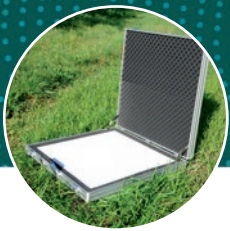


# Zenith Lite™

## Diffuse Reflectance Targets



field suitable



various greyscales



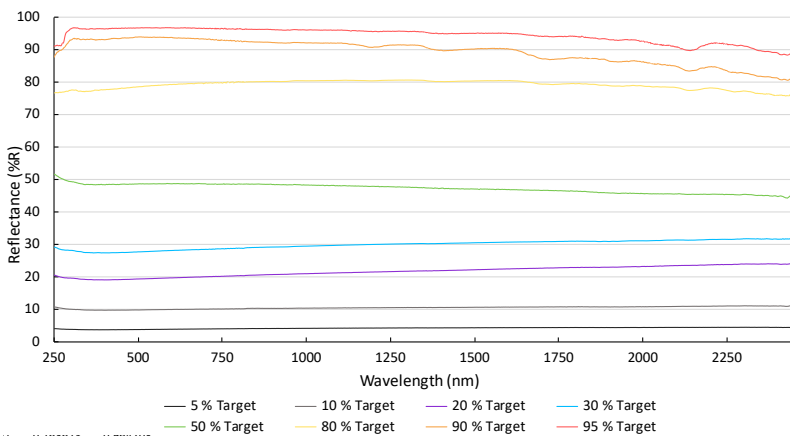
hydrophobic



### Lightweight and versatile

Zenith Lite™ Diffuse Reflectance Targets provide a constant and nearly ideal Lambertian reflection behavior over a wavelength range from 250 nm to 2500 nm. It is built by laminating a PTFE-based highly reflecting panel to a 10 mm thick aluminum honeycomb structured plate that serves as a solid, but lightweight backing. They are the ideal choice as a reflectance reference for both laboratory and field applications since they can withstand harsh environments for long exposure periods while being also lightweight and therefore easy to handle.

Typical Reflectance – Zenith Lite™ Diffuse Reflectance Targets



There are eight greyscales to choose from (the upper figure shows reflection properties of the different grayscale levels over the wavelength range from 250-2500 nm).

Diffuse reflectance targets are widely used as reference materials in optical laboratories, automotive industry, robotics as well as in remote sensing and other field applications involving optical measurements.

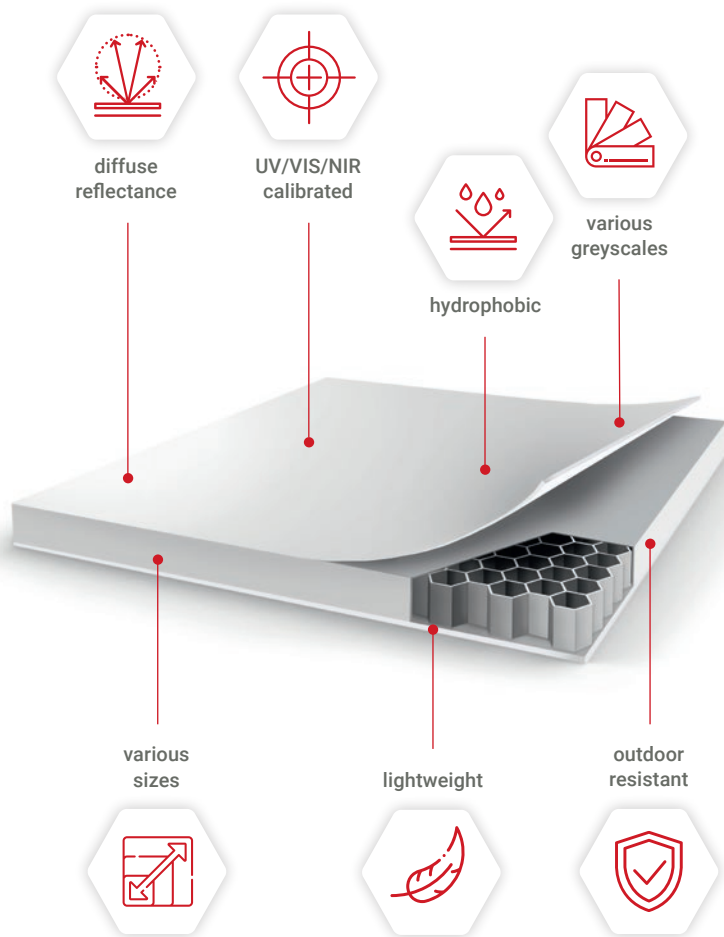
Due to their nearly perfect Lambertian surface, the measurement set up is independent of the viewing angle and the observer always detects a constant reflected radiance from the target. Furthermore, they have a high surface uniformity as well as a precisely known (calibration based) and nearly constant reflection level. These properties make the targets to be a reliable and versatile, well established, solution for many calibration purposes.

