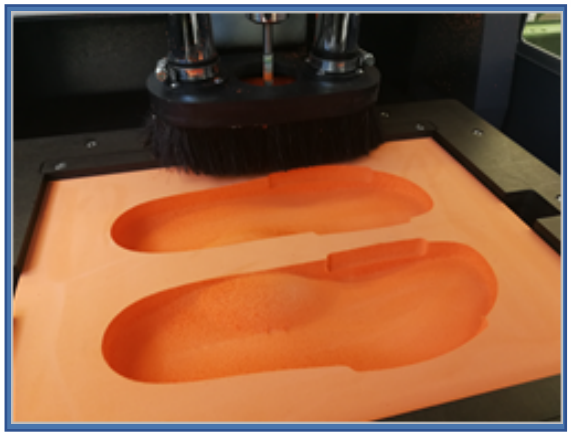
RhinoCAM does Custom Orthotics in Italy!



Duna Srl is a global company headquartered in Falconara, Italy that specializes in the production of general purpose and prescription orthotic footwear. The company manufactures a complete line of adult and kids off-the-shelf footwear products as well as custom footwear for patients who suffer from a range of mobility handicaps including sensory diabetic neuropathy (diabetic foot nerve damage), foot ulcers, peripheral vascular disease, birth defects and other injuries and deformities of the feet.

Duna has developed a complete orthopedic insole design and production system (hardware and software) with retail 3rd party manufacturing and sales outlets located across Italy, Europe, China and Thailand!

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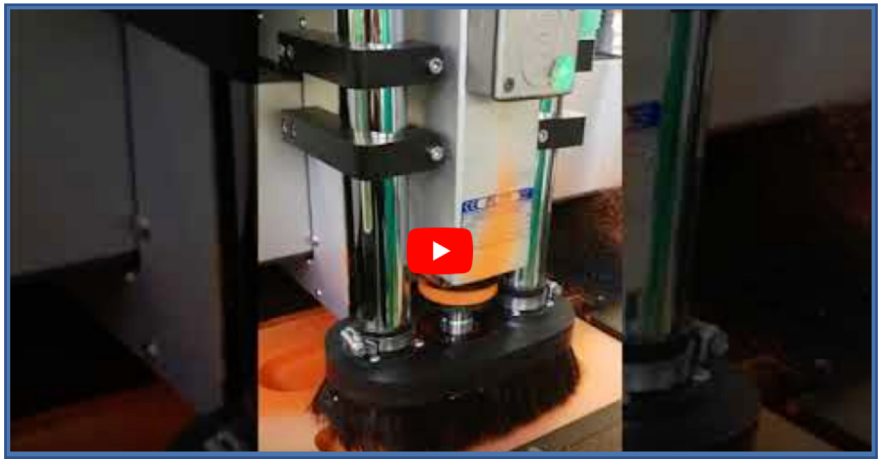
Click Here to watch the Duna Orthotic 3 Axis Machining Center in action cutting RhinoCAM toolpaths!



Duna has developed a CAD application that runs as a plugin to the Rhinoceros CAD system called *Insole Designer*. The CAD program expedites the process of insole design using knowledge bases, templates and specialized Rhino utilities. The CAD software's end result is a complete 3D nurbs polysurface model of the exact insoles ready to be housed inside the final shoe. The CAM software that Duna chose for their insole design and production system is RhinoCAM from MecSoft Corporation!

Raffaele Ieluzzi has a Masters Degree in Biomedical Engineering and is the Technology Development Manager for Duna Orthopedic Shoes. We recently sat down with Raffaele to discuss Insole Designer and see why they chose to integrate RhinoCAM into their orthotic production system.

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Here is a sample of what Raffaele had to say about RhinoCAM:

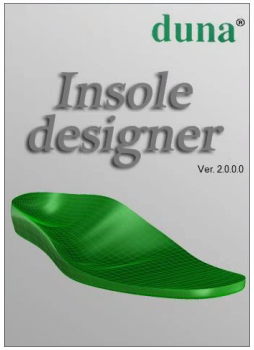
"We are very happy with the integration of RhinoCAM into our orthopedic insole production system. Because Insole Designer is highly customizable, we like how RhinoCAM provides access to every cut parameter and stores those parameters into a knowledge base. The milling strategies in RhinoCAM automatically adapt to any shape produced by Insole Designer. Because the two plugins work together seamlessly inside of Rhinoceros our users eliminate file translation errors and inaccuracies, resulting in the best fit for the patient and customer."

