



VisualMILL at Sisters High School

Tony Cosby is the engineering, woodworking and technology teacher at [Sisters High School](#) in Sisters Oregon, a community who takes its name from the nearby [Three Sisters Mountains](#). Tony teaches beginning and advanced Woodworking classes, a Construction class and an Introduction to Engineering & Design class through [Project Lead the Way](#), a national organization that provides K-12 curriculums written by engineers!

Tony's class produces Ukulele and Luthier Guitars. Since introducing the [Luthier Program](#) in 2005, his Woodworking II class has averaged the production of 30 guitars per year, with the help of one of the best Luthiers (guitar makers) in the northwest, Jayson Bowerman of [Breedlove Guitars](#).

The CAM software that Tony and his team at SHS rely on every school year is [VisualMILL from MecSoft Corporation](#)! Read on to learn more about Tony's amazing program. Be sure to check out the images at the end of this case study of some of the Luthier Guitars crafted by Tony's students at SHS.



Why VisualMILL?

We recently sat down with Tony Cosby to discuss his program and the use of VisualMILL there at Sisters High School. Obviously, we wanted to know why he uses VisualMILL and here is just a portion of what he had to say:



“Why do we use VisualMILL? Ease of Use is the primary reason! We don’t want our kids getting overwhelmed by the software. I’ve discussed this with instructors from a nearby school who use Mastercam and the kids there are really struggling just to use the CAM software. It takes so much time to learn new software that when you find something that both works and is easy to use, you stay with it!”

Tony Cosby, Technology Teacher, Sister’s High School, Sisters, OR

State Visit by Oregon Governor Kate Brown!

The program Tony has developed at SHS is so popular and successful that it has been [recognized both locally and statewide by Oregon’s own Governor Kate Brown!](#) Governor Brown wanted to visit SHS in person and gather facts about how Tony’s successful program at SHS can be implemented in other school districts in the state! [This story was also reported on by local affiliate KTVZ!](#) We here at MecSoft Corporation are proud to be a part of the successful program Tony has achieved at Sisters High School!

Kudos to Tony and his team at SHS!



Oregon's own Governor Kate Brown visits the program at SHS on a fact-finding mission!

Also featured on ABC affiliate KOHD!



[Watch Tony Cosby and SHS featured on local ABC affiliate KOHD!](#)

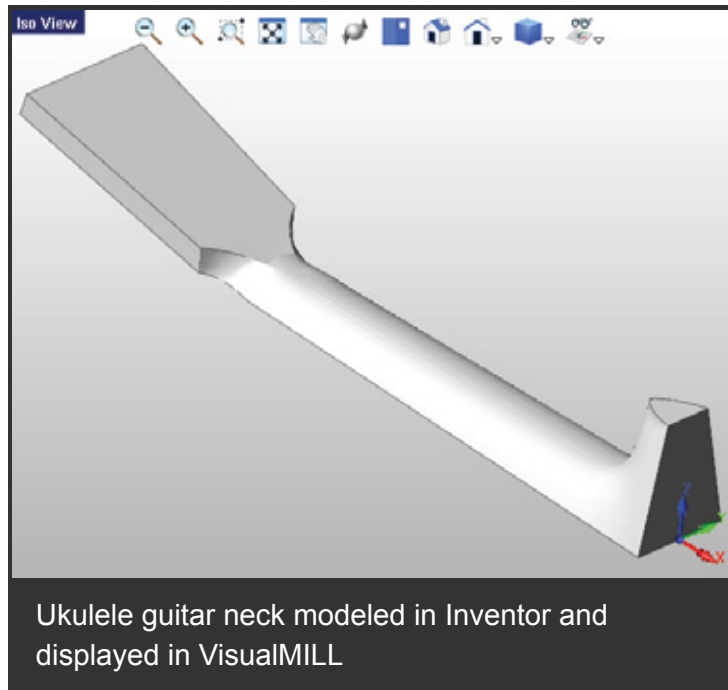
Woodworking at Sisters High School

Tony has adjusted his woodworking class curriculum to fulfill the entry level CAD/CAM requirements of COCC ([Central Oregon Community College](#)). Tony's students receive college credit and the opportunity to build their very own Luthier Guitar from start to finish with the guidance of Tony and his team of 12 dedicated adult volunteers!