Reflectance targets made from a whole piece of sintered PTFE show excellent reflectance properties, however, they also tend to be heavy, fragile, and expensive.

In contrast, with our Zenith Lite™ reflectance targets we are laminating a thin PTFE based film with a special adhesive to a 10 mm thick aluminium honeycomb structured plate. While the reflection properties remain nearly the same, this technique enables the production of large, robust, and lightweight targets at low costs.

## Calibration

SphereOptics runs a DIN EN ISO/IEC 17025 accredited calibration laboratory. The standard single point calibration is performed on a PerkinElmer® Lambda 950 spectrometer in 8°/hemispherical measurement geometry. The spectral range of the calibration measurements goes from 250 nm to 2450 nm (for PTB traceability) respectively from 250 nm to 2500 nm (for traceability according to NIST). The measurement data will be supplied electronically on a USB-stick in 1 nm steps as well as in 50 nm steps in the printed factory calibration certificate. For targets larger than 300 mm x 300 mm the calibration is not directly performed on the target itself. Instead, a smaller witness sample is provided that will be used for the calibration.



## Customer-specific solutions

The idea of attaching an optical material to a base plate leads to several other manufacturing possibilities with different reflection levels, that cover an even wider range of applications than only with our regular Zenith-Lite™ Targets. The following additional options are available:

- With optical coatings we can expand the dynamic range of reflection levels from 1.4 %R up to 98 %R (customer specific reflection values are also possible). Coating based targets are the optimal choice for indoor-based flat-field applications, such as testing of cameras in the visible range, especially for built-in illumination on medical devices (like endoscopes).
- Our self-adhesive S095 film can easily be applied on different shaped surfaces and offers a very cost-effective alternative for high reflection levels (~95 %R from 420 nm to 1350 nm).
- Targets with retroreflective materials are especially needed for traffic safety, photogrammetry or in industrial metrology and have already been realized by us in many projects.
- A combination of different reflection levels on one target is especially important when specific scenarios need to be simulated (such as low-end reflectivity or contrast measurement). This can be achieved by either attaching several PTFE films with different reflection levels or by printing any pattern on a single PTFE film.

### Optical properties

- Nearly ideal Lambertian reflectance values
- Almost constant reflection over the wavelength range of 250 nm to 2500 nm
- Reflection tolerances of +/- 3 %R (depending on the batch)
- No absorption bands in the range of 250 nm to 2500 nm
- Uniformity over the surface of +/- 1 %R
- Laser damage threshold: 8 J/cm<sup>2</sup> (for pulsed Laser applications)

### Other properties

- Nonpolar, therefore water repellent
- Pure material insulator
- Chemically inert, exception: Reacts with organic Lithium and Sodium compounds
- Usable temperature range of - 5 to + 70 °C
- Usable humidity range from 5 % to 90 %
- Weight < 9 kg/m<sup>2</sup>

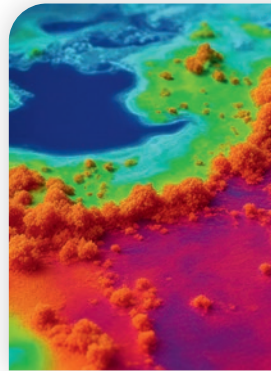
## Applications

Among a wide range of possible applications, the following overview represents a few of the most common ones.



### Automotive

Calibration of LiDAR sensors. The sensor is directed on a target and measures its reflectance data. By comparing the measured data with the calibrated ones, correction factors can be determined.



### Hyperspectral imaging

The target serves as a reference for the color calibration for the camera. By this it is ensured, that the different bands provide consistent and accurate color information.



### Remote sensing

The drone, with a mounted camera, flies above the target and the camera takes a picture under operation conditions. This serves as a reference for the camera's color and exposure settings.

