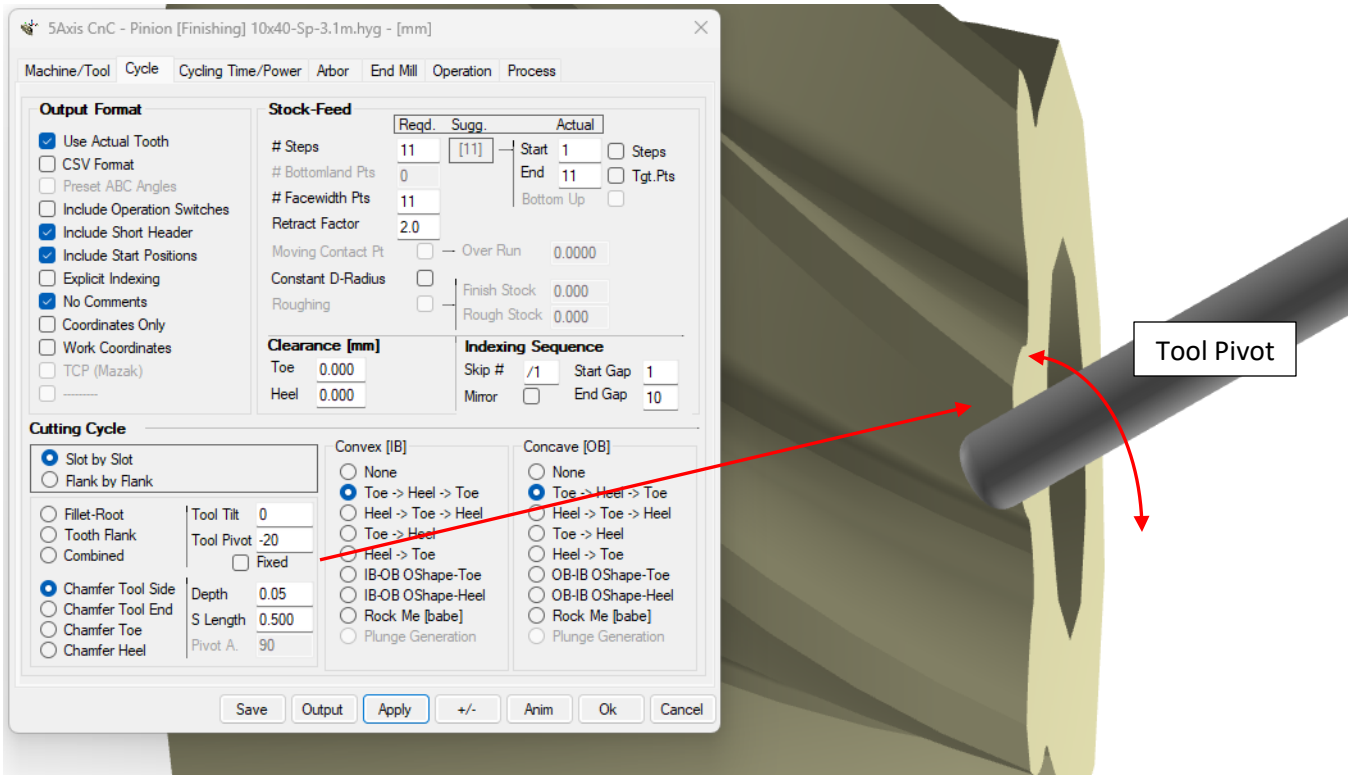
2) In 5Axis, when Chamfering at Toe / Heel with an End Mill tool, the Tool Pivot field is now enabled to allow the optimization of the chamfered edge. The Tool Pivot can be a + or – angle.

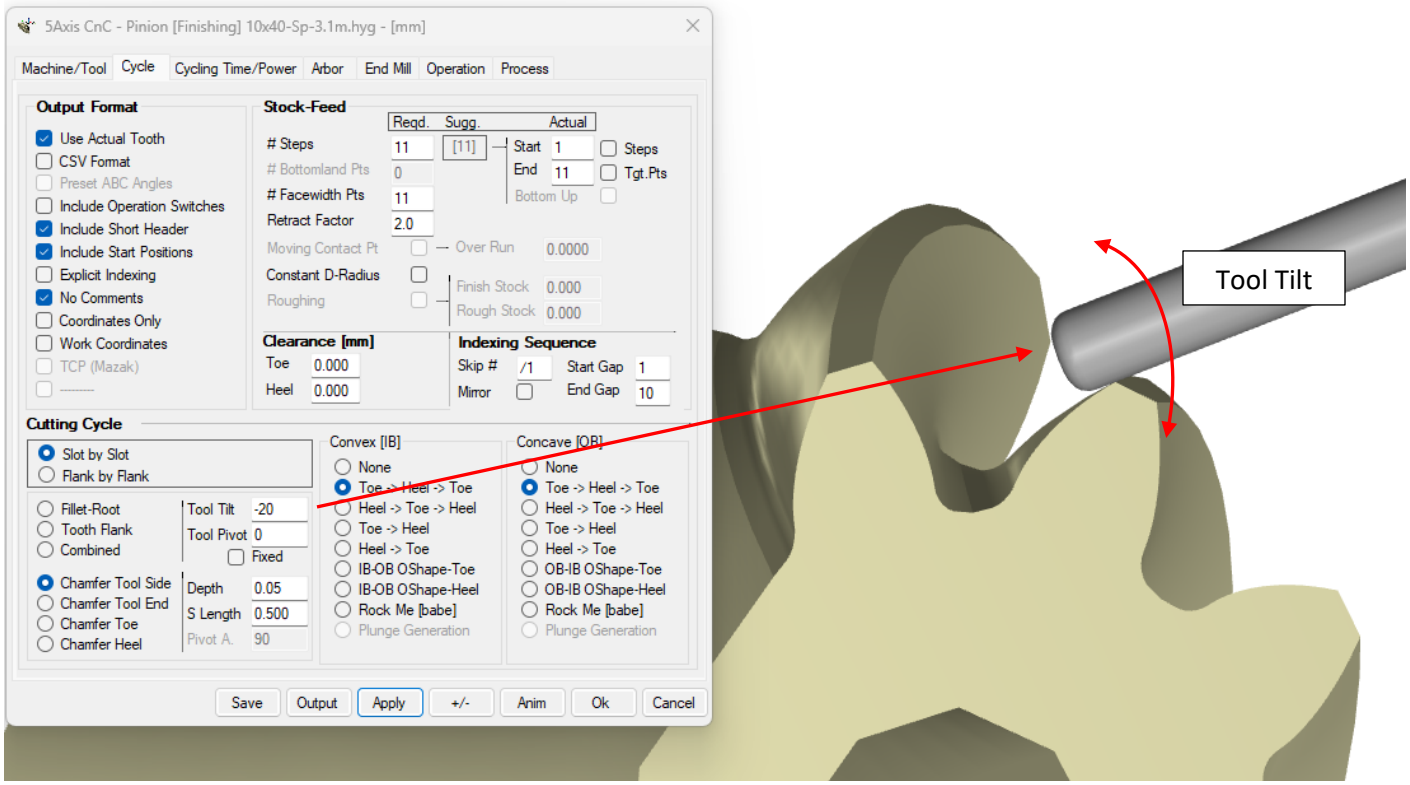
Since the tooth flanks can be selected individually, this allows tailoring the chamfering operation to the specific depth and angle that is required to obtain even chamfers on both tooth flanks.



3) In 5Axis, when Chamfering Tip with an End Mill tool, the Tool Pivot and Tool Tilt fields are now activated to allow the optimization of the chamfered edges.

The Tool tilt and Pivot can be + or – angles. Since the tooth flanks can be selected individually, this allows tailoring the chamfering operation to the specific depth and angle that is required to obtain even chamfers on both tooth tips.


5Axis CnC - Pinion [Finishing] 10x40-Sp-3.1m.hyg - [mm]
Machine/Tool
Cycle
Cycling Time/Power
Arbor
End Mill
Operation
Process
Output Format
Use Actual Tooth
CSV Format
Preset ABC Angles
Include Operation Switches
Include Short Header
Include Start Positions
Explicit Indexing
No Comments
Coordinates Only
Work Coordinates
TCP (Mazak)
Stock-Feed
Reqd.
Sugg.
Actual
Steps
Bottomland Pts
Facewidth Pts
Retract Factor
Moving Contact Pt
Over Run
Constant D-Radius
Roughing
Finish Stock
Rough Stock
Start
End
Bottom Up
Steps
Tgt.Pts
Clearance [mm]
Toe
Heel
Indexing Sequence
Skip #
Mirror
Start Gap
End Gap
Cutting Cycle
Slot by Slot
Flank by Flank
Fillet-Root
Tooth Flank
Combined
Tool Tilt
Tool Pivot
Fixed
Chamfer Tool Side
Chamfer Tool End
Chamfer Toe
Chamfer Heel
Depth
S Length
Pivot A.
Convex [IB]
None
Toe -> Heel -> Toe
Heel -> Toe -> Heel
Toe -> Heel
Heel -> Toe
IB-OB OShape-Toe
IB-OB OShape-Heel
Rock Me [babe]
Plunge Generation
Concave [OB]
None
Toe -> Heel -> Toe
Heel -> Toe -> Heel
Toe -> Heel
Heel -> Toe
OB-IB OShape-Toe
OB-IB OShape-Heel
Rock Me [babe]
Plunge Generation
Save
Output
Apply
+/-
Anim
Ok
Cancel
Tool Pivot