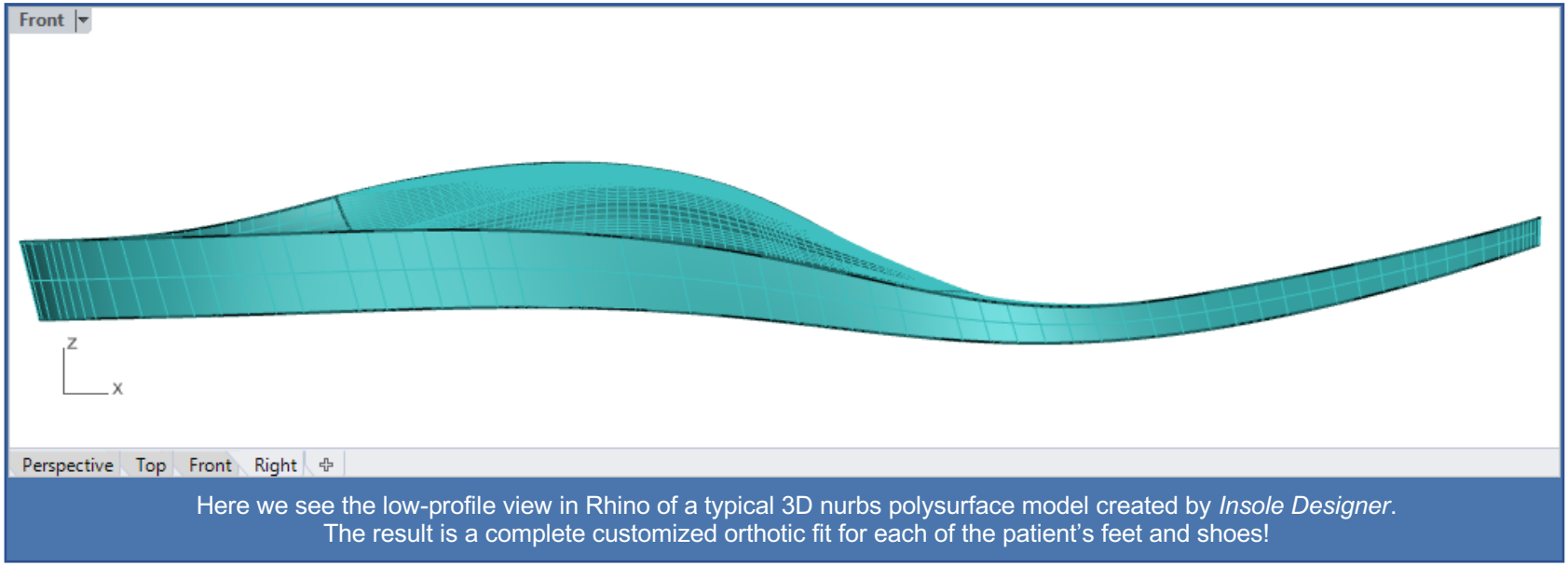
Raffaele Ieluzzi, Technology Development Manager
Duna Orthopedic Shoes, Falconara, Italy

Want to see how RhinoCAM can help you? Click Here to download a demo!

