

Automotive Applications for Synopsys Measurement Instruments

When designing vehicles using optical software, it is important to know as precisely as possible the optical characteristics of the materials that will potentially be used. Our high-precision measuring instruments allow you to obtain the optical properties of the materials and export them for use in optical design software so that they are as close to reality as possible.

This application note presents examples of measurement results for various elements of a vehicle measured with our instruments: a dashboard measurement with the Synopsys REFLET 180S, a bodywork measurement with the Synopsys Mini-Diff V2, and an anti-glare screen measurement with the Mini-Diff VPro. It also describes an example of our measurement services, which can provide volume scattering data that enable you to leverage diffuse materials in your designs.

All measurements made with our instruments can be exported to different optical design software.

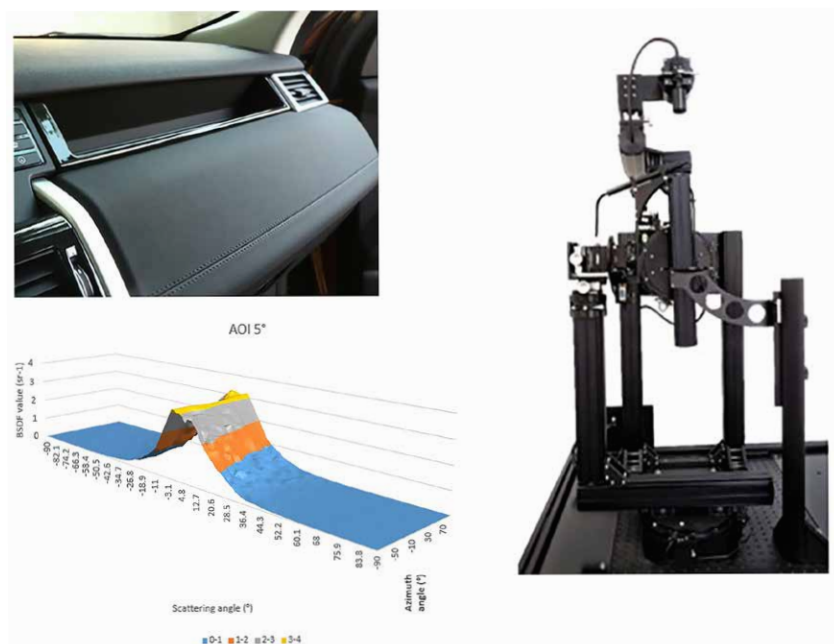
Dashboard with the Synopsys REFLET 180S

Main features: High dynamic range, high resolution, adjustable size spot and flux

The Synopsys REFLET 180S is a 10^{13} dynamic range goniophotometer that provides high resolution and significant flexibility in terms of measurement because all axes can move with a small step. Thanks to an adjustable spot size, the size of the spotlight can be adjusted to accommodate the area of interest and its texture.

The first measurement example is a grained dashboard surface (Mold-Tech). Synopsys REFLET 180S measurements of this surface can be performed to study the desired grain size, for example.

The following figure shows a measurement of the 3D BRDF of a dashboard sample with a 5° angle of incidence.