5Axis CnC - Pinion [Finishing] 10x40-Sp-3.1m.hyg - [mm]
Machine/Tool
Cycle
Cycling Time/Power
Arbor
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Operation
Process
Output Format
Use Actual Tooth
CSV Format
Preset ABC Angles
Include Operation Switches
Include Short Header
Include Start Positions
Explicit Indexing
No Comments
Coordinates Only
Work Coordinates
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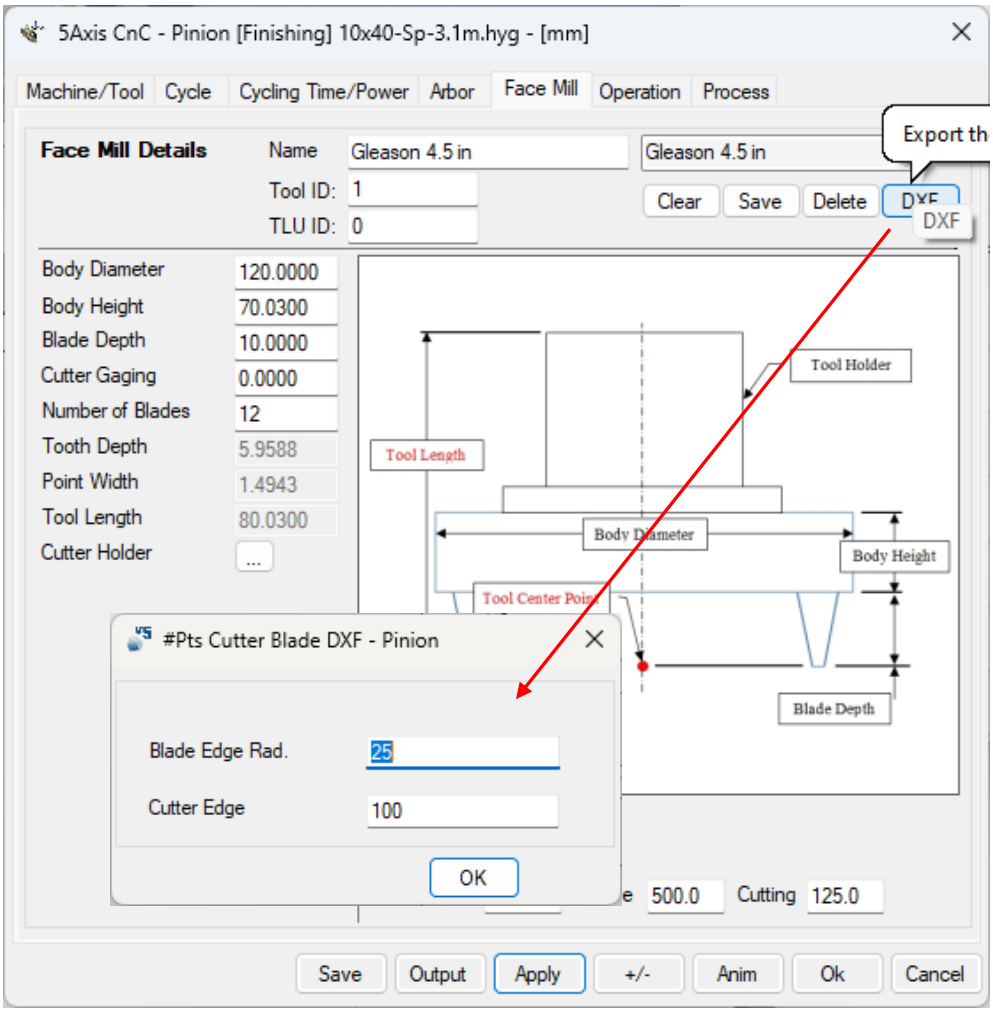
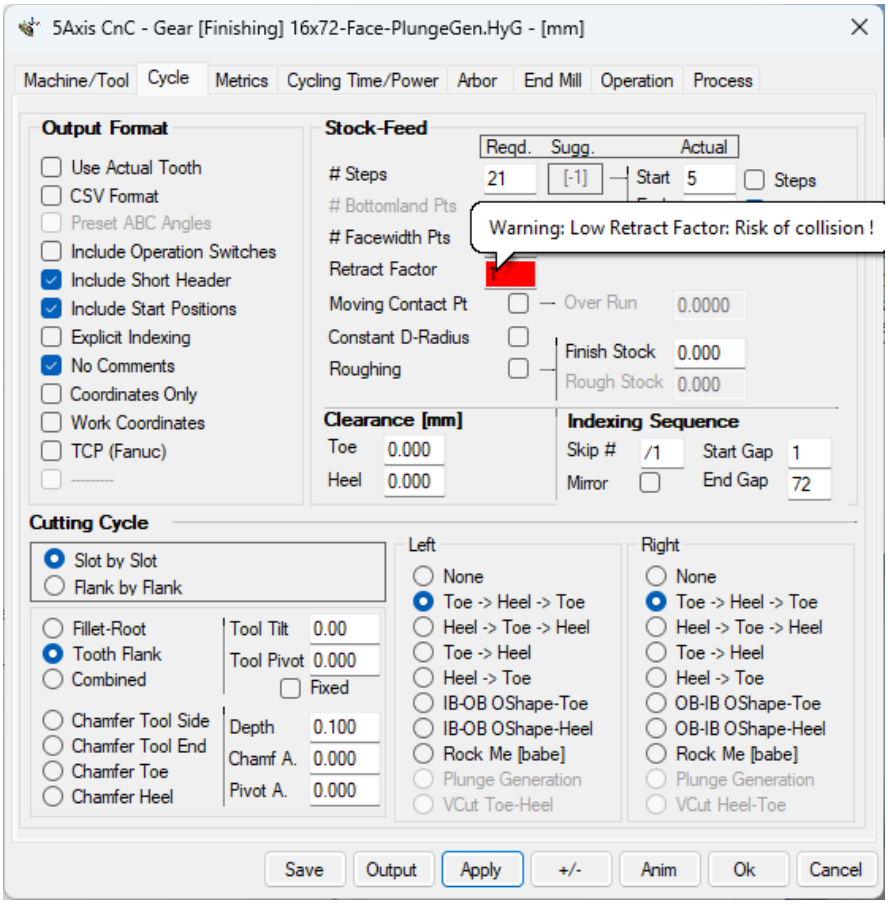
Stock-Feed
Reqd.
Sugg.
Actual
Steps
Bottomland Pts
Facewidth Pts
Retract Factor
Moving Contact Pt
Over Run
Constant D-Radius
Roughing
Finish Stock
Rough Stock
Start
End
Bottom Up
Steps
Tgt.Pts
Clearance [mm]
Toe
Heel
Indexing Sequence
Skip #
Mirror
Start Gap
End Gap
Cutting Cycle
Slot by Slot
Flank by Flank
Fillet-Root
Tooth Flank
Combined
Tool Tilt
Tool Pivot
Fixed
Chamfer Tool Side
Chamfer Tool End
Chamfer Toe
Chamfer Heel
Depth
S Length
Pivot A.
Convex [IB]
None
Toe -> Heel -> Toe
Heel -> Toe -> Heel
Toe -> Heel
Heel -> Toe
IB-OB OShape-Toe
IB-OB OShape-Heel
Rock Me [babe]
Plunge Generation
Concave [OB]
None
Toe -> Heel -> Toe
Heel -> Toe -> Heel
Toe -> Heel
Heel -> Toe
OB-IB OShape-Toe
OB-IB OShape-Heel
Rock Me [babe]
Plunge Generation
Save
Output
Apply
+/-
Anim
Ok
Cancel
Tool Tilt

4) In 5Axis, when using a Face Mill cutter, if the DXF option has been purchased, the [DXF] button becomes enabled and the section of the Face Mill cutter can be exported as a DXF file. HyGEARS now allows imposing the # of points that will be used for the Edge Radius and the Cutting Edge.

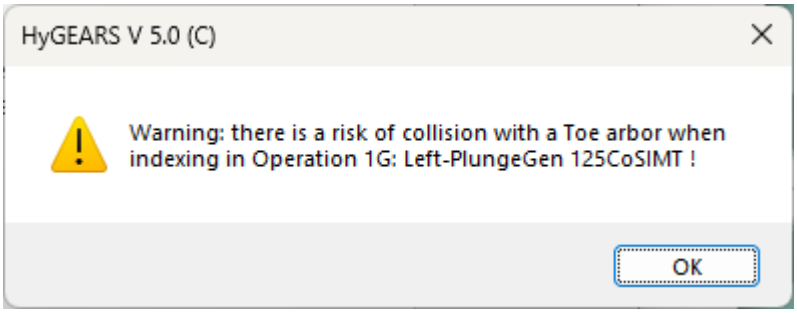


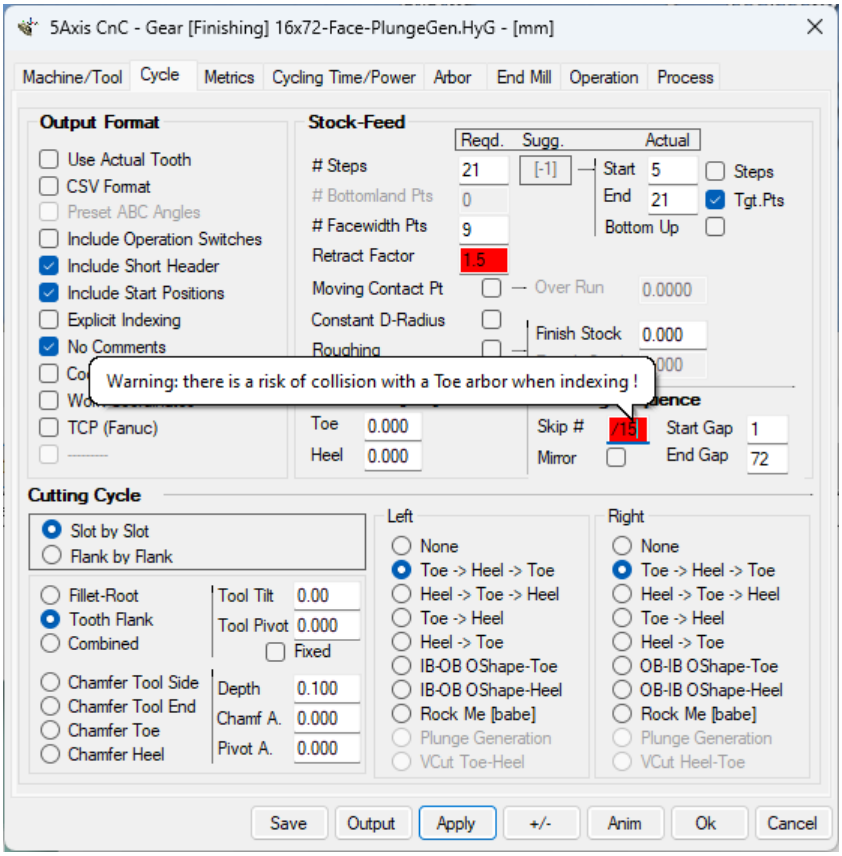
5) In 5Axis, when the Retract Factor is deemed too small (< 2), HyGEARS now reddens the Retract Factor input field and a Tool Tip is displayed when the mouse hovers over. This is in replacement of the older method where an exclamation mark was displayed.