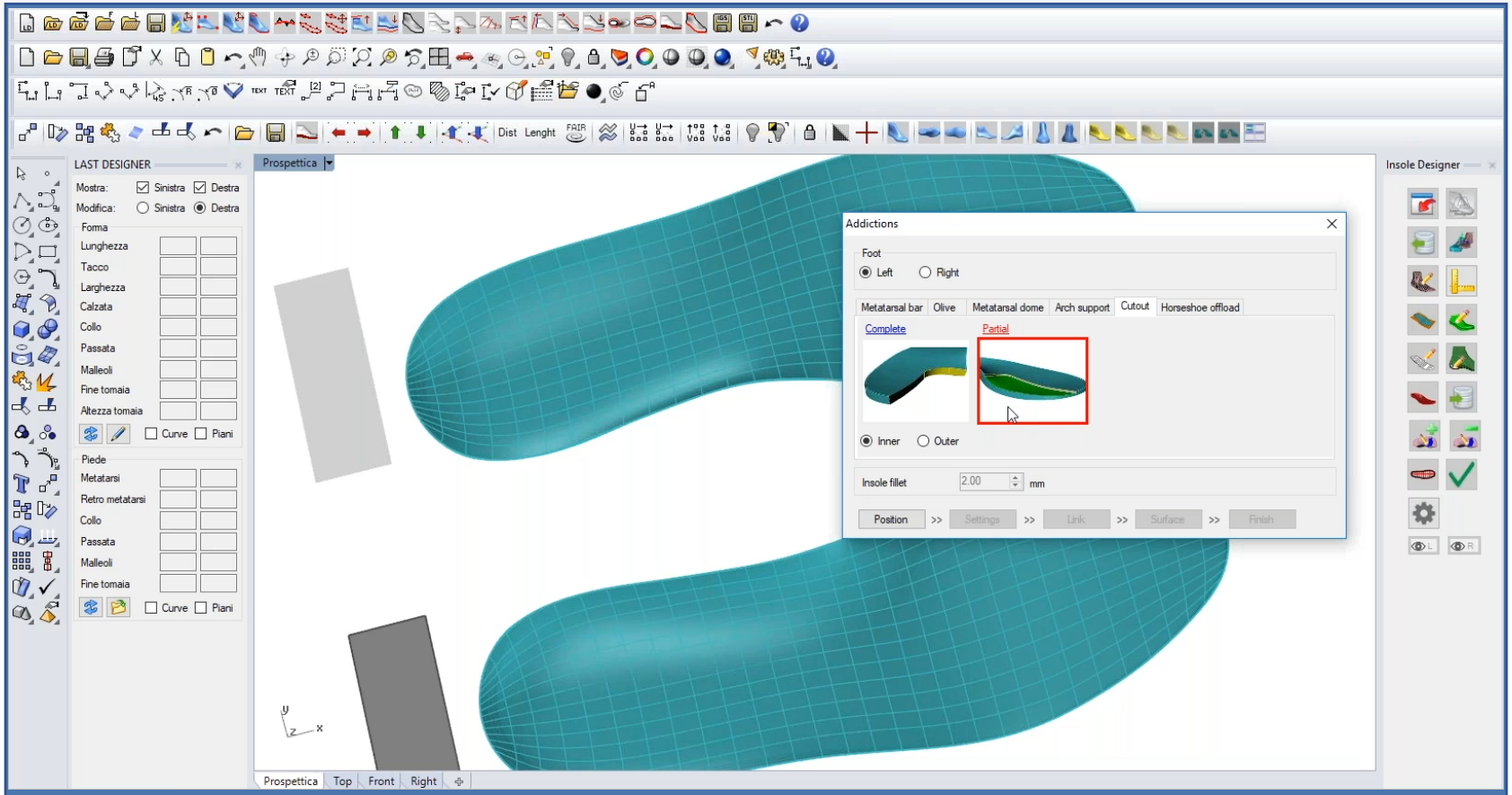
More about *Insole Designer*

Insole Designer uses integrated insole databases and templates coupled with an assortment of specialized tools and utilities to facilitate the creation of the customer's or patient's prescribed insoles. The integrated Rhino plugin creates a complete and accurate 3D nurbs polysurface model. Unlike other insole programs, Insole Designer develops the complete contoured insole top and bottom. The top fits the patient foot scan while the bottom and outer profile fits Duna's orthopedic shoe production. The result is a complete and custom fit for the patient using the least amount of added insole material. The profile view of a 3D nurbs polysurface insole created by Insole Designer is shown below. Notice the thin sculptured contoured top and bottom.





Here we see the low-profile view in Rhino of a typical 3D nurbs polysurface model created by *Insole Designer*. The result is a complete customized orthotic fit for each of the patient's feet and shoes!

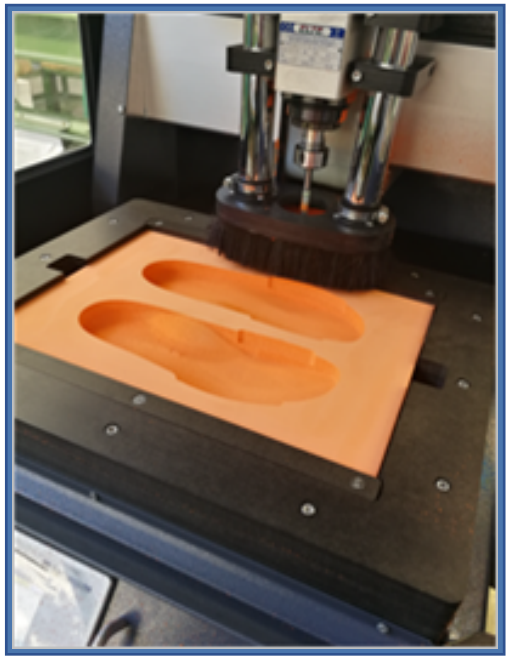


Insole Designer is an integrated Rhino plugin. The 3D nurbs polysurface model of the patient's insole prescription is displayed. The popup dialog shows just one of the many integrated insole design tools. There are Insole Designer toolbars located on the right side and top of the Rhino display. Both the left and the right insoles are created and customized together or separately by *Insole Designer.*

Want to see how RhinoCAM can help you? Click Here to download a demo!