The Ukulele Neck

Let's take a closer look at the ukulele guitar neck and see how VisualMILL helps Tony and his team get the job done. For this component we want to give a shout-out to both [Bill MacDonald of Kona Breeze Ukes, LLC](#) and [Kerry Bott](#), two of Tony's team of community volunteers who assisted with both the design and CAM programming of this component. Let's have a look.

On the left below, we see the neck originally 3D modeled in Autodesk Inventor and then opened in VisualMILL. On the right, we see the resulting part machined from g-code produced by VisualMILL's Mach3 post-processor on the school's Velox 3 Axis Machining Center. VisualMILL comes with over 300 customizable post-processors installed and a built-in post-process generator!



3 Axis machining is needed for this part due to the drafted walls and curvature design required. Tony and his team uses 3 Axis Horizontal Roughing for bulk material removal followed by 3 Axis Horizontal Finishing. The sections below provide a glimpse into these machining strategies and the parameters used for this part.



“I spent this past summer trying to use Fusion 360 from Autodesk and it was a miserable experience! It was so hard that I basically gave up. I’m sure that if I struggled with it more it would be easier but I didn’t want to spend the time.”

Tony Cosby Technology Teacher, Sister’s High School, Sisters, OR

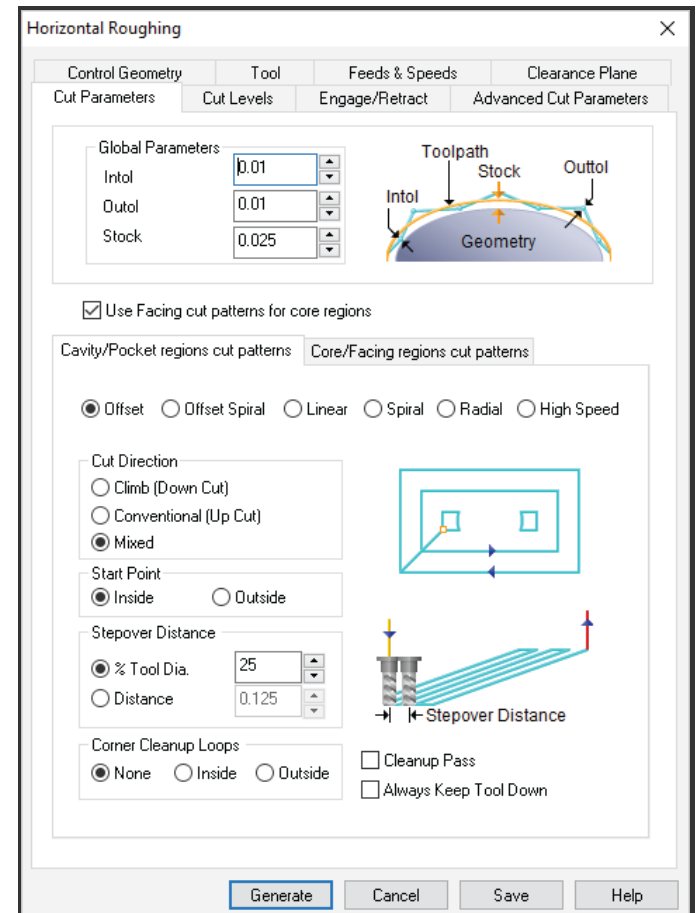
Horizontal Roughing

In the 3 Axis Horizontal Roughing strategy, bulk material is removed in layers from the raw stock model. The tool starts at the top of the stock model and removes material without changing its Z position and only moving in the XY plane. Once this level is completed, the tool then moves to the next successive (lower) Z level and continues clearing each level down to the base of the stock or until the specified containment level is reached.

