



## User Manual Pages

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## 3D Laser Scanning



After calibrating the camera (see [Camera Calibration](#)) you can start scanning. The following steps will guide you through the 3D laser scanning dialog of DAVID:

(For scanning without background, see here - experienced users only!)

1. Place the object that you want to scan between the camera and the Calibration Corner (close to the Calibration Corner). It should be visible in the middle of the camera image. Take care not to move the Calibration Corner or the camera! In the left and right part of the image, the Calibration Corner must be visible:

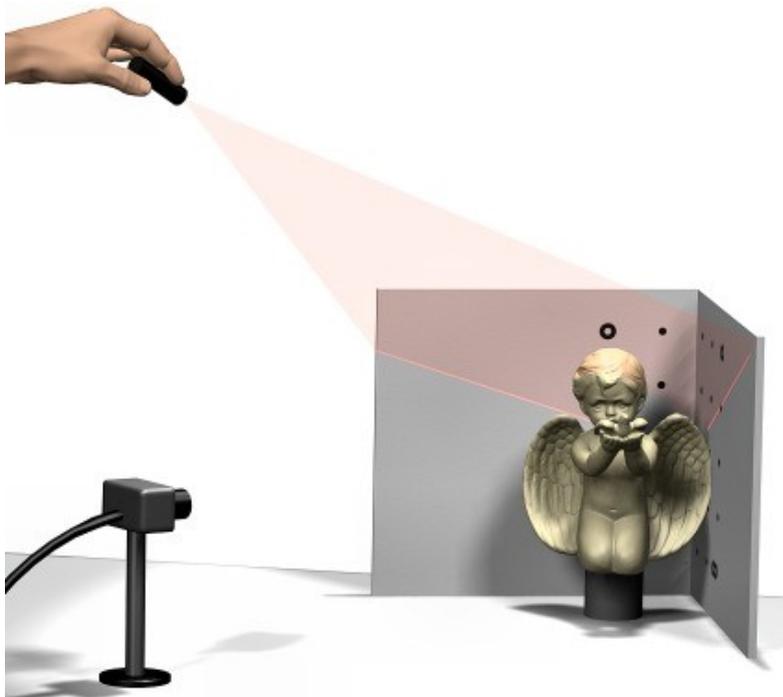


2. Switch on the laser and point it into the scene. Use the button for camera settings above the Pause button to adjust the camera settings (aperture, exposure), the position of the laser, and the light conditions in your room so that the laser line is clearly and brightly visible in the image, while the rest of the image is as dark as possible:



Furthermore, it is important to switch off all automatic image enhancements (like auto-exposure, auto-gain, auto-white-balance, auto-focus...).