The Machine & Setup

The Duna system is an integrated set of hardware and software tools designed to work together for the quick, consistent and accurate design and production of orthopedic insoles. The hardware consists of a compact 3 Axis CNC Machining center with vacuum table and fixture that accepts Duna's standard EVA foam stock material measuring 350 x 260 x 30 mm. Also included with the Duna system is a 3D scanner and software that integrates custom STL scanned point data directly into *Insole Designer*.



In RhinoCAM the Machine is set to 3 Axis with all coordinates output to the local setup coordinate system. *Insole Designer* creates the 3D nurbs polysurface model positioned to scale and as machined with both the WCS (World Coordinate System) and MCS (Machine Coordinate System) located at the bottom center of the stock definition. The post is set to Duna's customized RhinoCAM post-processor that outputs standard ISO G-Code in the format that is optimized for this 3 Axis CNC machine. The 3D insole model, stock and coordinate systems are shown in Rhino below. RhinoCAM's Machining Browser on the left shows the toolpath strategies and tool library loaded from the Duna RhinoCAM Knowledge Base.

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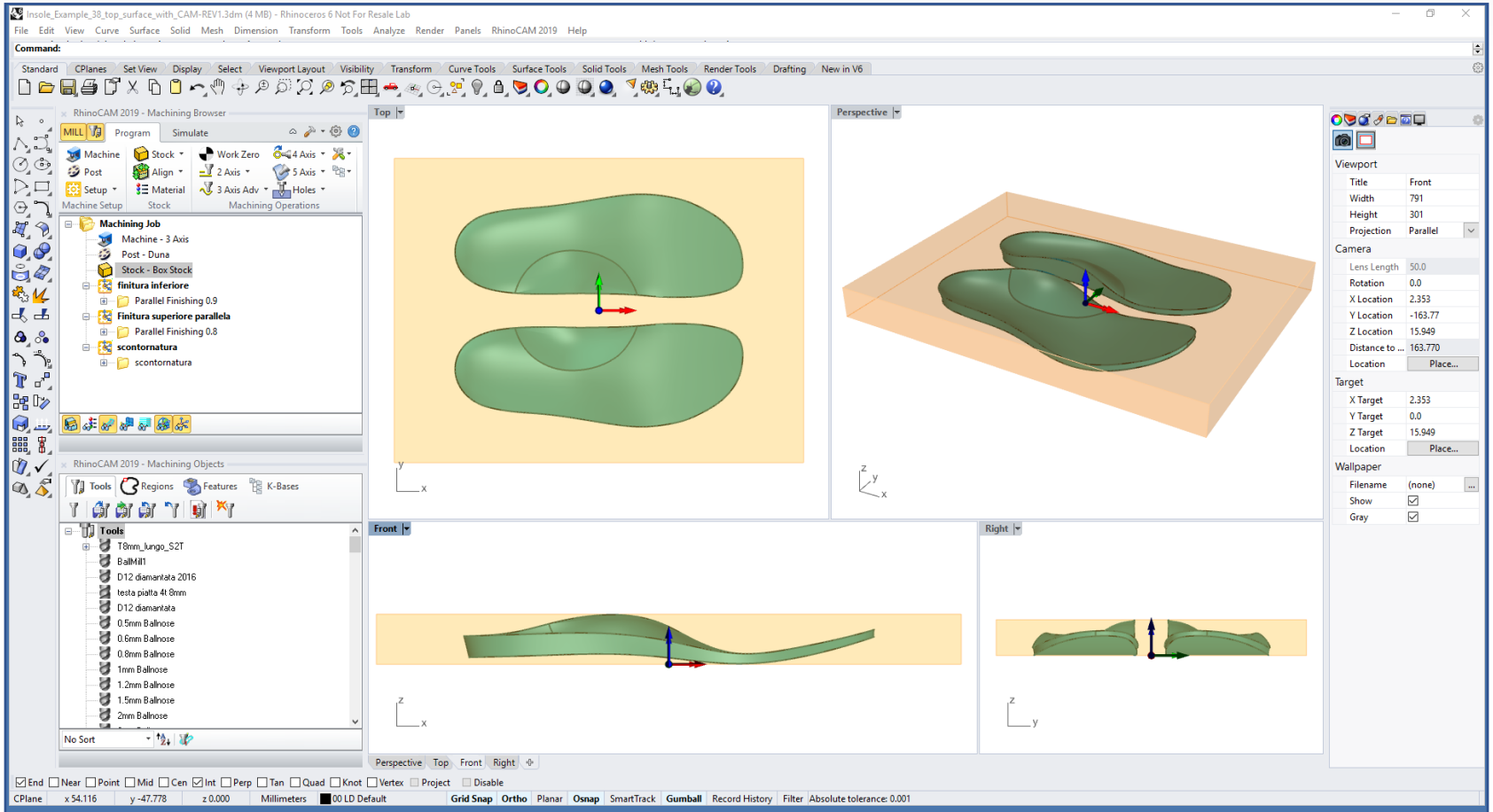

The 3D nurbs polysurface model from *Insole Designer* is shown in RhinoCAM. The Machining Browser on the left shows the toolpath strategies and tool library.