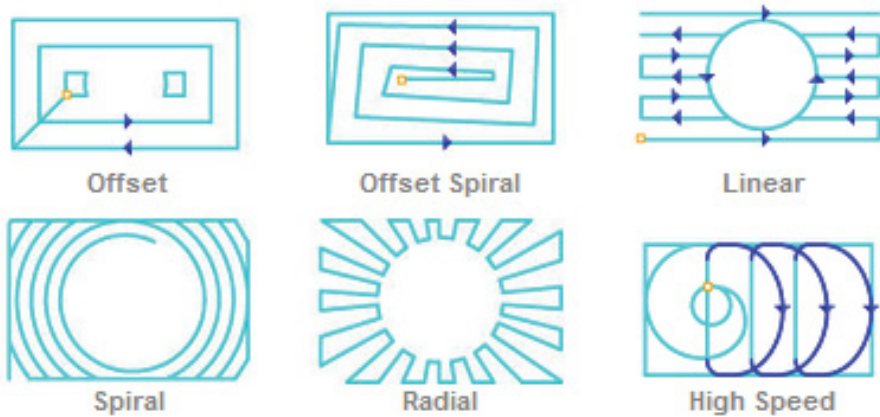
Cut Parameters

This toolpath strategy provides excellent flexibility when it comes to tool motion control. There are separate Cutting Parameter tabs for both Cavity/Pocket regions and Core/Facing regions that the tool encounters.

For example, in Cavity/Pocket regions, you can select from the six different cut patterns (Offset, Offset Spiral, Linear, Spiral, Radial and High Speed) shown below! For this part, Tony's team has chosen the Offset Cut Pattern. The tool will make successive offsets of the part's perimeter at each level. Additional parameters selected include a Mixed Cut Direction, an Inside Start Point and a Stepover distance of 25% of the tool diameter. In this case, a 1/2" diameter Ball Mill.

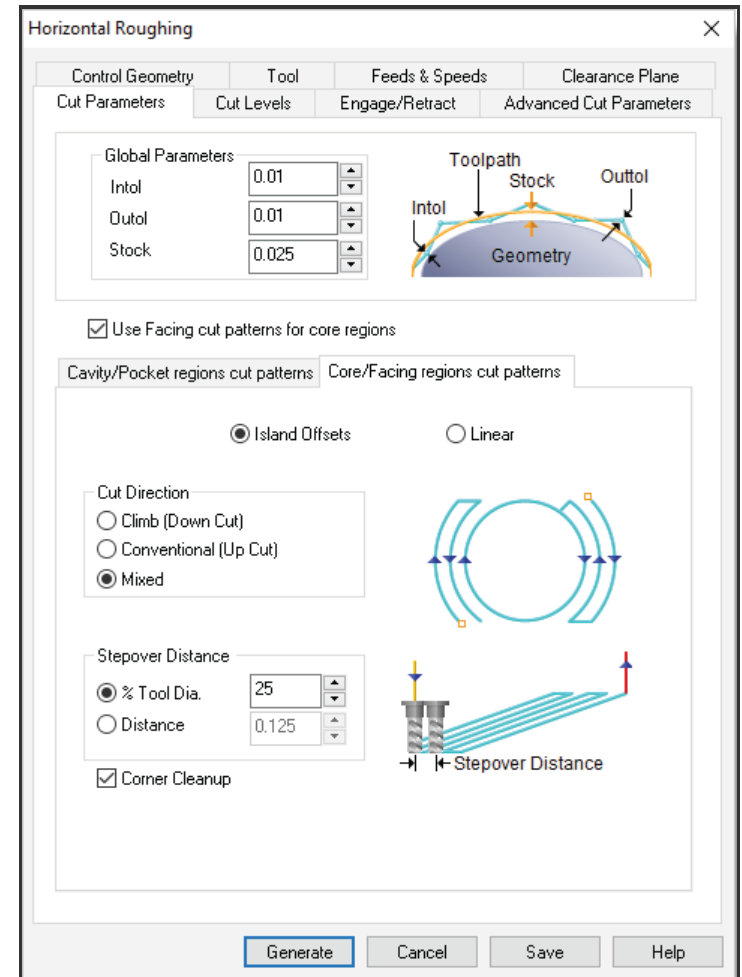


The VisualMILL Horizontal Roughing operation dialog is displayed, showing the Cavity/Pocket selections of the Cut Parameters tab for the ukulele neck.



