

Christopher Dungey  
Cello Maker

## RhinoCAM and Cello Making

*at Christopher Dungey Cello Maker Inc.*

[Christopher Dungey](#) of Grand Junction, CO started his career in 1978 with a music degree playing double bass performances. However, Chris was quickly captivated by the art and fine craftsmanship of the very instruments that he loved to play.

So much so that in 1979 Chris applied, and was accepted to, the prestigious 3-year program at the [Newark School of Violin Making](#) in Newark, England where only 4-5 international students from around the world are accepted each year. After completing the program, Chris moved to Los Angeles working for a couple violin shops performing repair and restoration on some very high-end and expensive instruments (Stradivarius, Guarneri and Amati) during the day while building his own instruments at night and selling them wholesale. Soon, musicians were contacting him directly to commission the creation of their own Christopher Dungey Cello!



## Forward Thinking

Chris realized early on that if he wanted to stay in the business of cello making he was going to have to incorporate machinery into the art and craftsmanship. In the early days he added band saws, planers, drill presses and even a pantograph at one time. Then in 2015 Chris purchased a [Laguna IQ HHC](#) 3 Axis CNC machining center. For CAD, Chris chose [Rhinceros](#) for its ability to model the organic shapes that his cellos needed. [RhinoCAM](#) was then the obvious choice for toolpath generation because of its seamless integration with Rhino. We recently sat down with Chris to discuss [RhinoCAM](#) and the amazing art and craftsmanship of a cello maker!



***“I considered other CAM software at the time but after a short demonstration of RhinoCAM it was a “done deal” for me!”***

*Christopher Dungey Cello Maker Inc., Grand Junction, CO*

## The RhinoCAM Difference

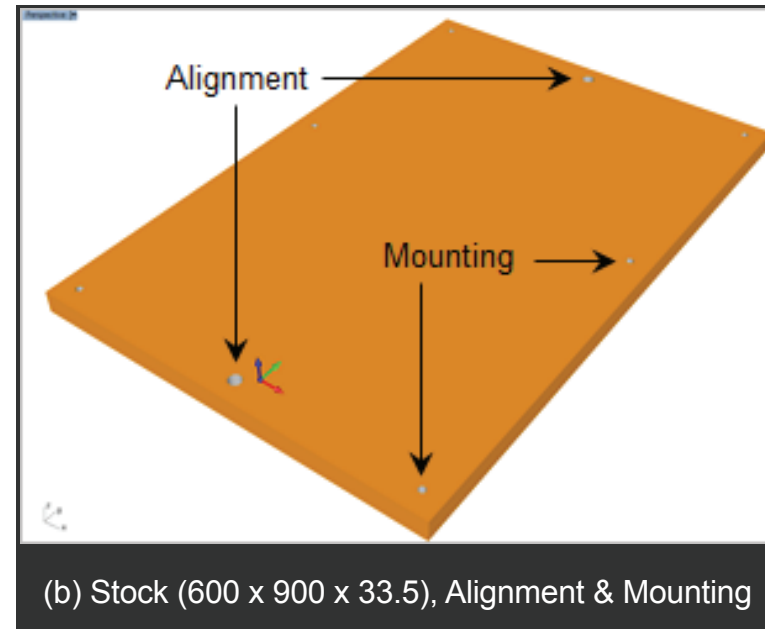
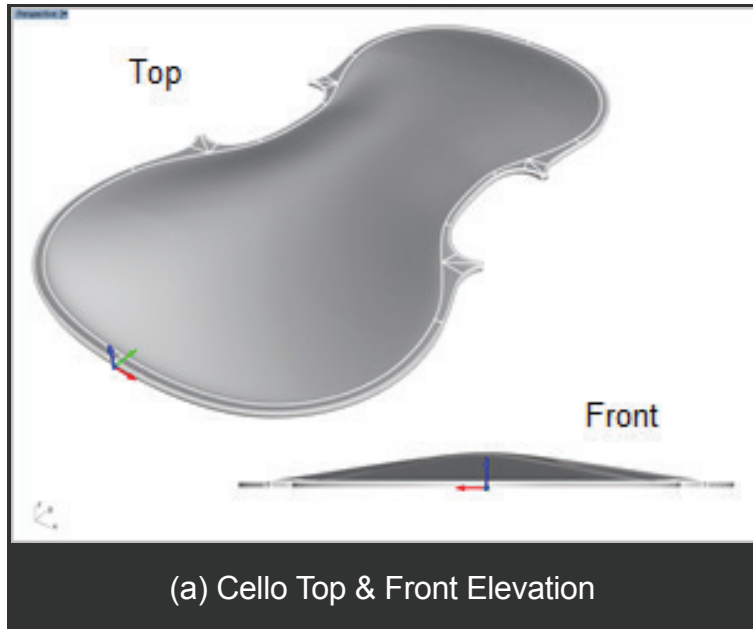
Chris will readily admit that even with some automation, it still takes 400-600 hours of labor and love to craft a Christopher Dungey Cello with #116 being completed as we speak, within the span of his 40-year career. However, cello making is an arduous profession that wreaks havoc on the upper arms, wrists and joints forcing short careers on many of his colleagues. With the help of RhinoCAM, Chris is able to automate the task of bulk material removal that 200 years ago would have been performed by apprentices.