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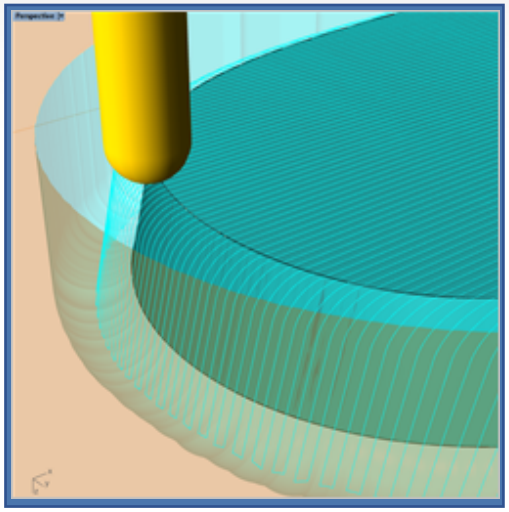
The RhinoCAM Toolpaths

RhinoCAM handles all toolpath generation and G-Code output for *Insole Designer*. Duna's RhinoCAM toolpath Knowledge Base is loaded and the required toolpath strategies are applied. Since *Insole Designer* creates the 3D nurbs polysurface model to the exact scale and coordinate location required, a consistent CAM programming procedure is established. In RhinoCAM, the Machine, Post, Stock size and Alignment are all the same for every insole.



The Underside Toolpath

The first setup in the Machining Job contains a 3 Axis Parallel Finishing toolpath strategy for the under side of the insoles. In this example, a roughing path is not required. The underside of the insoles do not even require a geometry selection to be made. RhinoCAM calculates a toolpath for all accessible surfaces (bottom and tapered sides) that the tool can access. Below we see the in-process stock and cut material simulation of the underside of the insole using an 8mm diameter ball mill. The cut parameters include a machining Tolerance of 0.03mm, a Stock allowance of zero, a Mixed Cut Direction and a stepover of 0.9mm. Linear entry and exit motions are used with straight Cut Connections.

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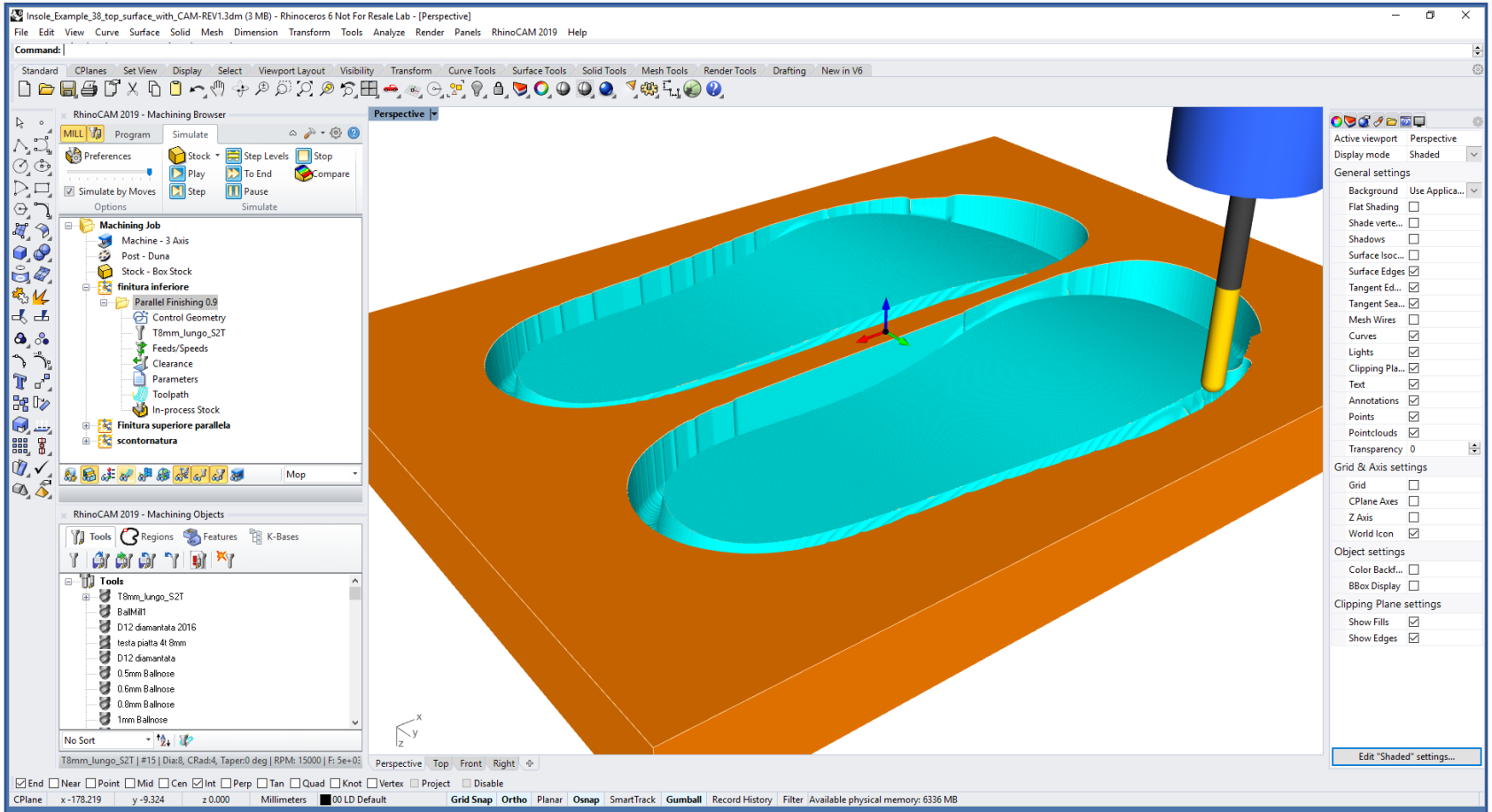