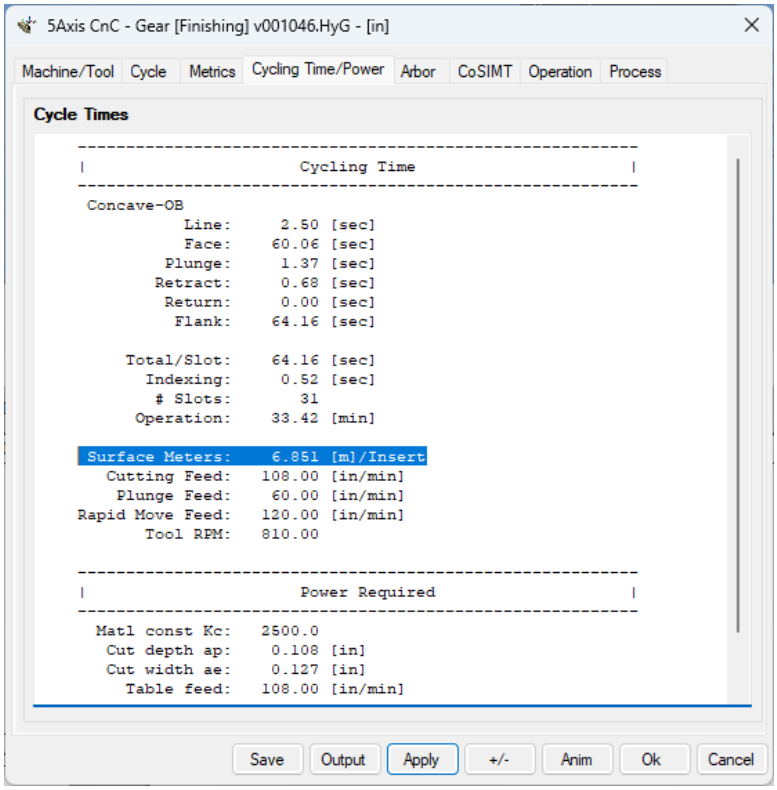
6) In 5Axis, if the Skip # input field is such that indexing from tooth gap to tooth gap is more than 30 degrees, HyGEARS reddens the Skip # input field and displays a Tool Tip when the mouse hovers over the field.

When the Output is issued, a warning will be displayed.



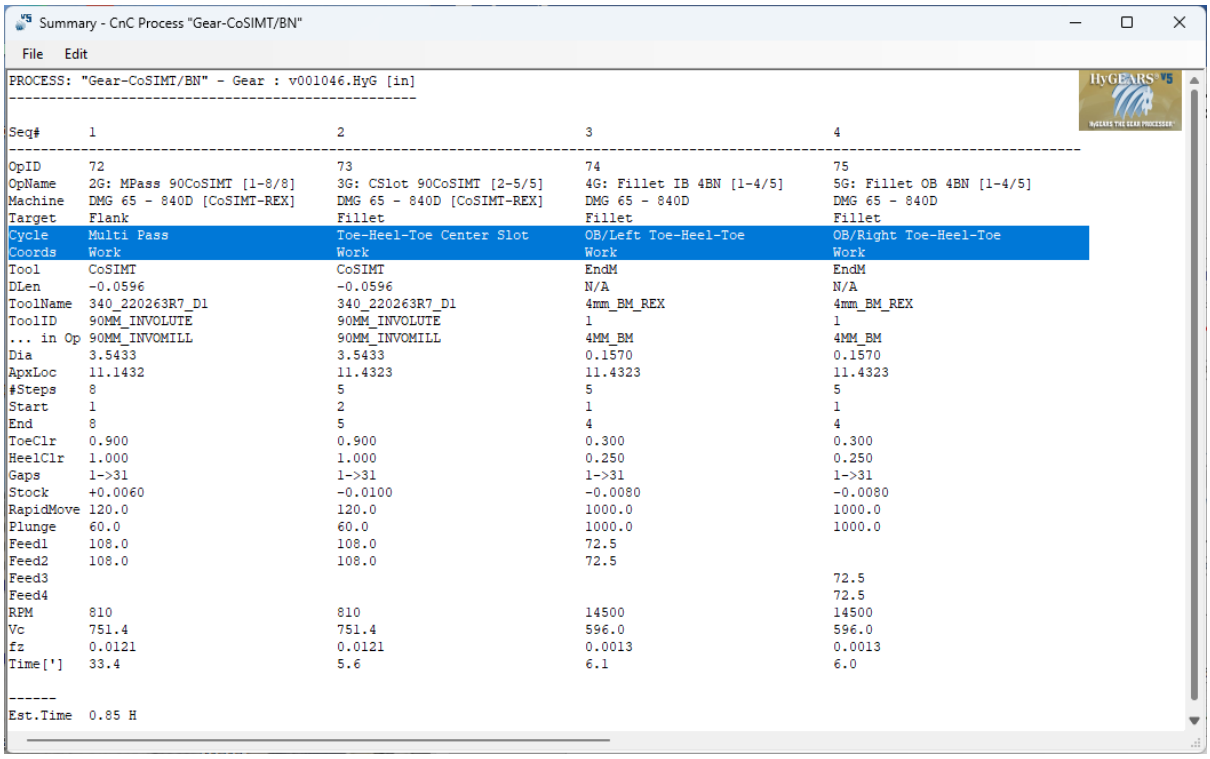


7) In 5Axis, when a Face Mill, Coniflex or CoSIMT tool is used, the calculated Surface Meters info is given on the Cycling Time/Power tab.



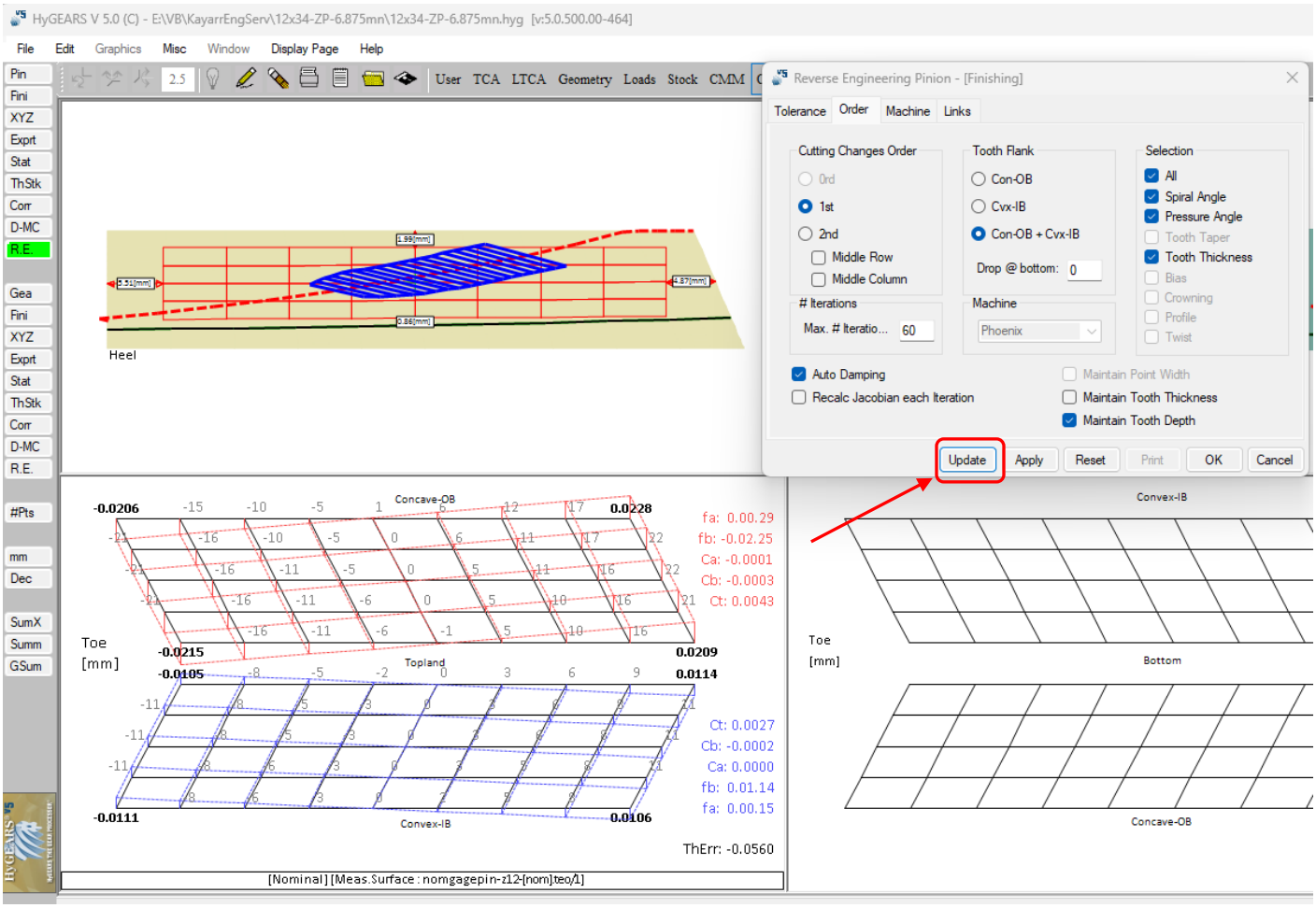
The Surface Meters is the distance covered by an insert to complete the job at task. Given the Face Mill, Coniflex or CoSIMT blade inserts are typically good for 20 to 30 surface meters, one can get an estimate of the tool life expectancy and thus plan accordingly.

8) In 5Axis, on the Process page, the [Summ] function now adds the Cycle and Coords data, which respectively inform on the used cutting cycle and whether Machine or Work coordinates are used.



9) When doing Reverse Engineering (RE) in the Corr-RE display mode, it is frequent that several iterations of RE are required to attain a specific result; up to now this meant that the user had to make one RE selection, click [Apply] and then [Ok] such that the internal data structure was updated, and then re-enter [RE] for another pass.

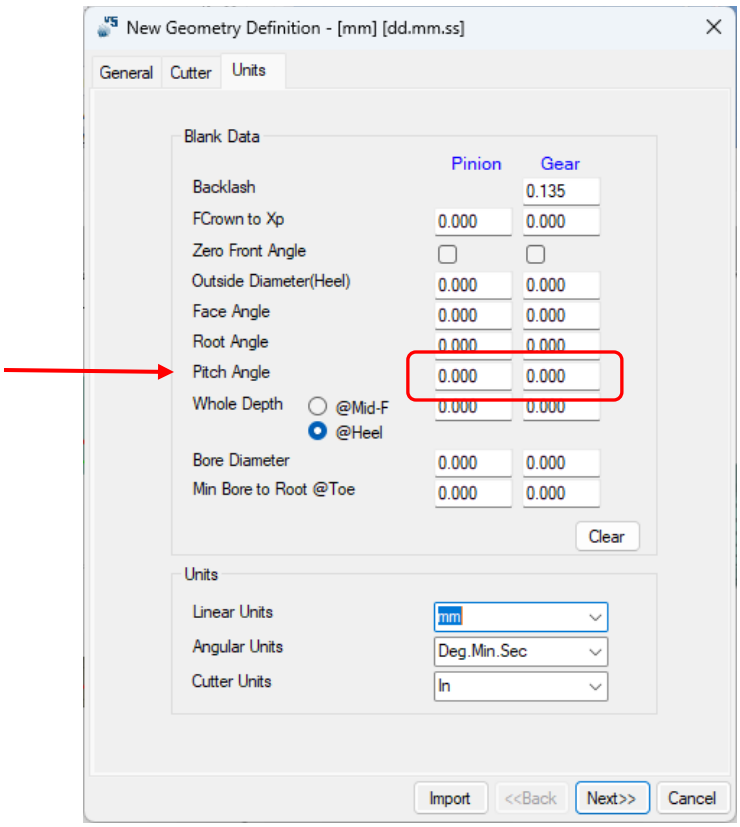
To avoid this repetitive action, the [Update] button has been added to the RE selection window: the [Update] button copies the current set of machine settings to the data structure of the member being RE. Thus, one can make a given selection for RE, click on the [Apply] button to calculate as required, and then click on the [Update] button to save the calculated machine settings state before making a new iteration with a different selection and without having to exit the RE selection window.