The six available Cavity/Pocket Cut Patterns are illustrated above

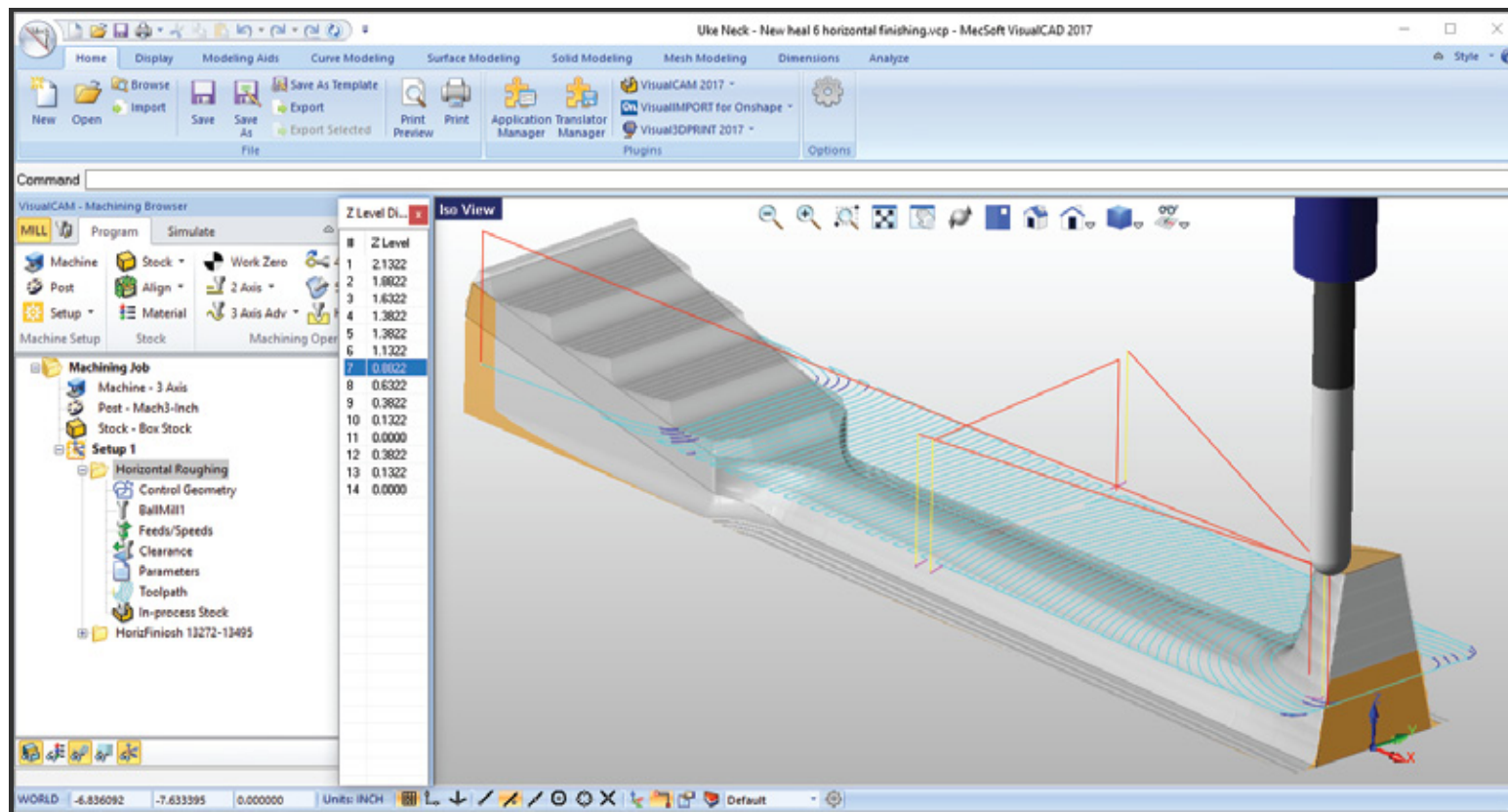
For the Core/Facing regions, the Island Offset Cut Pattern is selected (shown here in the dialog on the right), a Mixed Cut Direction and a 25% Stepover distance. Corner Cleanup is also selected. This allows you to insert a cleanup pass at the corners of islands at each level, similar to a profiling operation.



The VisualMILL Horizontal Roughing operation dialog is displayed, showing the Core/Facing selections of the Cut Parameters tab for the ukulele neck.