Here we see Rhino with the RhinoCAM plugin loaded showing the Machining Browser on the left.
A cut material simulation of the 3 Axis Parallel Finishing toolpath of the underside of the insoles is displayed.

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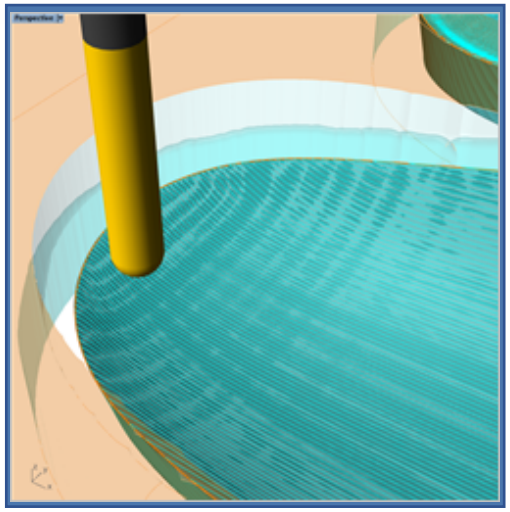
The Upper Side Toolpath

Once the underside toolpath is completed cutting, the in-process EVA box stock is turned over in the machining fixture and a 3 Axis Parallel Finishing toolpath is executed for the upper side. *Insole Designer* creates a nurbs curve around the upper outer perimeter on each right/left insole. The upper side toolpath is contained by these two outer perimeter curves. Below we see the in-process stock and cut material simulation of the upper side of the insole using the same 8mm diameter ball mill. The cut parameters are identical to the under side except for a tighter stepover of 0.8mm.