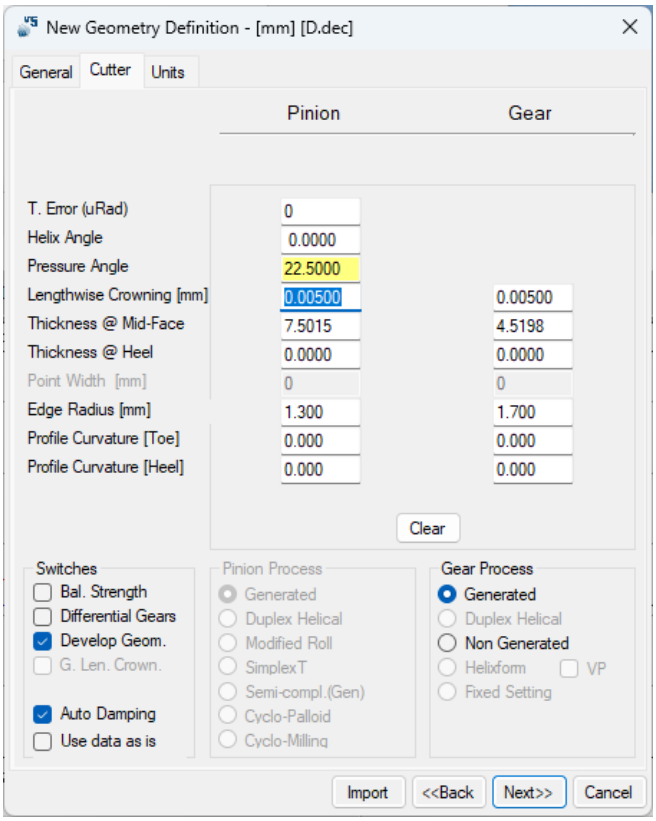
10) When creating a New Geometry (Hypoid gears only), the pinion's and gear's Pitch Angle can now be imposed. This can be useful in some cases where the pinion shaft has a Toe spigot (to support a bearing) which could be hit by the Face Mill cutter.

It can also be useful to impose the Gear member's pitch angle for HRH (High Ratio Hypoid) gears.

Note that not any value for the pitch angles can be used, and it is recommended to first run the HyGEARS New Geometry without imposing the pitch angles, look at the obtained values, and re-run the New Geometry using values slightly different from those that came out by default.



11) When creating a New Geometry – Straight Bevel Gear (Generated), the lengthwise crowning entered is now the desired value rather than a given value / 5 [mm] face width.



12) In the New Geometry input window, the Geometry Source File can now be either a ZG-Hypoid ND file or a KISSSoft text file, both of which will be read to populate the New Geometry window.

- The ZG-Hypoid ND file is a special output file of the ZGH-Suite software (from ZG-Hypoid, www.ZG-Hypoid.de) which can iterate through a series of gear dimensions (module, tooth count, spiral angle, etc.) to find the "optimal" combination for a given task; the results of this "optimal" combination are saved in a text file that is read by HyGEARS to populate the New Geometry window and HyGEARS will then generate the appropriate machine settings and cutter definition to obtain the desired micro-geometry. For the time being, this applies only to bevel gears;

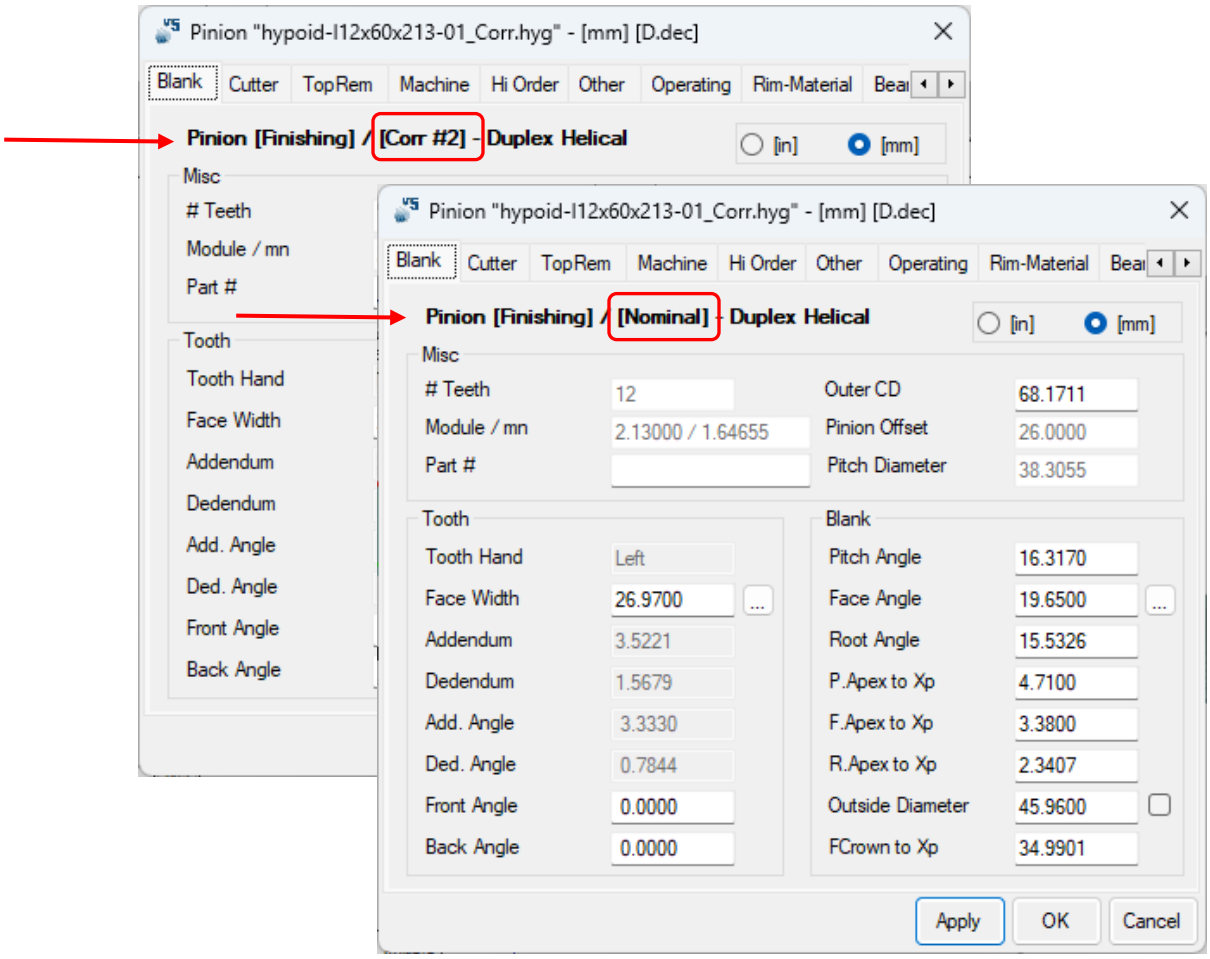
- KISSSoft can output its calculation results in a text file that can be read by the New Geometry window; the KISSSoft output file is scanned to populate the input fields of the New Geometry window. This applies to spur, helical, face, straight bevel and spiral bevel gears.

13) When calling either the Pinion or Gear Summary Editor, HyGEARS now displays what is the status of the summary being edited.

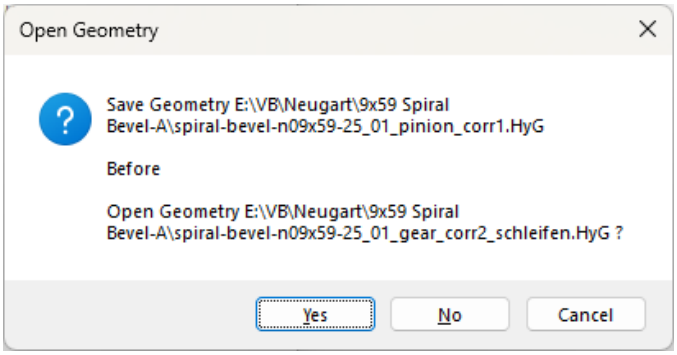
It can be:

- [Nominal]: this member has not seen any closed loop (Corrective Machine Settings);

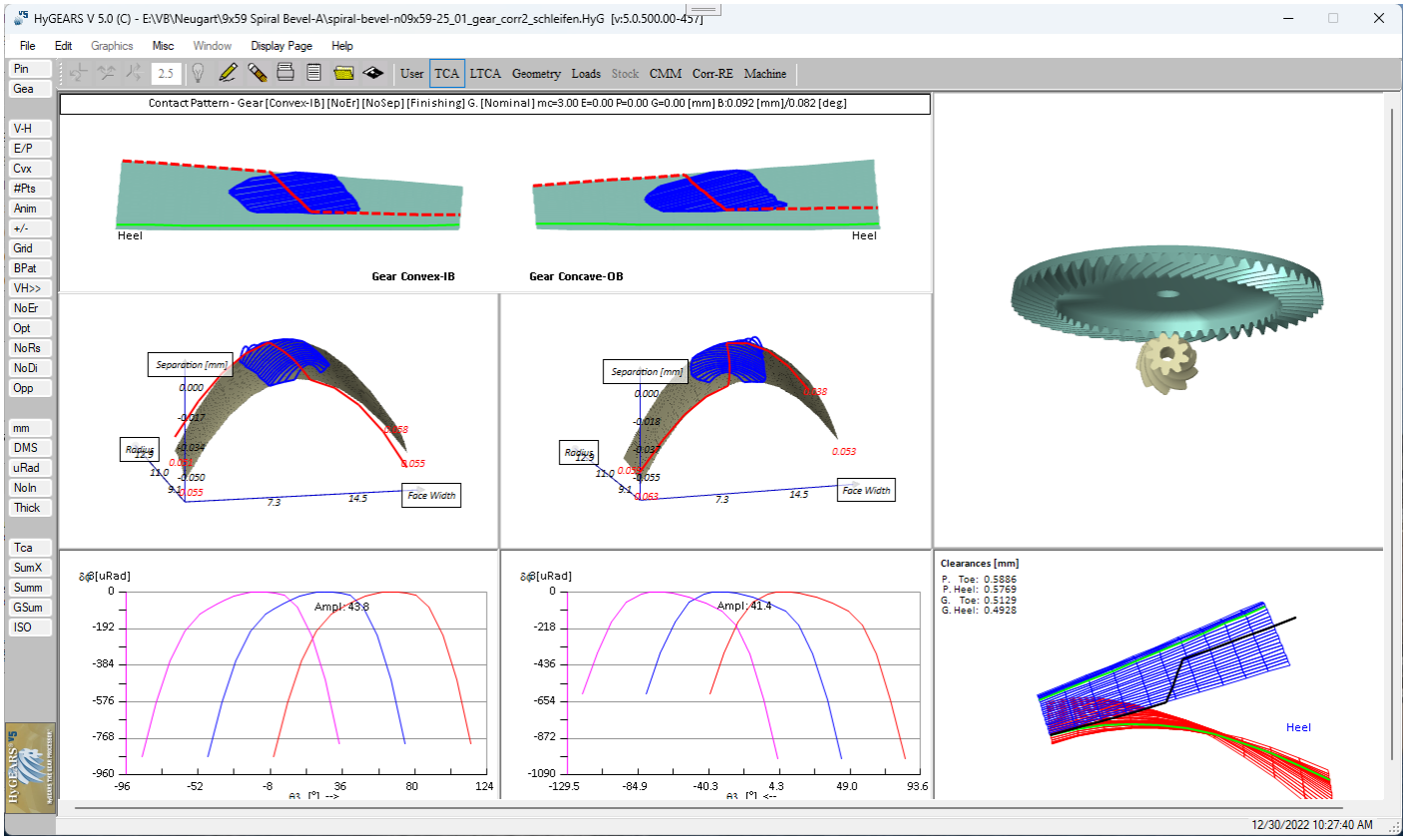
- [Corr #...]: this member has seen at least 1 closed loop iteration, and the current closed loop summary being edited is #...