Cut Levels

The stepdown spacing between cut levels can also be specified. Z level containment is achieved by allowing you to specify the Top and Bottom Z values directly or simply by selecting a point, edge or face from your 3D model. Once the toolpath is generated you can view each cut level independently using the Z Level Display dialog shown in the image below. For Cut Level control, a Step Down of 50% of the tool diameter is used.



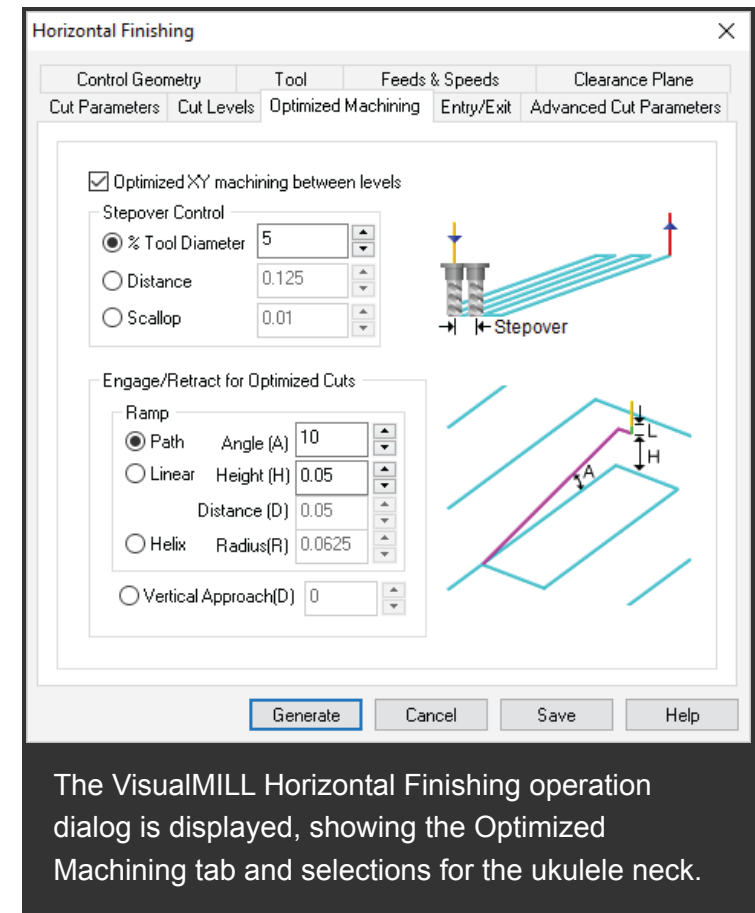
In VisualMILL 3 Axis Horizontal Roughing you can view each Cut Level independently using the Z Level Display dialog (shown here to the right of the VisualMILL Machining Browser).

Horizontal Finishing

3 Axis Horizontal Finishing is a toolpath method that can be used either as a pre-finishing or as a finishing operation. It is similar to 3 Axis Parallel Finishing with the difference being the cutter finishes in constant Z planes. This operation is suitable for parts with steep walls like the ukulele guitar neck. Using a Ball Mill with this operation allows steep areas to be machined using the upper radius of the cutter providing a smooth surface finish.