## Parts & Setup

Chris has spent a considerable amount of time reviewing and tweaking his 3D CAD models until they represent the perfect form that make his cellos unique. In image (a) below on the left, we see the top side of the cello as a Rhino 3D part model. Notice the curvature in the front elevation. On the right image (b), we see the stock model in RhinoCAM. The holes at the north and south ends are for alignment while those located east and west are for fastening the stock to the table of the CNC machine.

Please note that all dimensions mentioned below are in millimeters.





*“After my first training session I was just in awe of how much I learned in the first hour! I would highly recommend to anyone who is considering a CAM program to try RhinoCAM because of the quality of the training that MecSoft provides!”*

*Christopher Dungey Cello Maker Inc., Grand Junction, CO*

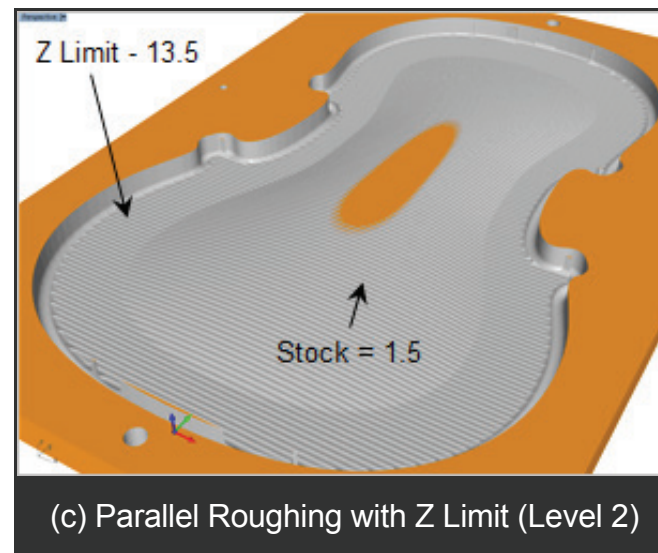
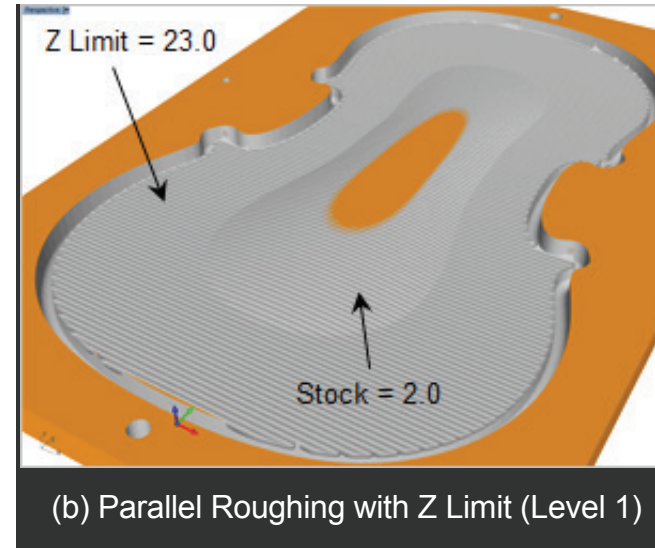
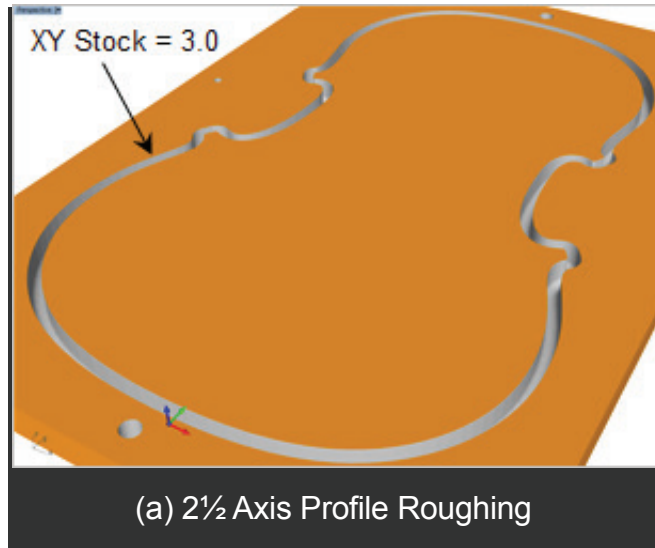
## Roughing