14) HyGEARS now allows “Drag and Drop” of HyG files on any empty area of the Parent Window. When doing so, if there is already a HyG geometry active, HyGEARS asks to save it prior to opening the dropped HyG file.



HyGEARS then proceeds to open the dropped HyG file and defaults to TCA mode.

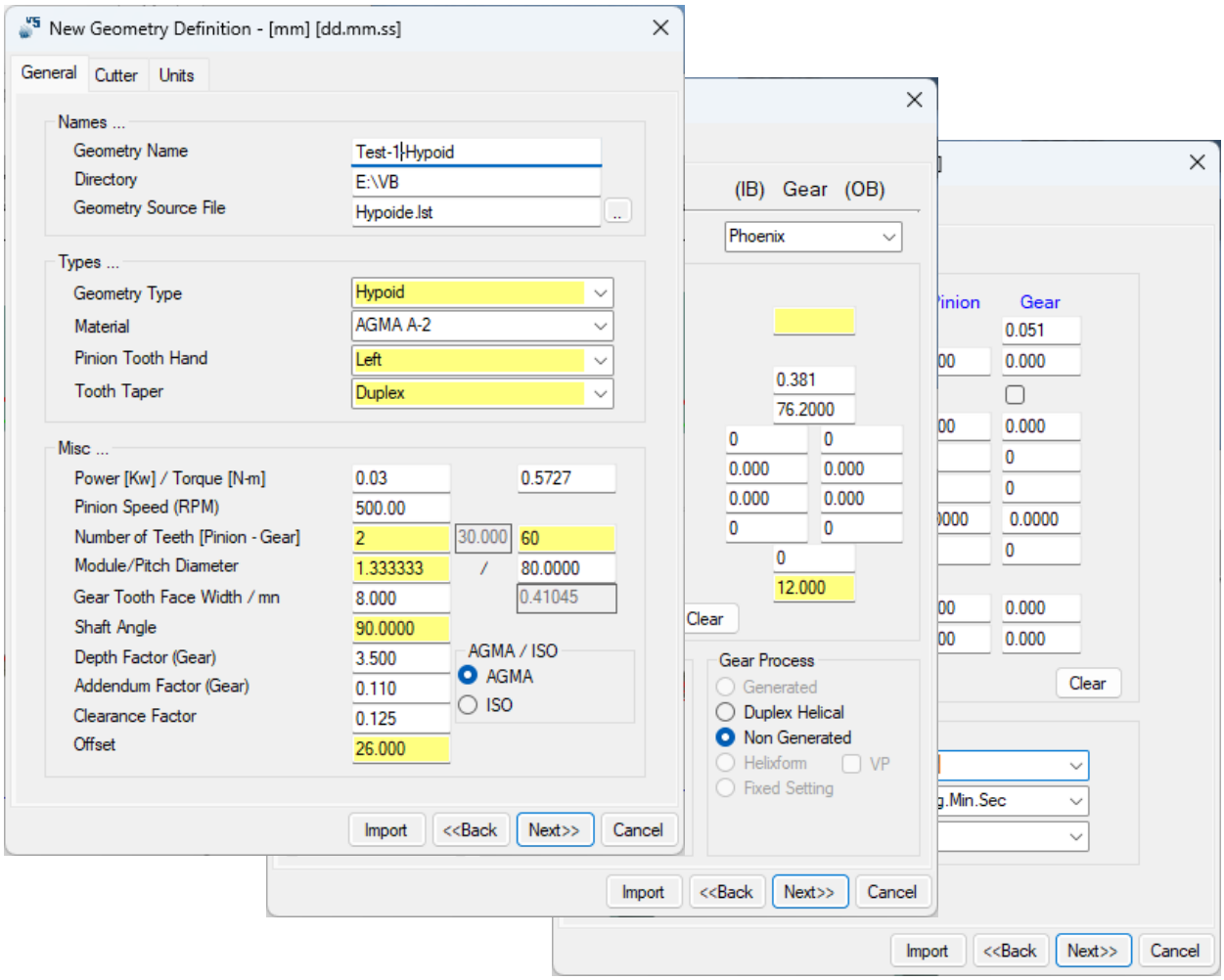


15) HyGEARS now offers the High Ratio Hypoid gears option – i.e. HRH gears – which are defined as having a pinion with 5 teeth or less and/or a gear ratio larger than 10:1.

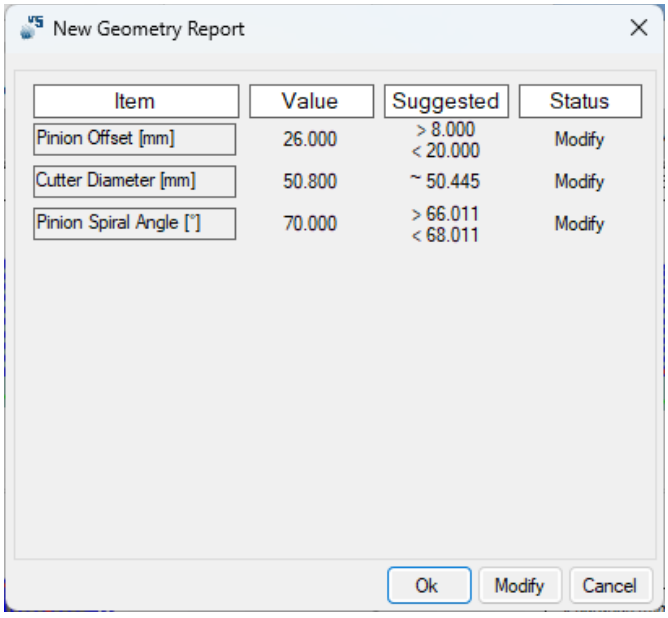
HRH gears are created the same way as regular hypoid gears; if the Duplex Helical process is used (which is the preferred approach), the resulting gear set will have:

- the same cutter Diameters,
- the same cutter Blade angles,
- and the same cutter Point Width,

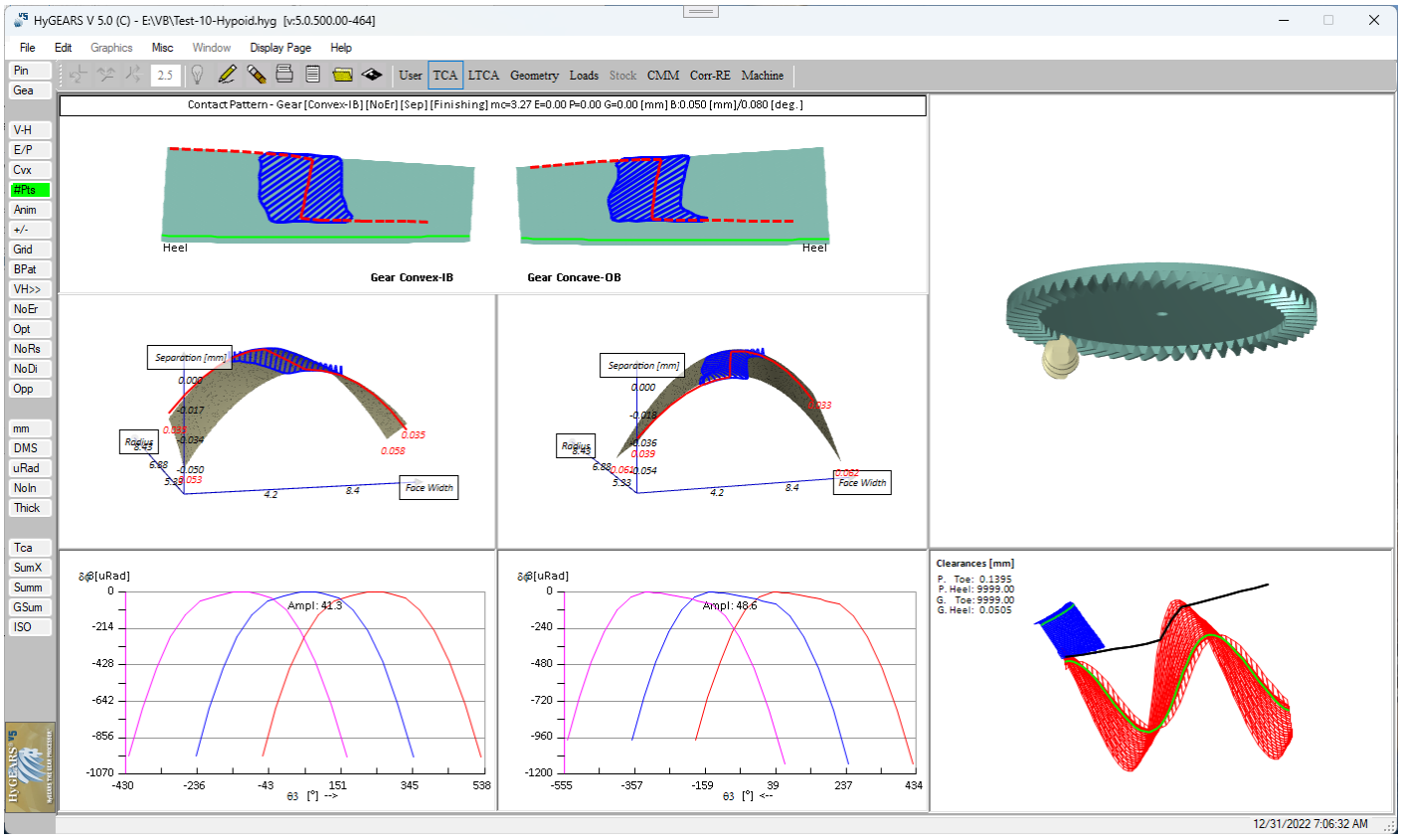
therefore, exactly the same cutters which is a cost advantage when manufacturing.