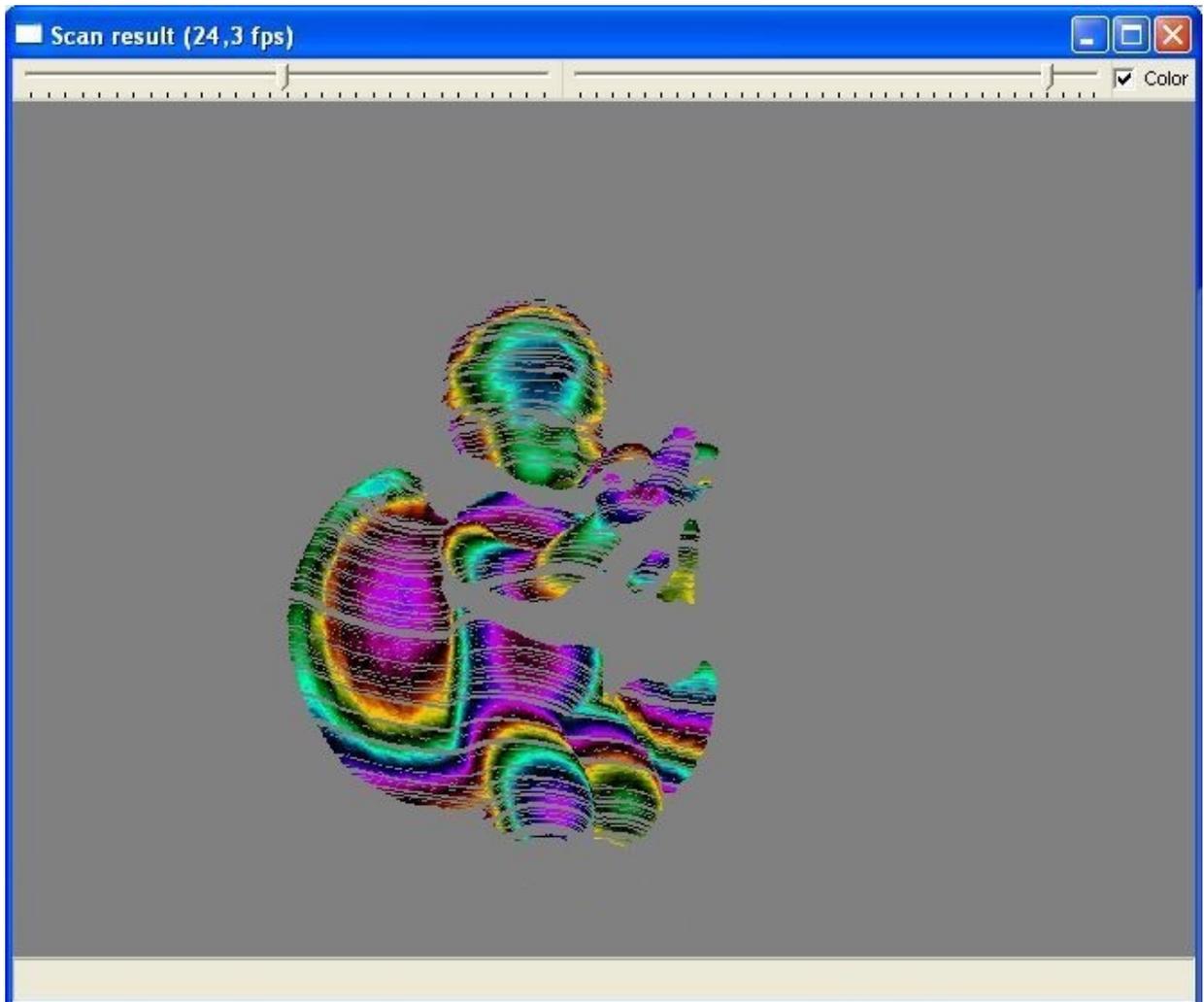
3. The light conditions in your room should not change too much from now on!
4. Choose the correct laser color (Red laser vs. Green laser).
5. Switch OFF the laser (or at least do not let it point into the scene), then press "Start"!
6. Switch ON the laser, hold it in your hand and scan the object by "brushing" the laser line over the object:



**7. Some very important hints:**

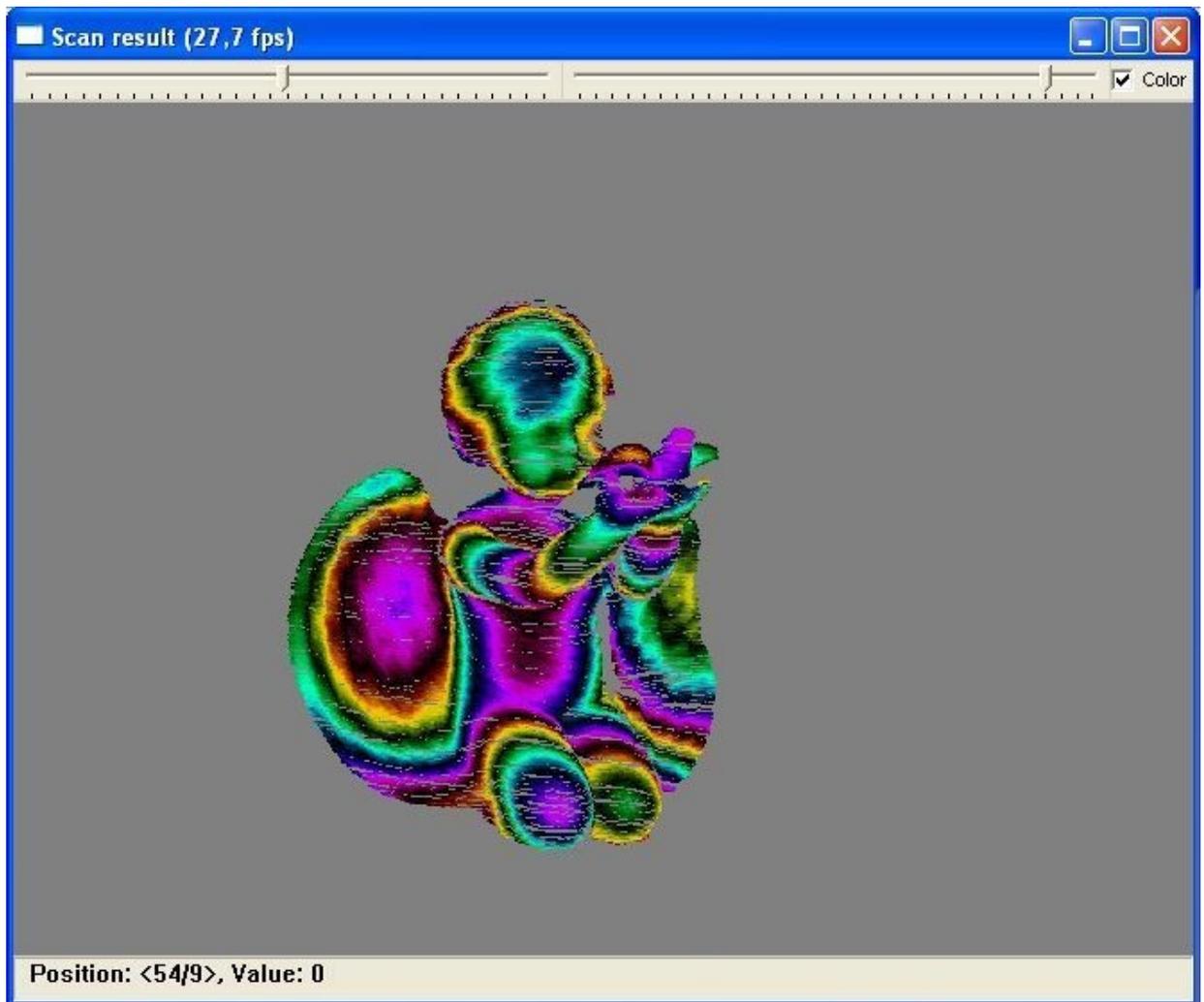
- The Scan Quality Feedback in the Scan Result window will help you optimize your scan conditions.
- The laser line MUST be visible on the Calibration Corner in the left and right part of the image, and on the object in the middle AT THE SAME TIME.