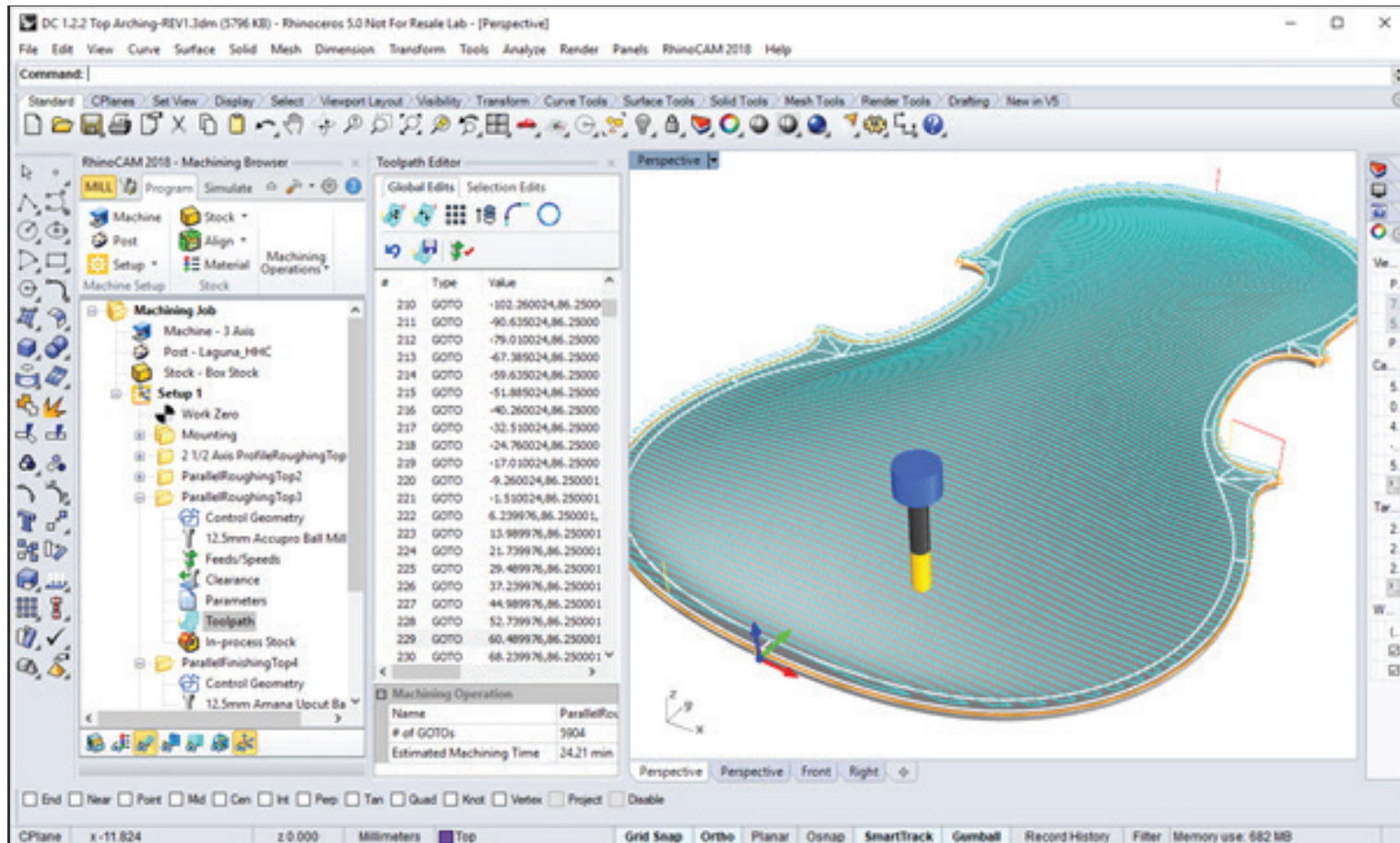
It is important to note here that the CNC machine is ONLY used for the bulk removal of excess wood. The final finishing work is all done by Christopher Dungey's own two hands (see Hand Finishing below).