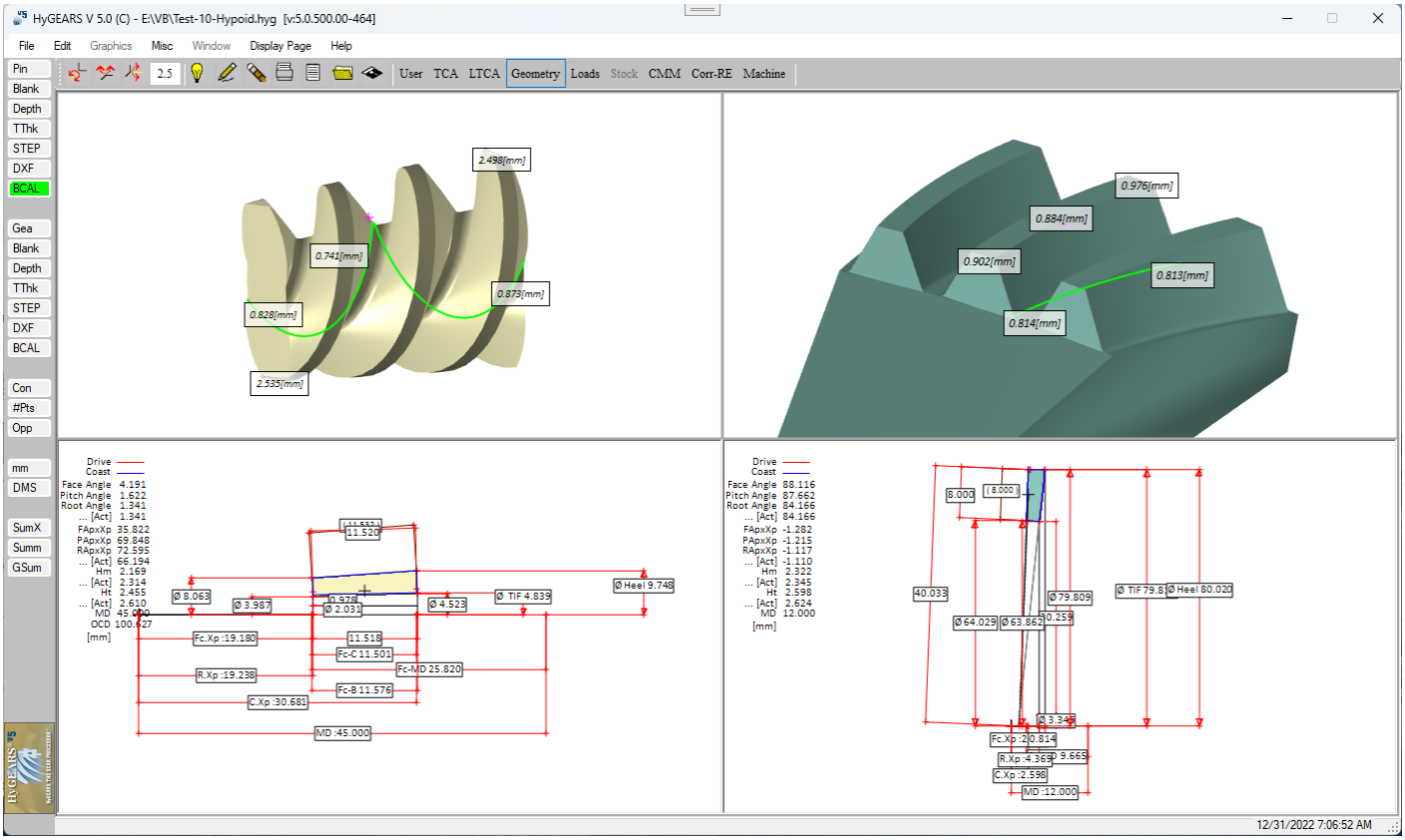


As usual, HyGEARS outputs a New Geometry Summary, and in the case of HRH gears, it is important to follow the recommended values for spiral angle and cutter diameter because of the sensitivity.



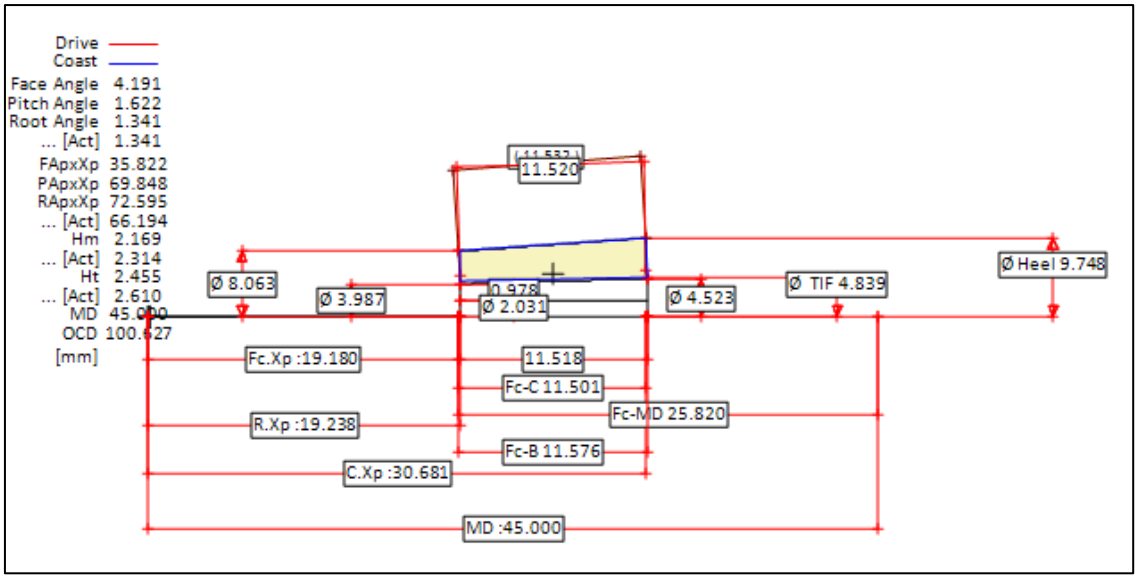
For example, the 2x60 gear set described in the above pictures results in the following TCA and dimensions.





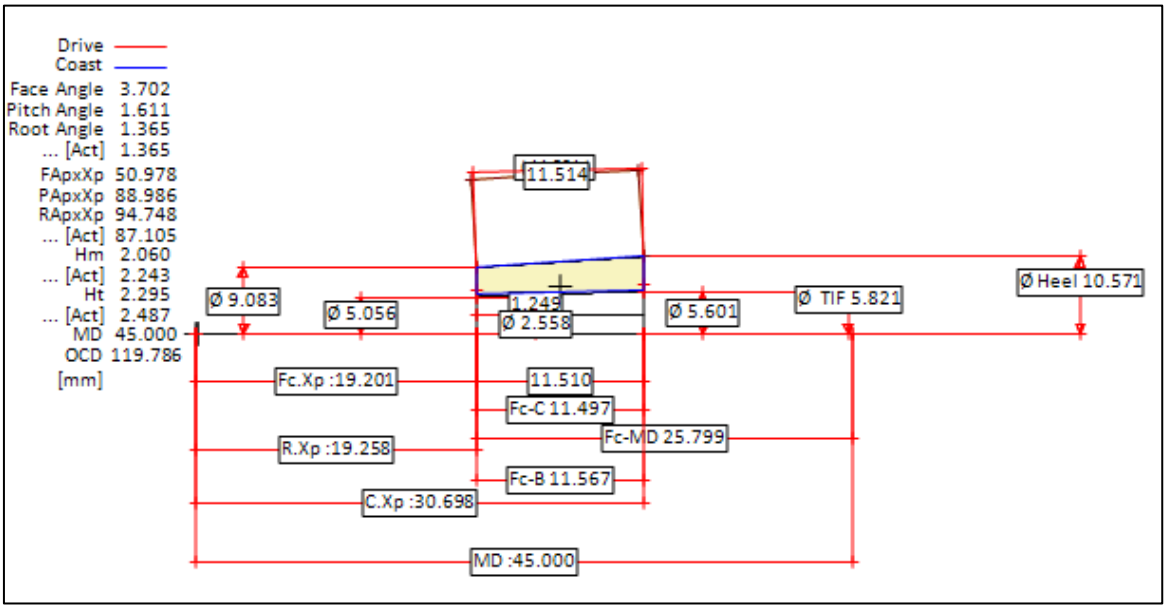
We can see that the Contact Patterns (CP) are well centered on the gar tooth flank, and that the 26 mm pinion offset results in a pinion almost at the ID of the gear. We therefore have a situation similar to a Spiroid gear set.

One potential issue however is that the Toe ID on the pinion is less than 4 mm, as shown below, and therefore less than 2 tooth depths. The design pinion spiral angle is 65 degrees.