- The distance between the camera and the laser plane (i.e. the triangulation angle) should be as large as possible for high precision. Otherwise, you will see a warning “INTERSECTION ANGLE TOO LOW”.
- Depending on your camera's exposure settings, you should not move the laser line too fast.
- In the “Scan results” window, you can always see which parts of the object you have scanned, and where you should “brush over” again:



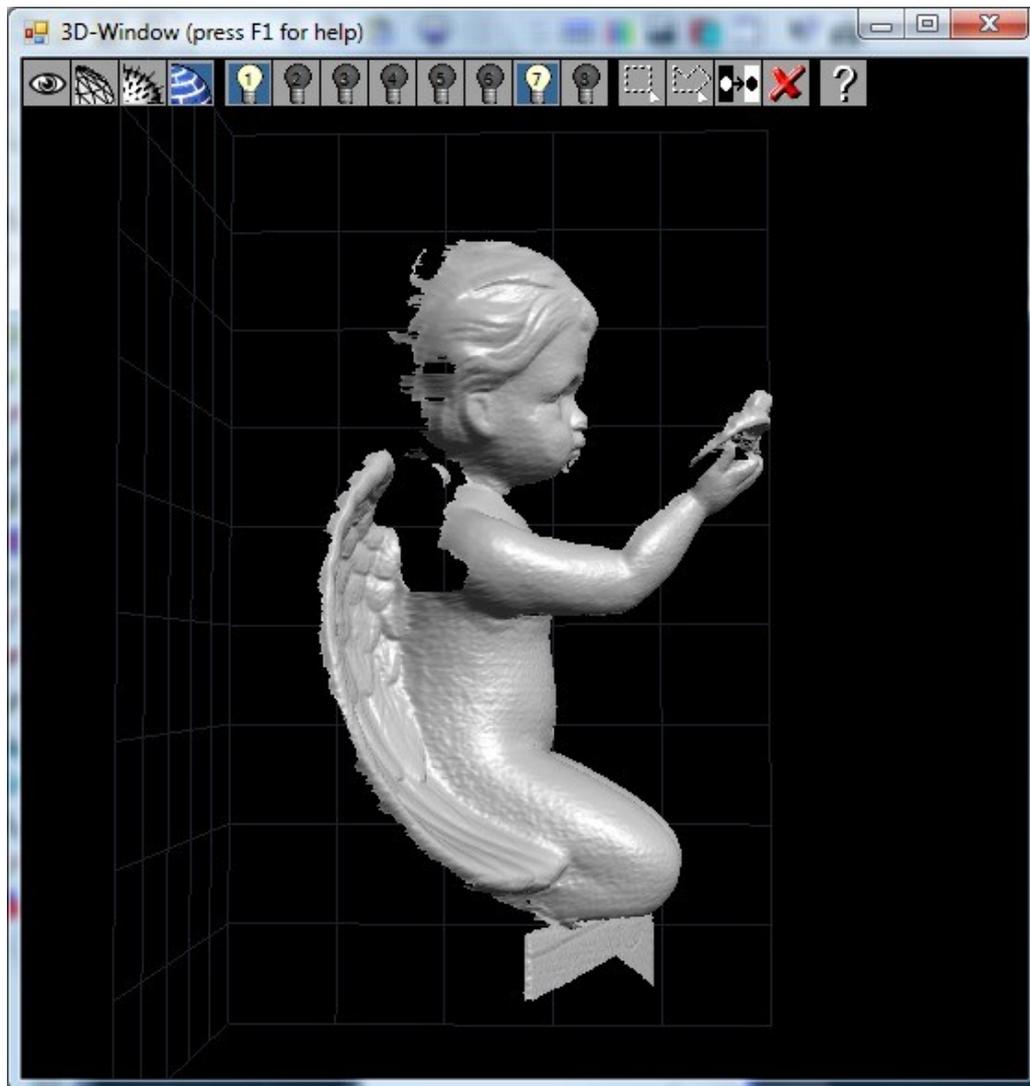
The color of the pixels in this window represents the distance of the corresponding surface point from the camera. This distance will also be displayed in the “Scan results” window when you move the mouse over it (bottom of the window, “value”, in mm). You can adjust the coloration with the sliders at the upper window border.

