

VIVID 9i Training Report



KONICA MINOLTA

VIVID 9i Training Report – December 3, 2004

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Timberland Shoes

Timberland Shoes designs and manufactures shoes for the general retail market. Although most of the manufacturing is performed in Asia, much of the design work is completed in their Stratham, NH Headquarters.



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Men's Collection

BOOTS THAT WORK AS HARD AS YOU DO.

Steel Toe Boots

Timberland 
DON'T WEAR IT. USE IT.™

WE STARTED OUT AS BOOTMAKERS, but we're about much more. Like you, we care about the strength of our neighborhoods, the well-being of our environment, and the quality of life in our communities. We believe in making a difference and invite you to join us.

Their interest is to be able to use the scanner for Reverse Engineering, Design and Rapid Prototyping work. The team responsible for the implementation of the scanner is the CAD group managed by Toby Ringdahl. Toby and his two key designers, Doug and Rob were all present for the training session.

The CAD group has a number of tools at their disposal. They have a Z-Corp printer for rapid prototyping purposes. They have a number of CAD tools. However, they have recently purchased the 3Shape Shoe last design package that will be the primary tool to manipulate the scan data.

The goals of the training session were as follows:

- Basic Scanner Setup and Theory of Operation
- Use of Polygon Editing Tool (PET) For Scan Data Collection
- Determine Best Process Flow for Shoe Last Scanning Including:
 - Use of Geomagic Capture for Collection of Scan Data
 - Use of Geomagic Wrap for Polygon Editing
 - Export Data to 3Shape Design Package

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System Configuration

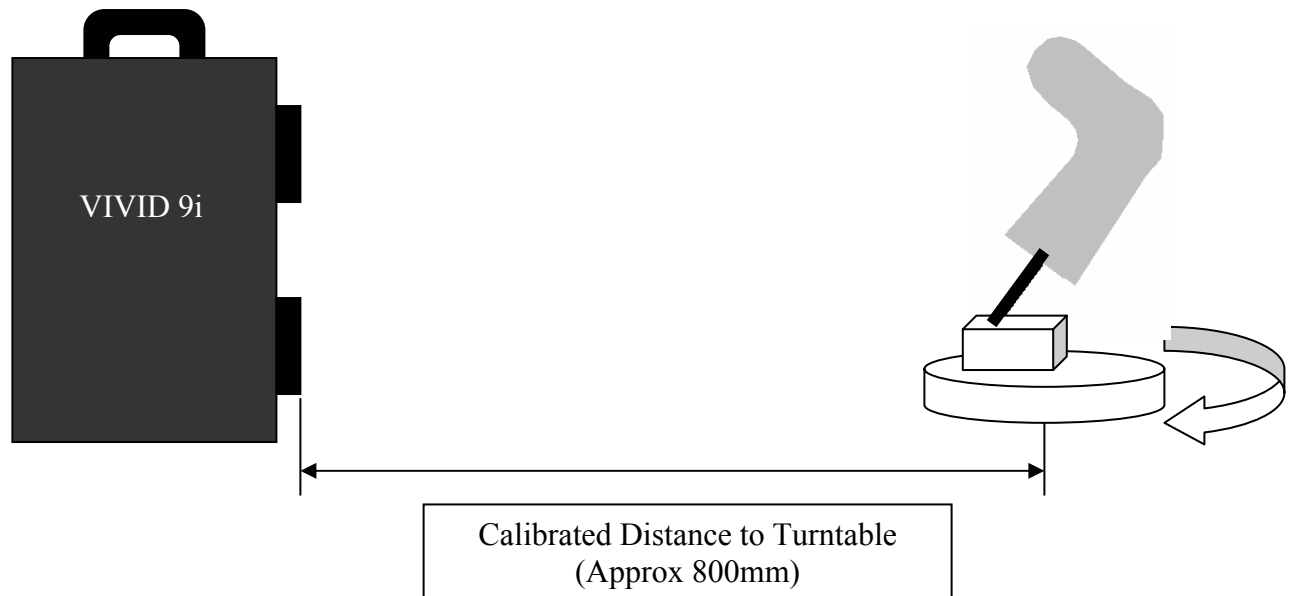
Timberland purchased a VIVID 9i system with the automated turntable. They had both the Konica Minolta PET software as well as Raindrop Geomagic Capture and Wrap Modules.