Now for the tech talk: In the first image (a) below, we see a 2½ Axis Profile roughing operation using a 12.5 diameter Ball Mill with the XY Stock allowance set to 3.0 mm and Cut Direction set to Conventional (Up Cut). The Z depth of this profiling operation leaves a 7.0 mm thickness at the base of the stock and two rectangular bridges (20 long x 7 high) at the north and south locations. Refer to the Rough Finishing section below to see the Bridges & Tabs clearly.

The next operation shown in image (b), is an interesting use of 3 Axis Parallel Finishing, but used as roughing, again with a 12.5 diameter Ball Mill. Chris has a stock allowance of 2.0, a Mixed cut direction, a 46% Stepover and then sets the Lowest Z Containment to 23.0.

This is followed by the same operation (c) but with Stock at 1.5 and the Lowest Z set to 13.5. Both (b) and (c) have Engage and Retract motions set to Linear but with zero length and Approach and Departure motions set to 0.6. This allows the tool to start cutting while centered on the inner edge of the stock left from the previous Profiling operation.

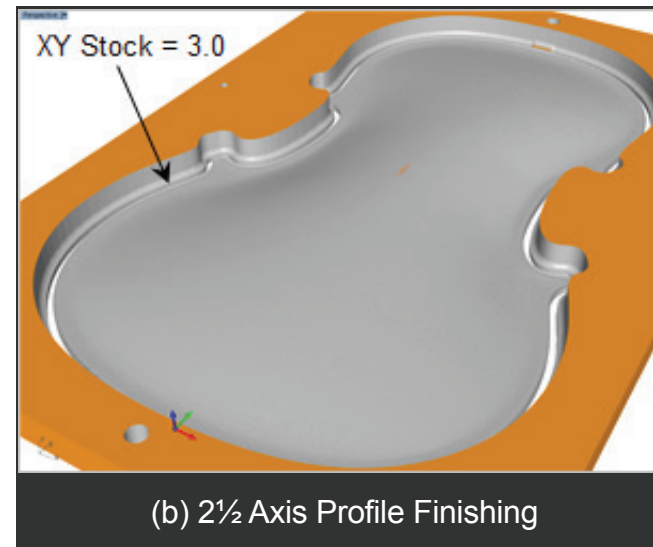
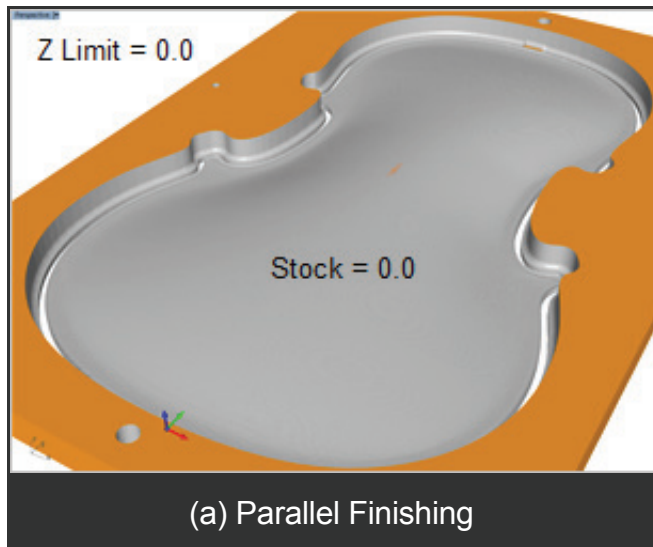