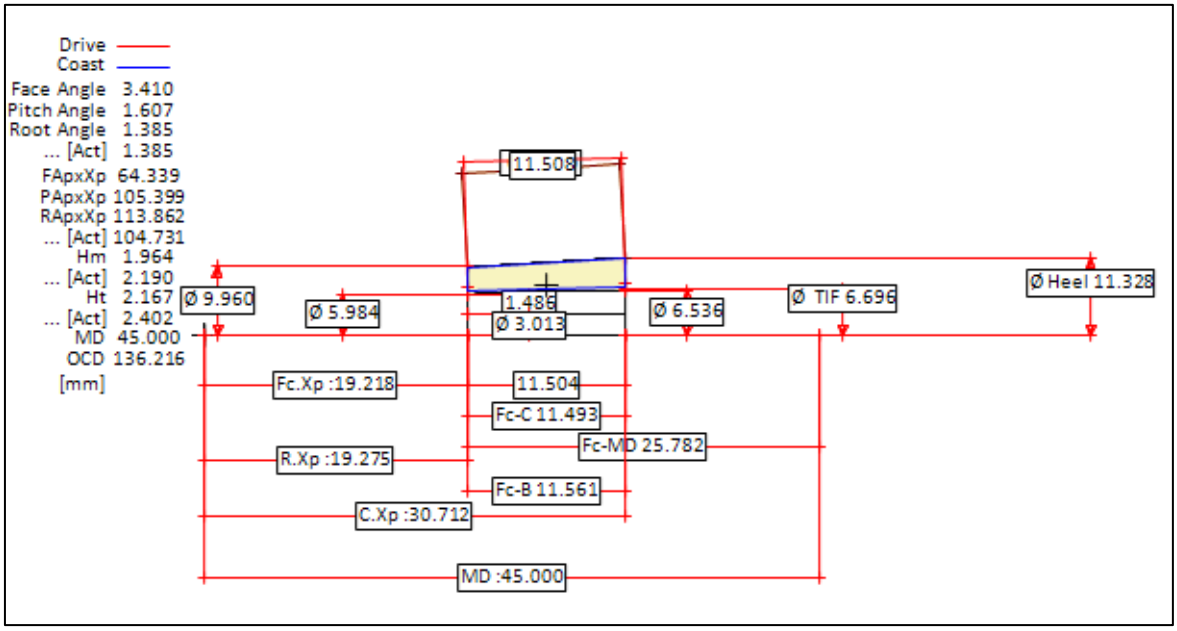


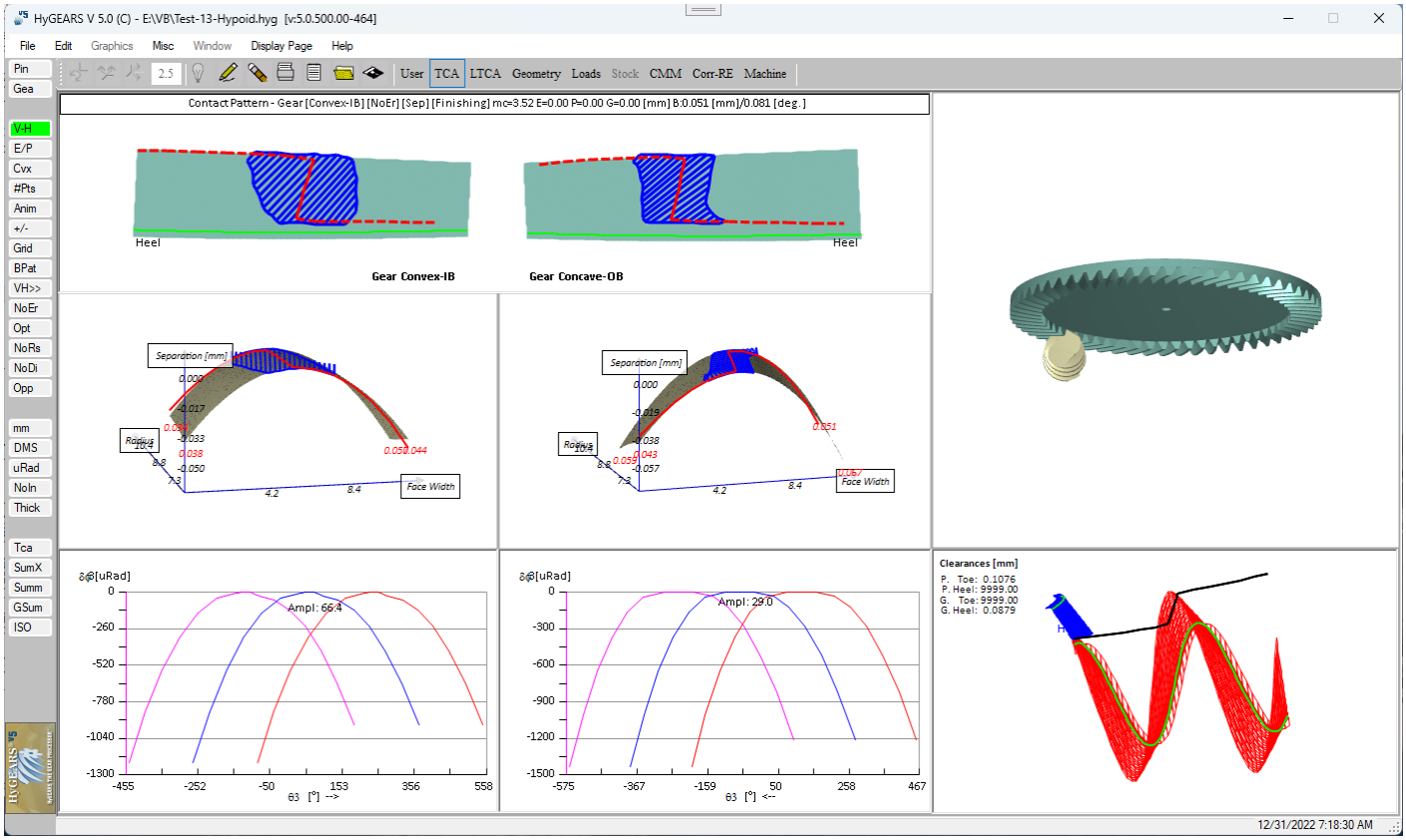
As shown above, typically, the pinion in HRH gears has a very small tooth number, and therefore the ID at Toe can be very small. At this time, the [only] way to increase the Toe ID on the pinion is by increasing the

spiral angle. Increasing the pinion spiral angle to 70 degrees yields a 5 mm Toe ID, with the same kinematics.



Increasing again the pinion spiral angle to 73 degrees yields an even better result with a Toe ID of nearly 6 mm (some 2.5 times the tooth depth at Heel) with excellent kinematics, as shown below.

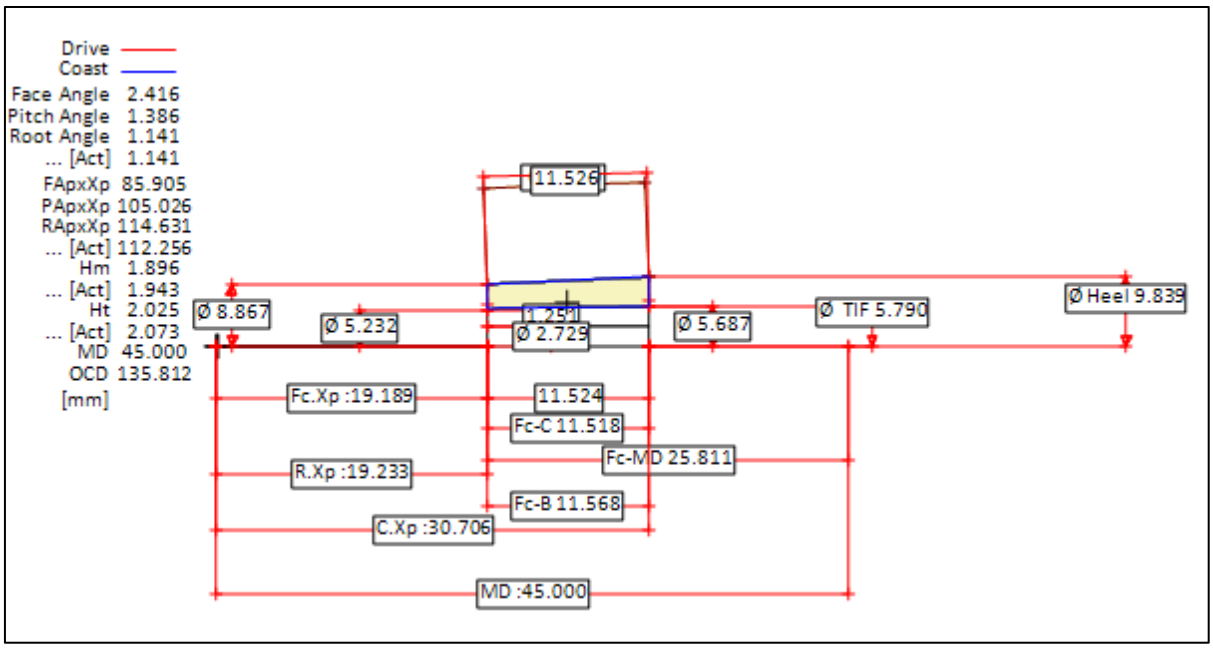


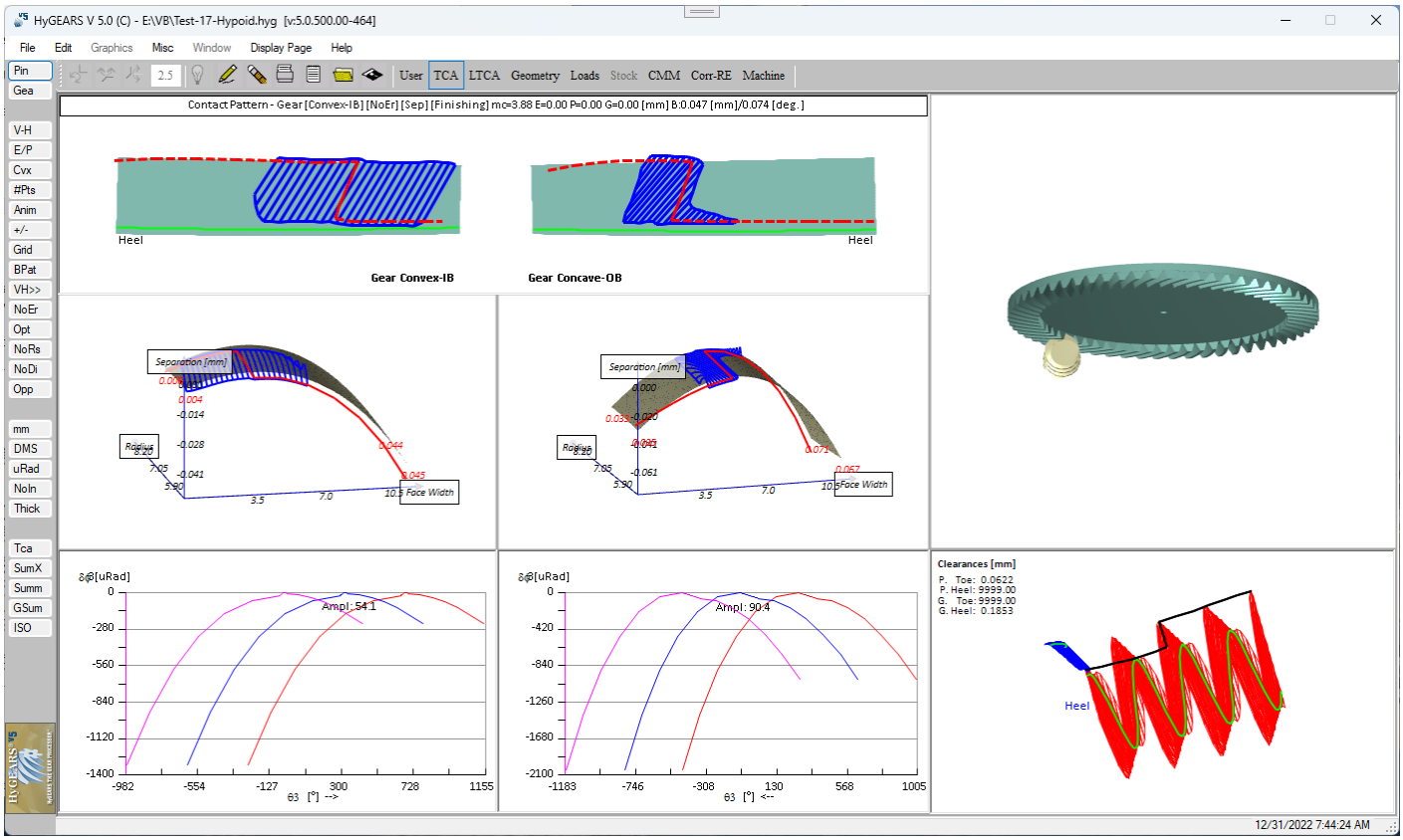


However, increasing again the pinion spiral angle would not give correct kinematics and therefore a practical upper limit would be around 73 degrees.