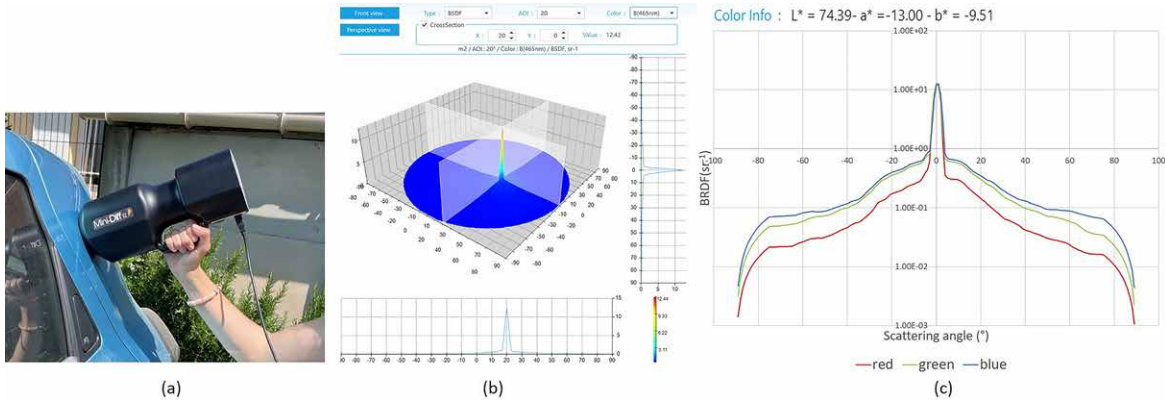


Car Bodywork Measurement with the Synopsys Mini-Diff V2

Main features: Portable, fast, 3D BSDF in one shot, information on color

The Synopsys Mini-Diff V2 is a portable device that is fast and easy to use. This camera-based scatterometer allows you to obtain 3D BSDF in one shot, thanks to a patented optical system developed and assembled by Synopsys. Among other options, it can provide information on color.

The following example illustrates its usefulness for the automotive field: a car bodywork measurement that was performed directly on the car with the Synopsys Mini-Diff V2, shown in figure (a).



In figure (b), the 3D perspective view of the BRDF is represented. Thanks to a cross-section tool in the software, you can focus on an area of interest, such as the specular peak in this example.

In addition, the Synopsys Mini-Diff V2 software provides an RGB tool that gives color information with an RGB representation and the L*a*b coordinates, which is key for this application. From this information, we can extract red, green, and blue curves in one plane, shown in figure (c), to study the color. Notice, for example, that the red curve presents a lower level of scattering than the blue or green curves, which is expected.

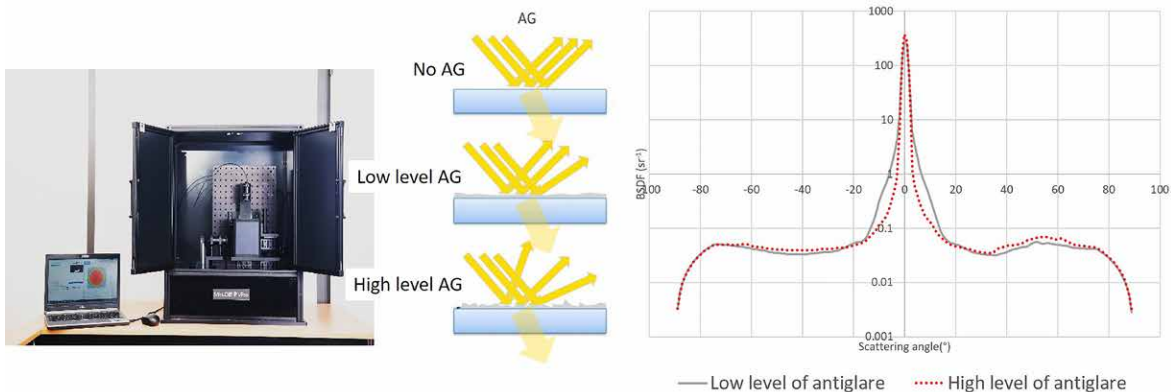
Anti-Glare Screen with the Synopsys Mini-Diff VPro

Main features: High dynamic range, fast, information on color

The Synopsys Mini-Diff VPro enables you to quickly obtain a measurement of the 3D BSDF with high resolution and dynamic range. This camera-based system also provides information on color. The software is the same as for the Synopsys Mini-Diff V2.

In this example, it is used to qualify the performance of an anti-glare system on a screen. This kind of system minimizes reflectance, and therefore avoids blinding reflection. This is important for safe driving.