Optimized Machining

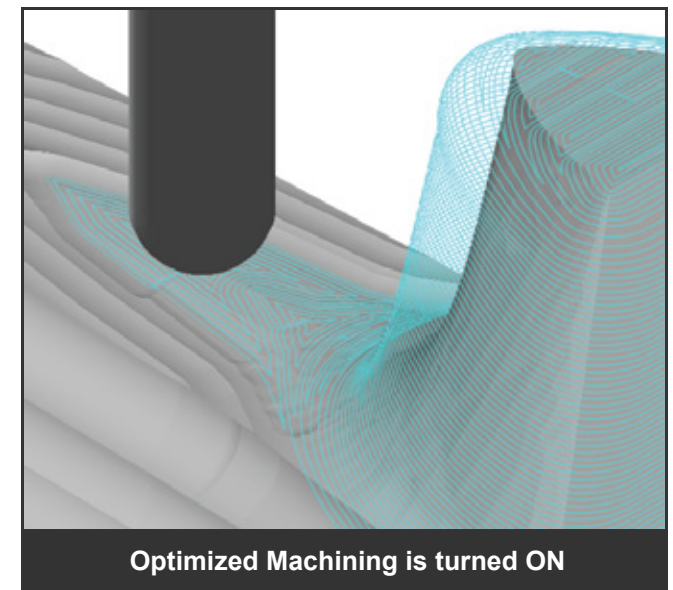
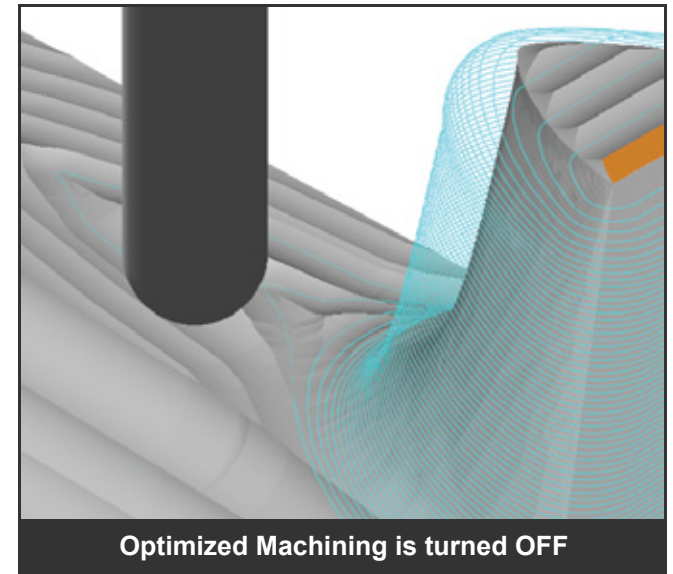
Not to be outdone, the Horizontal Finishing strategy has some cool features of its own. For example, the Optimized Machining tab can be used when you want to maintain a constant scallop height during machining. Due to the constant Z depth spacing of this toolpath, machining relatively flat areas can leave uneven scallop heights. The size of each scallop increases proportionally with the degree of flatness in the target areas.