Note that while increasing the pinion spiral angle results in a larger Toe ID, which is essential for structural strength, it also decreases efficiency since it results in more sliding. Thus the gear engineer must carefully balance each aspect and will likely make several trials to obtain an acceptable design.

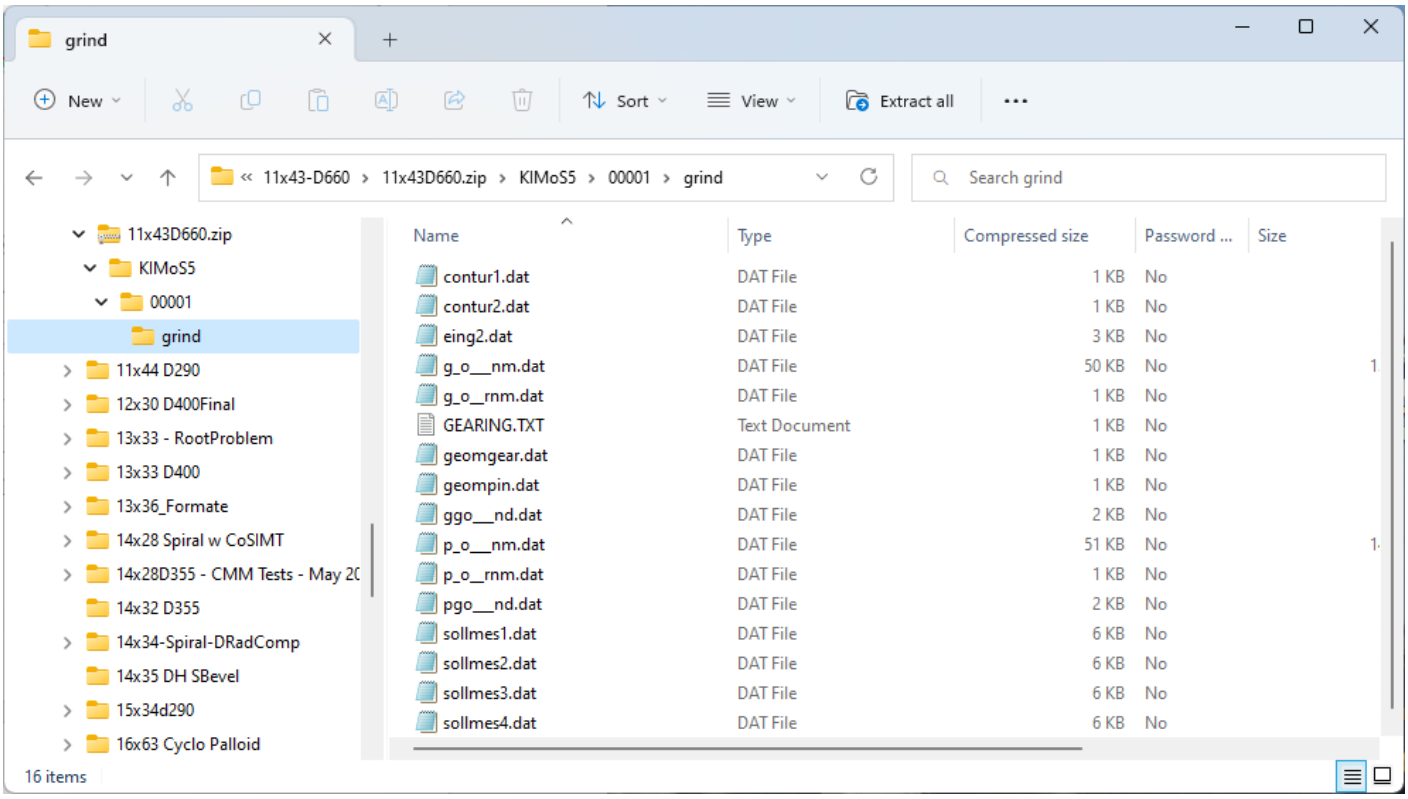
Gear ratios of up to 100:1 can be reached by carefully selecting the combination of pinion offset, sum of pressure angles, pinion spiral angle and cutter diameter. However, not every combination will yield acceptable results and the gear engineer may have to make a few trials. For example, the above 2x60 gear set is changed to 1x60, with the same module and cutter diameter; however, the spiral angle must be increased to 82 degrees to yield an acceptable Toe ID on the pinion, as is shown below.



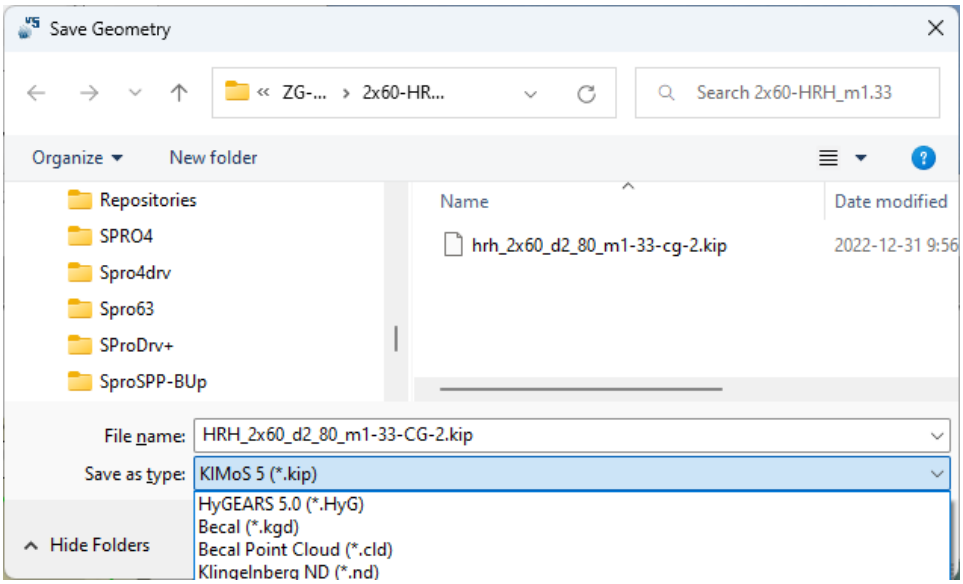


16) KIMoS Kip files: HyGEARS can now read and save spiral bevel gear geometries as KIMoS Kip files.

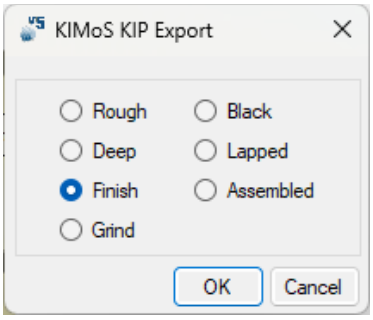
In fact, KIMoS Kip files are simple Zip files with the extension changed from “Zip” to “Kip”. This means that a Kip file, once renamed Zip, can be read with apps such as RAR and WinZip; its content and tree structure can also be viewed in Windows as shown below.



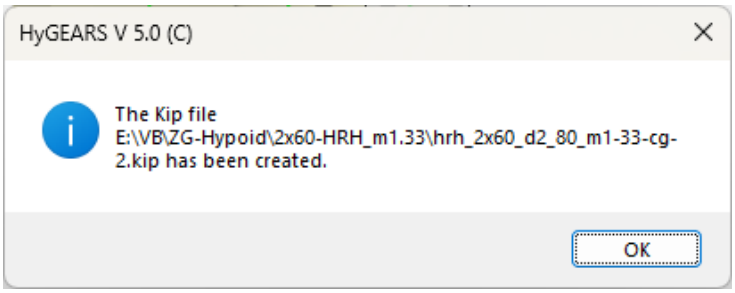
If the required KIMoS In/Out option has been purchased, when HyG gear sets are “Save As”, the “KIMoS 5 (*.kip)” file type is added to the list as shown below.



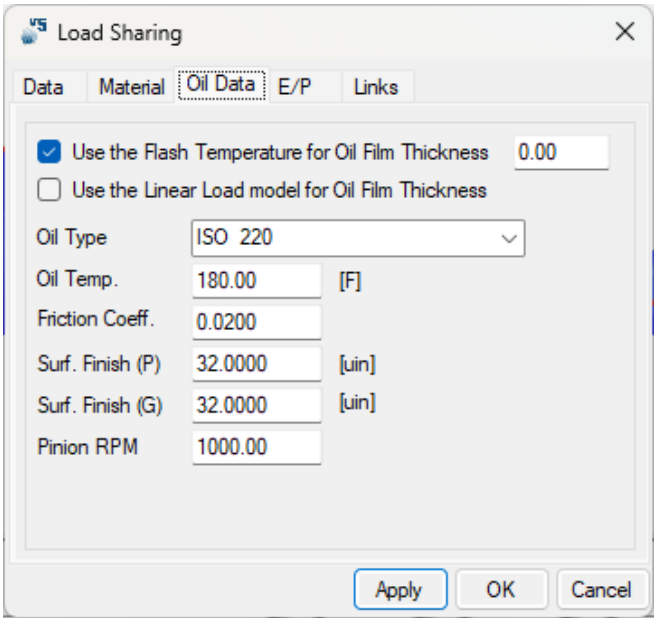
If this option is selected, HyGEARS then asks which way the Kip file is to be created. Finish is the default.



Once confirmed by clicking on [Ok], the Kip file is created in the same folder as that of the current HyG file and a confirmation is given on-screen.



17) In the LTCA [Load] window, the "Oi Data" tab has been added where it is easier to do "what if" scenarios. As can be seen below, most fields are self-explanatory, but the 2 following options do require a bit of info.



- *Use the Flash Temperature for Oil Film Thickness*: by default, until now, HyGEARS assumed that the Flash T affects the oil viscosity and pressure-viscosity coefficient, both of which enter in the oil film thickness equation; however, not all references in the literature agree on this and the choice is now given to use, or not, the Flash T, and if used, to what extent it is used, hence the input field where the % of the Flash T to be used is entered, which ranges from 0% to 100%.

- *Use the Linear Load Model for Oil Film Thickness*: by default, for spiral bevel gears, HyGEARS uses an elliptic non-linear load distribution model along the major axis of any instant contact ellipse; if the extent of the contact pattern under load is large enough, or if the relative curvature is deemed small enough, the Linear Model can be used instead where it is assumed that the load distribution along an instant line of contact is linear.