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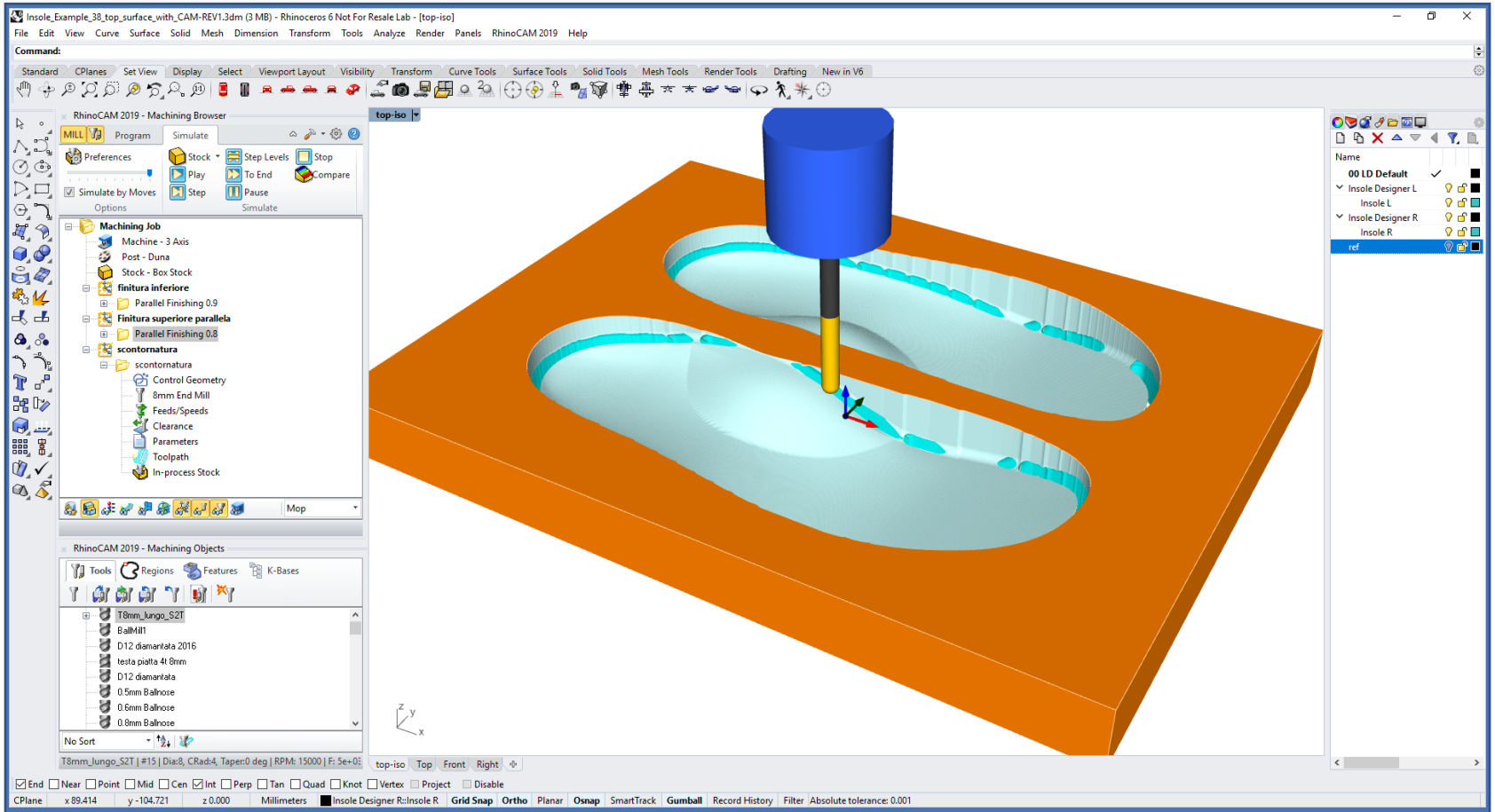

Here we see the RhinoCAM plugin loaded showing the Machining Browser on the left. The in-process stock and cut material simulation of the 3 Axis Parallel Finishing toolpath of the upper side of the insoles is displayed.

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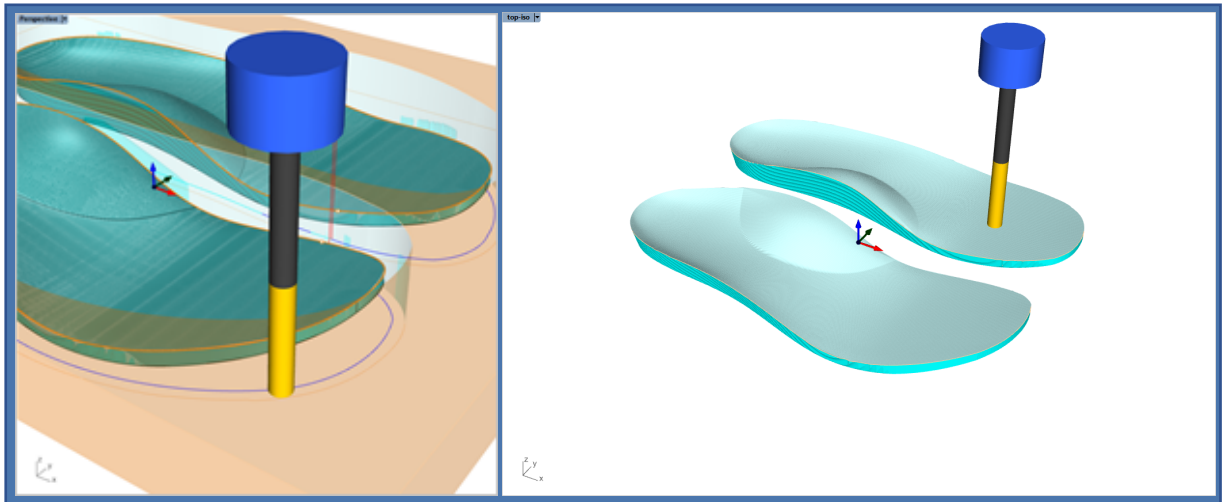
“RhinoCAM’s knowledge base tools allow the CAM programming to proceed very quickly using the same CAD interface that our Duna Insole Designer provides. We tested other CAM applications including Delcam. One of the reasons we decided on RhinoCAM is because it provides the 3 Axis toolpath strategies we needed directly inside of Rhinoceros.”