The space in the CAD area was a little cramped. The VIVID 9i was located atop a Bogen tripod and the turn-table was positioned on a small table. The table seemed to be free of vibration, however a more permanent installation would be more stable.

The most difficult task was finding an appropriate fixture for the shoe lasts. They are made of a slick polymer that makes clamping them well very difficult. My recommendation is to give some thought to a more permanent mounting scheme, or this may become a source of some frustration.

Due to the lack of a good fixture we chose to scan the shoe lasts "one-half" at a time. The last was placed on the turntable and scanned with the toe up, then the process was repeated with the toe down. It may be possible to scan the complete last in a single rotation with a better fixture.

The Middle Lens was used and the standoff distance was slightly less than 800 mm.



If a new fixture is developed, it would be ideal to allow the last to be oriented at different angles relative to the turntable axis. This would provide for maximum coverage of scan data for each rotation.

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Process Flow Outline

Due to its imminent release, most of the training was performed on Geomagic's Version 7.0. This will be the first release of Geomagic that will support the VIVID 9i Scanner. Until Version 7 is released Konica Minolta's PET software must be used to collect the scan data.

Process Flow Steps:



Scan the last with the toe up. Angle the scanner such that there are no holes in the scan data for the toe. It appears that six scans taken in continuous mode would give appropriate coverage.



Create a group of the toe scan data and perform a global registration on those scans. Ensure the registration proceeds past 10 iterations for a good convergence.



Scan the last with the heel up. Angle the scanner such that there are no holes in the scan data for the heel. A total of six scans are taken in continuous mode.



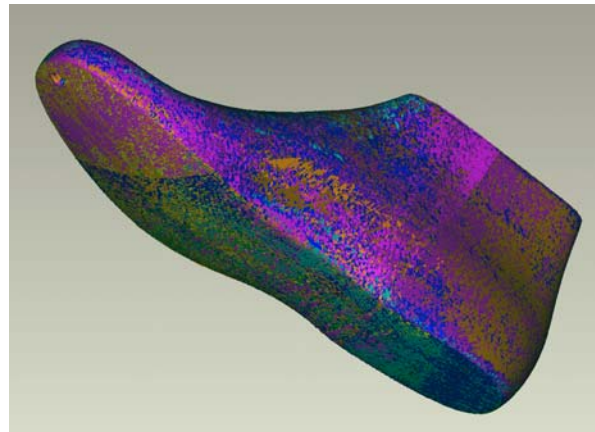
Create a group of the Heel scan data and perform a global registration on those scans.



Use manual registration to align the heel scans with that of the toe. Ensure the groups are similarly positioned in the Fixed and Floating windows if single point registration is to be used. Use the register button to improve initial alignment. Use the modify button for correcting large errors.



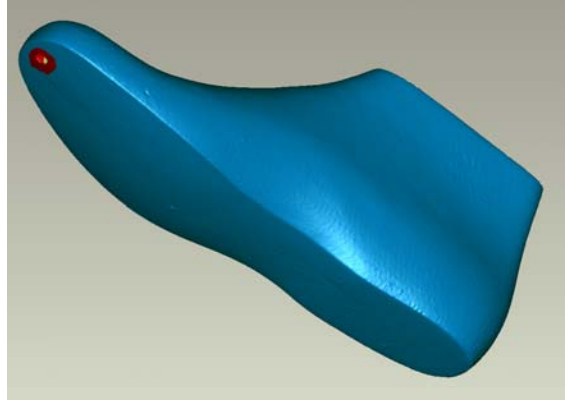
Perform a global registration on the combined scan data. Use the default settings for alignment.