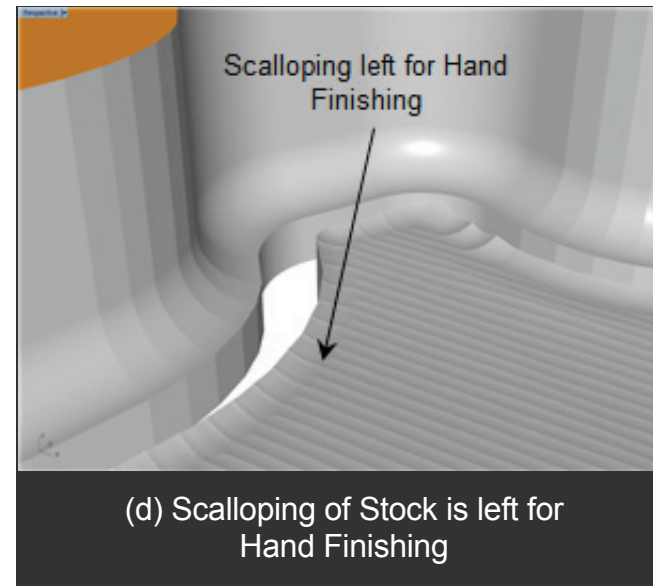
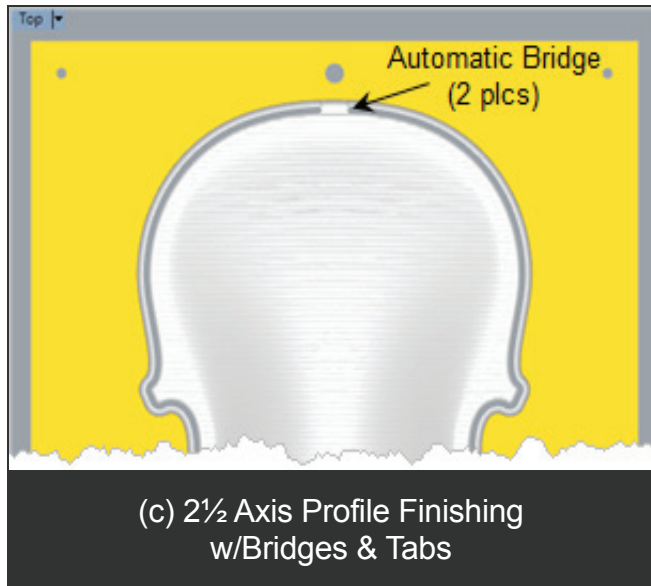
Here we see RhinoCAM 2018 and the second Parallel Finishing operation that is shown simulated in image (c) above. In this operation the Stock to leave is set to 1.5 and the Z Limit is set to 13.5. A 12.5 diameter Ball Mill is used with a Stepover of 46%.

## Rough Finishing

In these next series of images we see the final 3 Axis Parallel Finishing operation and the final 2½ Axis Profiling operation. The Parallel Finishing (a) is identical to the two shown above but with Stock and Z Limit both set to 0.0 and Stepover reduced to 12%. In image (b), the second Profiling operation is shown, this time with the XY Stock allowance set to zero and the rectangular bridges (north & south) set to 25 long by 6 high. The north end bridge is shown in image (c). Also notice the scalloping of stock material left on the part shown in image (d). This is by design. The final exterior cut is done completely by hand (see Hand Finishing below).