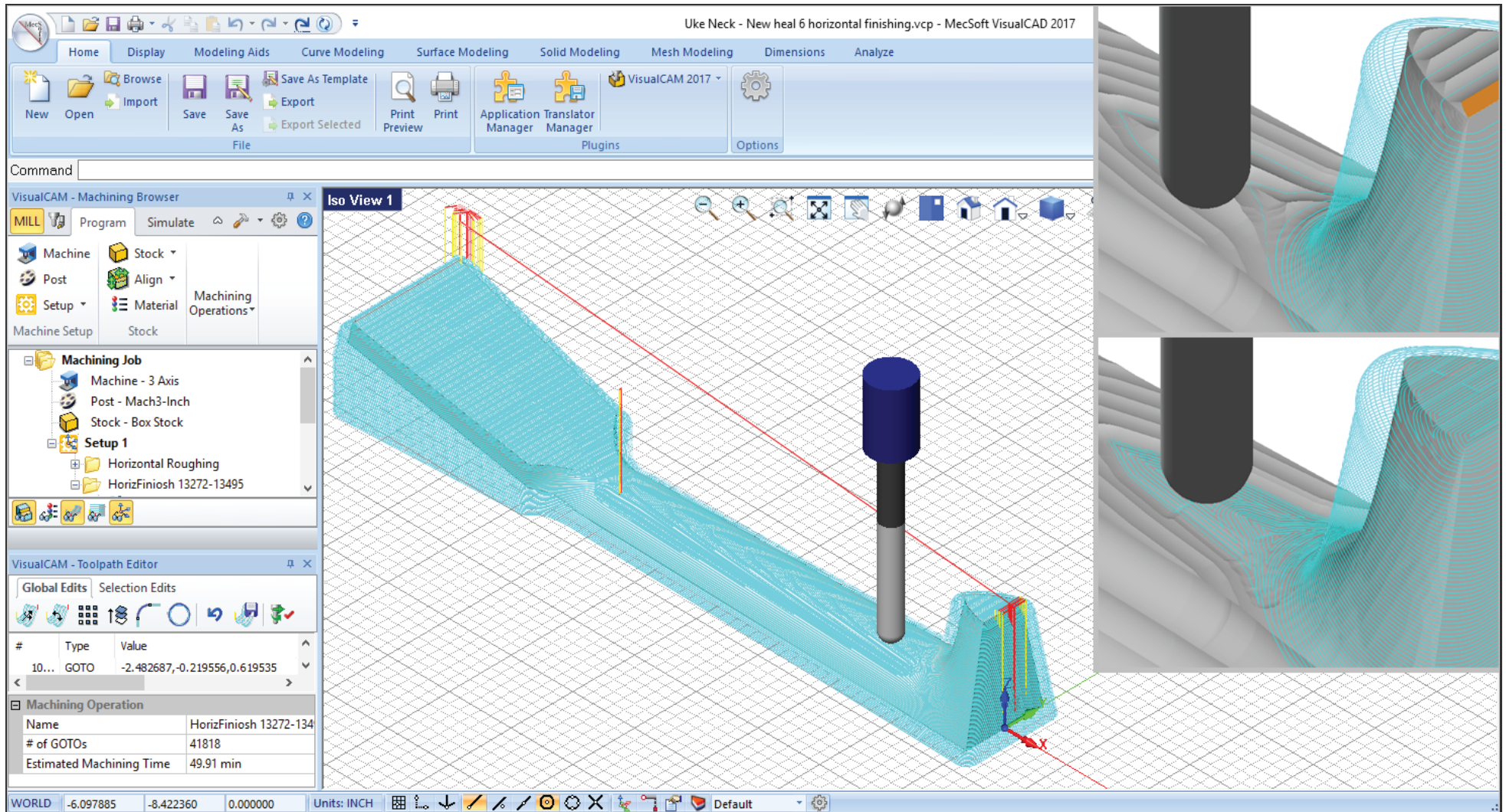


Optimized Machining automatically recognizes these flat areas and inserts projection toolpaths, similar to 3 Axis Projection Pocketing to clean out unmachined areas. This is a highly effective way of maintaining a uniform scallop height on the part. You have Stepover Control of the spacing of these optimized toolpaths as well as Engage/Retract for Optimized Cuts as shown in the dialog above.

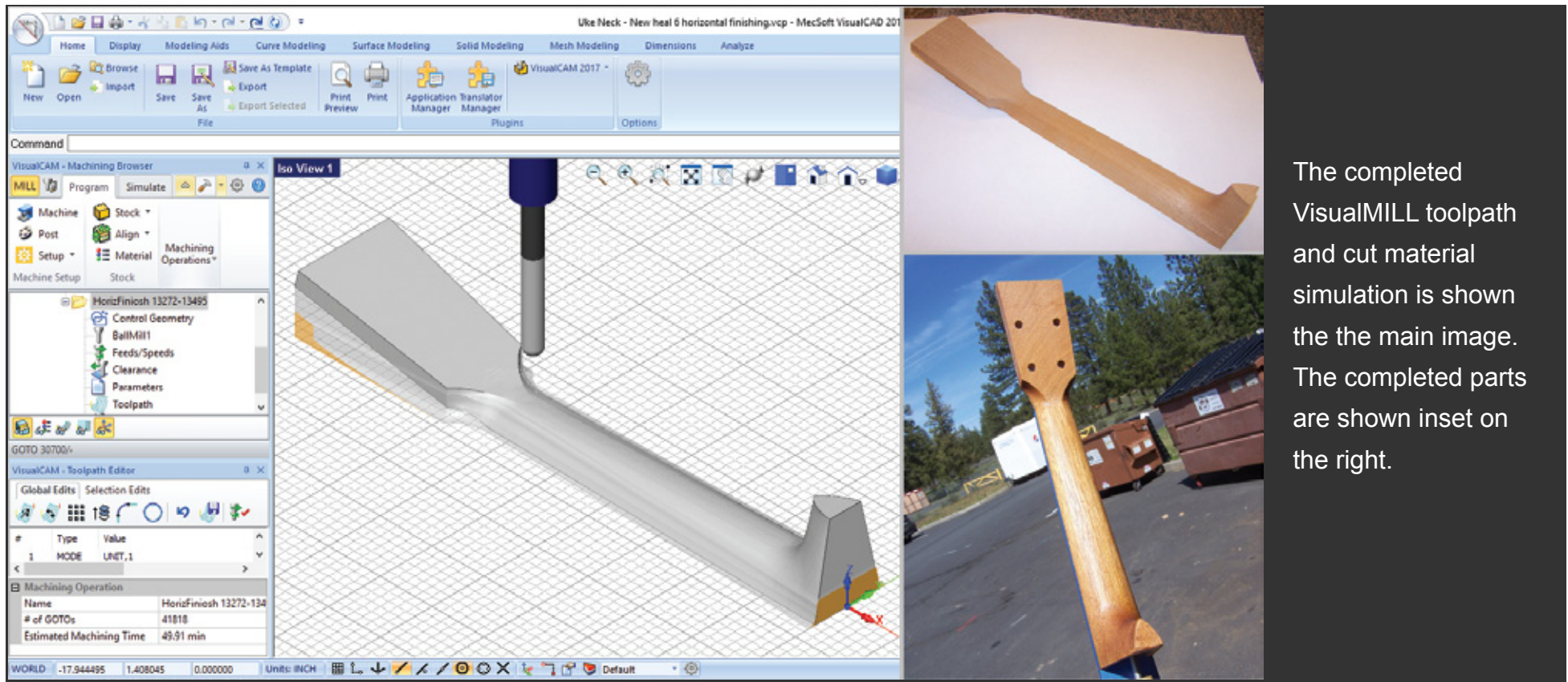
Let's take a closer look at the ukulele guitar neck model. The top right image shows the Horizontal Finishing toolpath without Optimized Machining enabled. Notice that in the near horizontal regions of the part, the scallop height increases because the Z planes create a wider stepover distance.