Good Registration Result



Use the Merge command to create a single shell from the multiple scans. Some experimentation with smoothing levels will be required for best results. We used **minimum** local noise reduction and the **Auto** setting for global noise reduction. Make sure Global Registration, Point Spacing and Target Triangles are unchecked. Ensure that the Keep Points box is checked. This allows us the option to repeat global registration should the merged model contains major defects.



Use the custom region select tool to highlight areas that require hole filling or a large amount of smoothing.



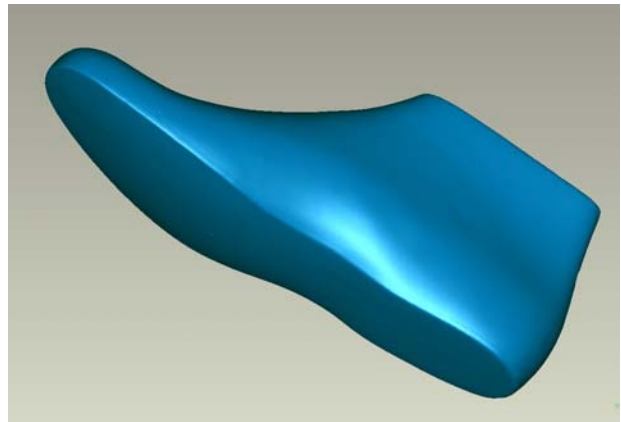
Use the Defeature Tool to smooth and fill the highlighted areas.



The Sandpaper Tool can also be used to ‘touch-up’ areas that require a little smoothing.

Polygons

Use the “Reduce Noise” Selection under the Polygons menu to perform smoothing on the entire last. By using the “Prismatic Shapes (Aggressive)” setting, a nice smooth surface can be obtained without rounding the sharp edges of the last. The slider bar controls the amount of smoothing performed. Select the display deviation checkbox to get feedback on the smoothing process.



Run the Make Manifold Open command to trim any

remaining polygons which may not be connected to the model. Run the Fill holes command to ensure that there are no holes remaining in the model. After this step the model may be exported as a clean STL file.

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Optional Process Steps:

The following steps may be required to optimize the compatibility of the data for use with the 3Shape last design software. None, any or all of these functions can be performed as required.



Use the Sharpening Wizard (Located under the Polygon Menu) to sharpen the edges of the last. This is a multi-step process that the user can control. It is a difficult step to automate.



Use the Decimation Tool to reduce the number of polygons in the model. Based on our one-time experiment it seems that the 3Shape would prefer a vastly reduced model. Target model size was approximately 20,000 polygons.



Toggle between Move Camera and Move Model modes in order to reposition the last in the coordinate system. Select the front view in the Move Model mode. Align the part such that the front view is what you desire. The same process can be repeated for the remaining views. Use the Reorient Model command from the Edit Menu to complete the move process. Remember to reselect the Move Camera mode once the last has been moved to its new coordinates!

Further Improvements:

Listed below are a few items that may be worth investigating to maximize the potential for the 3D scanning system.

More Space! A small 3D scanning studio will definitely reduce the clutter in the office area and allow for better control of ambient light conditions.

Last Fixturing: an improved method for fixing the lasts on the turntable will be the best step possible for improving the process near-term.



Macro Functions: Many of the standard process steps can be included in a MACRO. Judicial use of macros can significantly speed post processing of the scan data.

Formal Geomagic Training: I highly recommend the training offered by Geomagic at their facility in North Carolina. You can never know too much.

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Conclusions

The CAD Group at Timberland is sure to be successful in the use of their new scanner. The application is an excellent fit for the technology and the group appears to have all of the tools they need. They are a talented organization and were very quick to comprehend the theory behind the scanner and accompanying software.