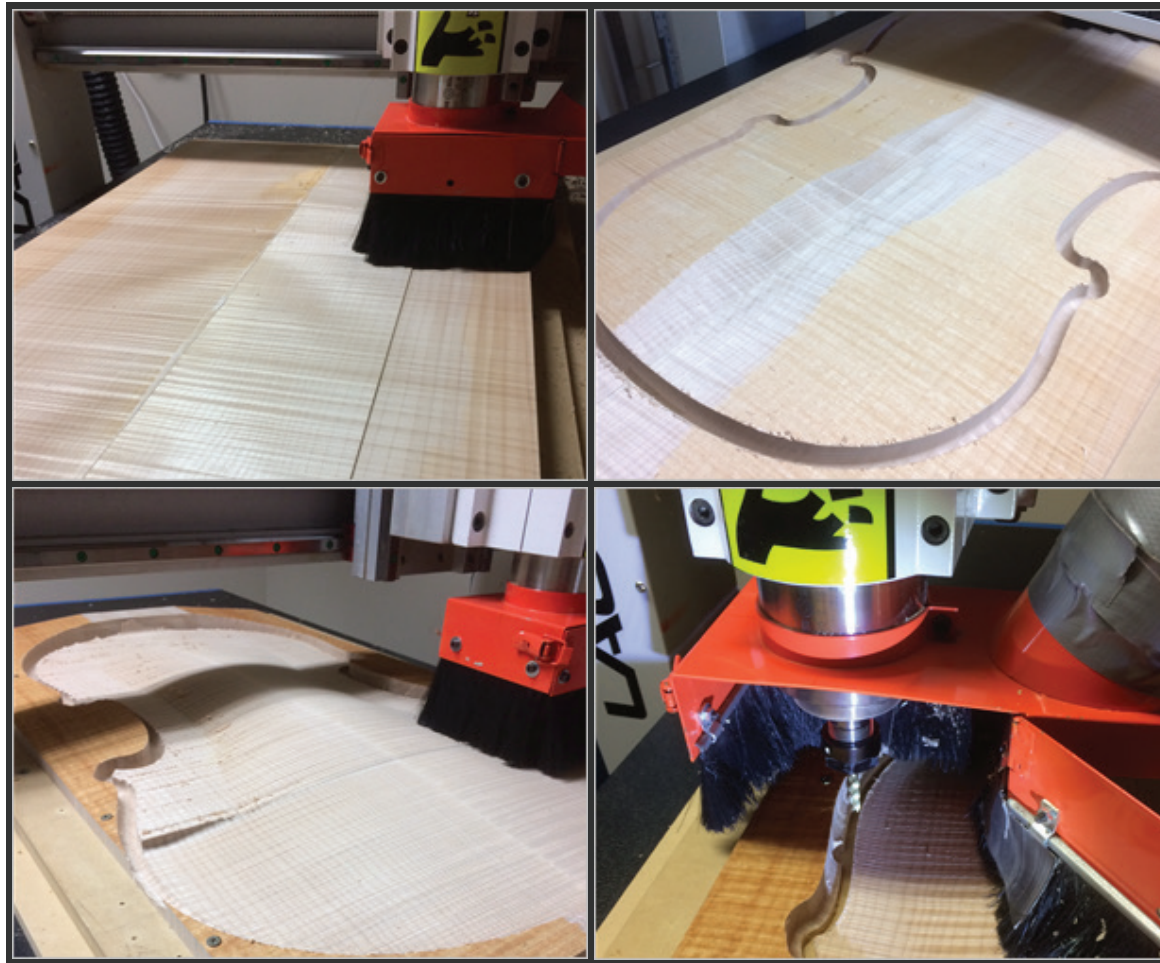






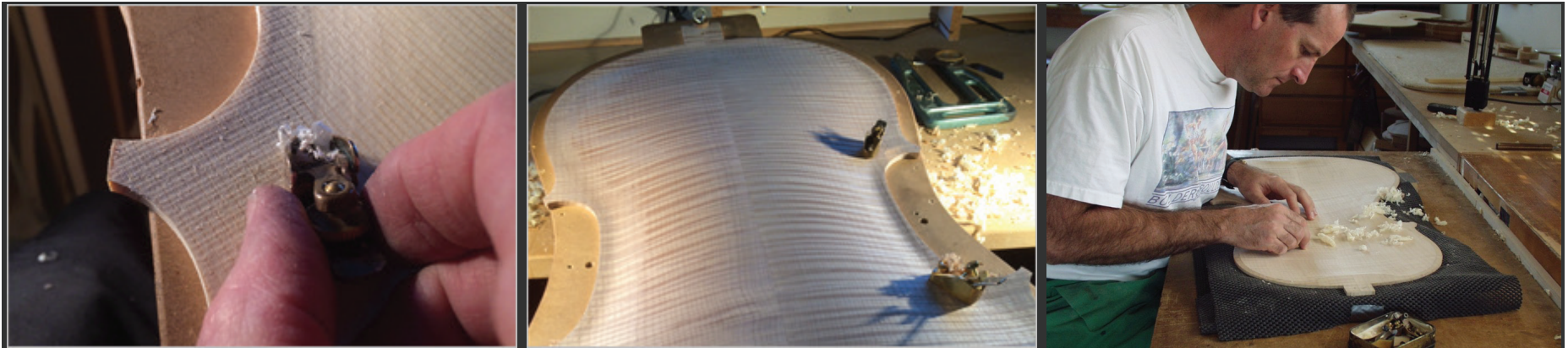
## CNC Machining

Here are some images of the part shown above being machined on Chris's [Laguna IQ HHC](#) 3 Axis Machining Center.



## Hand Finishing

Regardless of the use of modern CNC machine tools (for bulk wood removal only), a Christopher Dungey Cello is a finely crafted instrument. The images below show you all you need to know about the quality, skill and craftsmanship incorporated into each and every Christopher Dungey Cello.



## A Christopher Dungey Cello

Here are images of a completed Christopher Dungey Cello. Chris has become an expert in many different varnishing methods that include new varnish as well as those for restoration and repair. In image (d) below, Chris is shown standing next to a Kauri Tree in New Zealand. The fossilized resin from this tree is used in the varnish of every Christopher Dungey Cello.



## Cello Maintenance

A cello is a finely tuned instrument that matures over time; from brand new to seasoned instrument meeting the players' demands and traveling to many climates around the world. Chris maintains contact with many of the owners of his cellos with follow up adjustments so that the instrument can continue to sound beautiful and perform powerfully as it matures. Here we see Chris "Dialing in" a recent cello on the road at the [Grand Teton Music Festival](#).