Raffaele Ieluzzi, Technology Development Manager
Duna Srl, Falconara, Italy

Cleanup & Extraction

While the in-process EVA box stock is still in the machining fixture a 2 Axis Profiling toolpath strategy is sometimes performed using the same outer 3D perimeter curves depending on the amount of residual stock material needed for removal. This toolpath uses an 8mm diameter end mill. Cut parameters include the top of cut set to 30mm in Z and a cut depth also set to 30mm. This produces a single profile path at the bottom of the stock material as shown in the images below. Arc fitting is also enabled for a smooth perimeter surface finish. The matching right/left insoles are then extracted from the EVA stock, hand ground to remove any extraneous machining marks and assembled into the customer's or patient's prescription footwear.



On the left we see the cut material simulation of the 2 Axis Profiling toolpath. It follows on the outside of the upper outer perimeter nurbs curve (shown in dark orange) of both the right and left insole. The cut parameters produce a single pass at the base of the stock material (shown in dark blue). On the right we see the completed insoles cut material simulation after the three toolpaths are complete.

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The completed custom orthotic insoles from Insole Designer and RhinoCAM at Duna srl.

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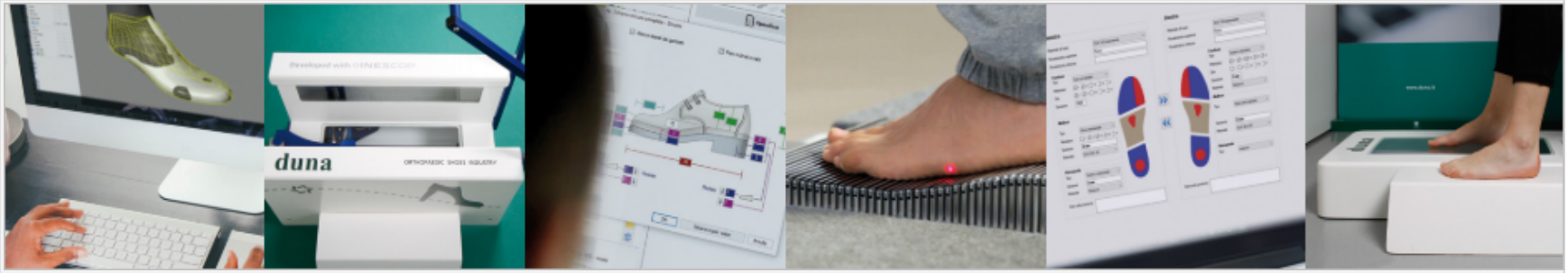
More about Duna Orthopedic Shoes

Duna Srl is a global company that offers off-the-shelf and Individual footwear orthotics design, manufacturing, materials, technology products (hardware and software) and services dedicated to the Orthotic footwear market. TCO – Technological Customized Orthosis – is the innovative measure-to-manufacturing production process developed by Duna's Innovation & Technology to innovate all the operating phases that contribute to the manufacturing of orthopaedic custom- made insoles Duna offers the following hardware and software orthotic diagnostic tools.



FootWizard®
Ortho FootScan 2
FootWizard® Insole

FootWizard® Custom
3 Axis Milling Machines
INERTIAL SYSTEM

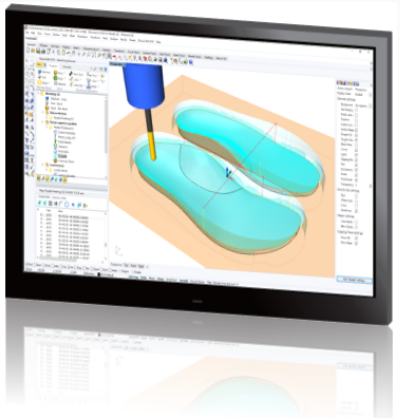
TCO Insole designer
PRESSURE
PLATFORMS

3D DigiPlan
Last Designer

To learn more about Duna srl and the software and systems they offer we invite you to contact them at info@duna.it or visit them online at https://www.duna.it/en.

More about RhinoCAM

RhinoCAM - MILL is available in five different configurations (Express, Standard, Expert, Professional and Premium). The part shown here was programmed using the Professional 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. Also now includes 2½ Axis Turning!
- **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.

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For the complete features list, we invite you to visit the
RhinoCAM Product Page:
mecsoft.com/rhinocam

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