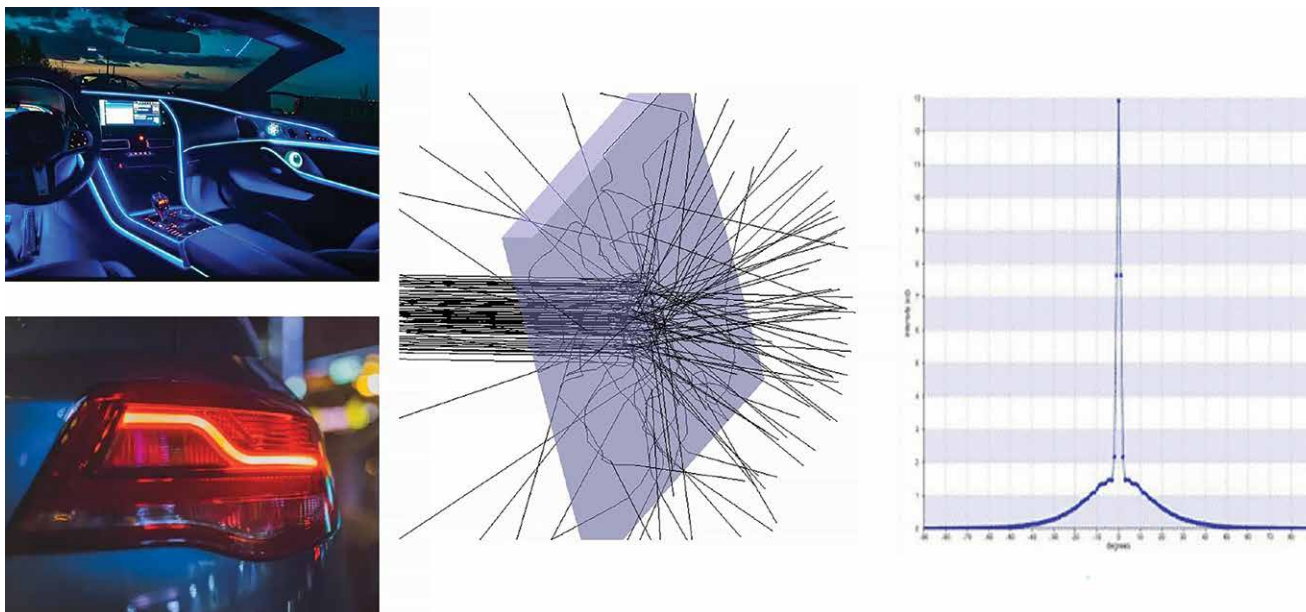
The following figure shows one slice of the 3D BSDF map of a screen with a low level of anti-glare compared to a screen with a high level of anti-glare.



Thanks to these measurements obtained with the Synopsys Mini-Diff VPro, you can see the difference between these two levels of anti-glare. In fact, you can see that the specular peak is larger with the low level of anti-glare, which enables you to qualify the performance of this kind of screen.

Volume Scattering Measurement for Light Guides

In addition to the devices described above, we also offer volume scattering measurement services that provide you with the scattering properties of diffuse materials using measurements from the Synopsys REFLET 180S. A typical diffuse material contains small particles that cause light to scatter within the volume. Volume scattering materials are used primarily to create glowing light guides for interior and exterior automotive applications, so it's important to obtain an accurate model in order to produce a high quality rendering.



For volume scattering, we first measure the 2D BTDF of the same material in four thicknesses with the Synopsys REFLET 180S. We have developed special models in LightTools that use these four BTDF measurements to find the parameters needed to simulate the scattering of this material. You can choose either of the following volume scattering particle types:

- Gegenbauer model, which uses mean free path, Alpha, and g parameters.
- Mie Scattering model, which uses radius, density, and refractive index of particles.

Afterward, we can verify that the calculated data provides the same simulation results as the measurements.

In the field of automotive design, our measuring instruments and measurement services provide solutions for determining the real optical properties of materials with great precision. These properties can then be incorporated in optical design software to generate designs with reliable accuracy.