## More about Christopher Dungey Cello Maker

We want to thank Chris for allowing us to share his story of a modern day Cello Maker and RhinoCAM! To learn more about Christopher Dungey and his passion and talent for cello making, we invite you to visit his website at [www.dungeycello.com](http://www.dungeycello.com) and on [facebook](#). We also invite you to hear a Christopher Dungey Cello at these video links:

- [Lynn Harrell's 100th Birthday Tribute to Orlando Cole](#)
- [Andante \(A Short Film\)](#)



## More about RhinoCAM Configurations

RhinoCAM - MILL is available in 5 different configurations (Express, Standard, Expert, Professional and Premium). The parts shown here were programmed using the Standard configuration. Here are some additional details about each of the available configurations. For the complete features list, visit the [RhinoCAM Product Page](#).

- **RhinoCAM MILL 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. Includes ART & NEST modules as well!
- **RhinoCAM MILL Standard:** This configuration includes everything that is in the Express configuration and additional 2-1/2 Axis, 3 Axis & Drilling machining methods.
- **RhinoCAM MILL Expert:** Suitable for 4 Axis rotary machining. Includes the Standard configuration plus 4 Axis machining strategies, advanced cut material simulation and tool holder collision detection.
- **RhinoCAM MILL Professional:** Ideal for complex 3D machining. 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.
- **RhinoCAM MILL Premium:** Tailored for complex 3D machining with both 3 Axis and full 5 Axis methods. Includes the Standard, Expert and Professional configurations plus 5 Axis simultaneous machining strategies.