- You can scan as long and often over the object as you want. Theoretically, you can move your laser hand around as you wish, but practically, you may get better results if you try to keep it at the same position and just rotate the laser.
- If you activate the “Reduced display frequency”, DAVID will update the “Scan results” window only once per second. Depending on your hardware, this can increase the scanning speed.
- In most applications, you do not need to scan EVERY pixel (see following screenshot for a typically sufficient “Scan result”)



8. To see or update the scanned object in 3D, press the "Show 3D" button. In the 3D window, you can use the right mouse button to rotate the object. If you press the right mouse button near the border of the window (i.e. outside the white circle), you can rotate the view around the view axis. You can also use the left mouse button to move and the mouse wheel to zoom your view. Press F1 (while the 3D window is active) to get a comprehensive hot key list.





9. You can change the filter parameters and see their effect in the 3D Window immediately. The values 4, 2, 0 are recommended. These filters are applied for the 3D Window, the Save function, and the Forward function.
10. You can continue scanning anytime, or restart by pressing “Erase”.

## Optional: Texturize your object

To get a high quality texture you have to care for a uniform bright illumination. Most suitable is a very diffuse lighting that causes no reflections, no shades, and no shadows in the scene. For texture grabbing, you may need different camera settings; use the camera settings button below the “Pause” button for these settings. After that, the “Grab Texture” button allows you to grab a camera shot that will be used to texture (i.e. colorize) your 3d scan. If you want to see the texture you have to reopen the 3D window by pressing “Show 3D”. DAVID stores texture coordinates in the OBJ-File. Whenever you save your texturized 3d scan, DAVID will save the texture too. The texture will be saved under the same filename as the OBJ-File, but with BMP as file extension. Also a material file (.MTL) will be created.

## Saving / forwarding the scan result

When you are satisfied with your scan result (and texture), you can export the scanned data into an .OBJ-file by pressing the “Save...” button. The Alias Wavefront OBJ format is a standard mesh format, which can be read by many 3d applications. The 3d vertex coordinates and triangle list (indexed face set) is stored as plain text file. If you need a different file format, it is possible to convert the OBJ-file using 3rd-party freeware tools.)

You can directly “forward” the scan to [DAVID-Shapefusion](#) if you are planning to combine it with more scans (different views). Also, DAVID-Shapefusion is able to save to different file formats (.STL, .PLY). Nevertheless, we recommend to additionally save each scan to a file, such that it cannot get lost after a software crash or handling error.

## Alternative to laser: Shadow line

Instead of using a laser, i.e. projecting a bright line onto the object, you can also project a dark line: Use a bright light source pointed towards the object, and move e.g. a cord between them, such that it projects a thin shadow line onto the object (without being directly visible in the camera image). To use this feature, you must select “Thin shadow line” under “Scanning Process” in DAVID's Scan dialog. It is important that the line is really straight and as sharp as possible. So you will need a point-shaped light source or parallel light, e.g. bundled by a lens.

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