Now look at the bottom right image. Same part, same toolpath but with Optimized Machining enabled. Notice that the stepover distance in the flatter areas matches the Z depth distance in the horizontal areas! This allows for the optimum amount of material removal and a much finer surface finish. The entire part and toolpath is shown below.





In the main image, we see the entire 3 Axis Horizontal Finishing toolpath displayed in VisualMILL. (Inset Bottom Right) With Optimized Machining enabled, the step over distance in the flatter areas matches the Z step down distance in the vertical areas, resulting in a constant scallop height and finer surface finish.



The completed VisualMILL toolpath and cut material simulation is shown in the main image. The completed parts are shown inset on the right.

As you may guess, Tony's program challenges, inspires and motivates his students. After completing their guitars, the students are given the choice to keep or sell them with the school's help. Tony and SHS have wonderful support from the local business community there in Sisters Oregon. Mecsoft Corporation is now a fan as well! We want to thank Tony, his volunteer staff and all of his awesome kids in the Luthier Guitar Program there at Sisters High School for allowing us to showcase their work. They are truly an inspiration for all of us!

More Images from Sisters High School





More about Sisters High School

- For more information about Tony Cosby and his machining classes at [Sisters High School](#) we invite you to visit the high school web page.
- We want to extend a special thanks to [Bill MacDonald of Kona Breeze Ukes, LLC](#) and [Kerry Bott](#), two community volunteers who help Tony Cosby make the program there at Sisters High School a resounding success! Thank you both!

More about VisualCAD/CAM (VisualMILL)

VisualCAD/CAM (also referred to as VisualMILL) is available in 5 product configurations (Express, Standard, Expert, Professional and Premium). Here are some additional details about each of the available configurations. For the complete features list, visit the [VisualMILL Product Page](#).

- **VisualCAD/CAM Express:** This is a general-purpose program tailored for hobbyists, makers and students. Ideal for getting started with CAM programming. Includes 2 & 3 axis machining methods.
- **VisualCAD/CAM Standard:** This is a general-purpose machining program targeted at the general machinist. This product is ideal for the rapid-prototyping, hobby and educational markets where ease of use is a paramount requirement. Includes 2-1/2 Axis, 3 Axis, and drilling machining methods.
- **VisualCAD/CAM Expert:** Includes the Standard configuration plus 4 Axis machining strategies, advanced cut material simulation and tool holder collision detection.
- **VisualCAD/CAM Professional:** Includes the Standard and Expert configuration plus advanced 3 Axis machining strategies, 5 Axis indexed machining, machine tool simulation, graphical toolpath editing and a host of other features. Setup 4: Pocketing & Deep Drill 7
- **VisualCAD/CAM Premium:** Includes the Standard, Expert and Professional configurations plus 5 Axis simultaneous machining strategies.