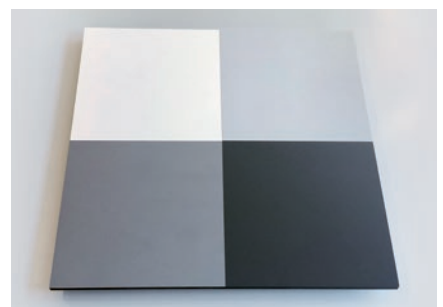


### Machine vision

Radiometric calibration of 1D and 2D sensors. By collecting data from a reference target, the sensors can be set to the correct intensity setting and sensitivity calibration.

## Delivery terms and additional features

- All standard targets are delivered in a lightweight protection box.
- 100 mm, 200 mm and 300 mm targets delivered with one M4 thread insert in the centre of the backside. 500 mm and 1000 mm targets come with four M4 threads inserts (standard pattern, drawing available on request).
- Order number for targets include PTB traceable calibration as default. For NIST traceability add "-N" to the order number and for uncalibrated targets add "-U".
- Custom sizes on request. Single targets available up to 1000 mm x 2000 mm. With help of a metal frame structure, even larger targets are possible.
- Lead time for targets 1-2 weeks
- Standard single point calibration will be performed on a Perkin Elmer Lambda 950 spectrometer (factory certificate, data in 1 nm steps, PTB/NIST traceability over the 250 nm to 2500 nm range).
- Specific patterns with varying reflectance values available on request (e.g. checker boards, stripe patterns, Siemens Stars, custom patterns, etc.)
- Additional uniformity pattern calibration at defined wavelength, e.g. 905 nm are available on request.



## Zenith Lite™ Targets, available standard sizes, and order numbers

Order-No. (PTB calibrated)	Order-No. (NIST calibrated)	Order-No. (uncalibrated)	Reflectivity	Dimensions
SG 3141	SG 3141-N	SG 3141-U	≈95 %	100x100x12 mm (approx. 4x4 inch)
SG 3142	SG 3142-N	SG 3142-U	≈90 %	100x100x11 mm (approx. 4x4 inch)
SG 3180	SG 3180-N	SG 3180-U	≈80 %	100x100x11 mm (approx. 4x4 inch)
SG 3143	SG 3143-N	SG 3143-U	≈50 %	100x100x11 mm (approx. 4x4 inch)
SG 3181	SG 3181-N	SG 3181-U	≈30 %	100x100x11 mm (approx. 4x4 inch)
SG 3145	SG 3145-N	SG 3145-U	≈20 %	100x100x11 mm (approx. 4x4 inch)
SG 3144	SG 3144-N	SG 3144-U	≈10 %	100x100x11 mm (approx. 4x4 inch)
SG 3146	SG 3146-N	SG 3146-U	≈5 %	100x100x11 mm (approx. 4x4 inch)
SG 3151	SG 3151-N	SG 3151-U	≈95 %	200x200x12 mm (approx. 8x8 inch)
SG 3152	SG 3152-N	SG 3152-U	≈90 %	200x200x11 mm (approx. 8x8 inch)
SG 3182	SG 3182-N	SG 3182-U	≈80 %	200x200x11 mm (approx. 8x8 inch)
SG 3153	SG 3153-N	SG 3153-U	≈50 %	200x200x11 mm (approx. 8x8 inch)
SG 3183	SG 3183-N	SG 3183-U	≈30 %	200x200x11 mm (approx. 8x8 inch)
SG 3154	SG 3154-N	SG 3154-U	≈20 %	200x200x11 mm (approx. 8x8 inch)
SG 3171	SG 3171-N	SG 3171-U	≈10 %	200x200x11 mm (approx. 8x8 inch)
SG 3155	SG 3155-N	SG 3155-U	≈5 %	200x200x11 mm (approx. 8x8 inch)
SG 3166	SG 3166-N	SG 3166-U	≈95 %	300x300x12 mm (approx. 12x12 inch)
SG 3167	SG 3167-N	SG 3167-U	≈90 %	300x300x11 mm (approx. 12x12 inch)
SG 3184	SG 3184-N	SG 3184-U	≈80 %	300x300x11 mm (approx. 12x12 inch)
SG 3168	SG 3168-N	SG 3168-U	≈50 %	300x300x11 mm (approx. 12x12 inch)
SG 3185	SG 3185-N	SG 3185-U	≈30 %	300x300x11 mm (approx. 12x12 inch)
SG 3169	SG 3169-N	SG 3169-U	≈20 %	300x300x11 mm (approx. 12x12 inch)
SG 3172	SG 3172-N	SG 3172-U	≈10 %	300x300x11 mm (approx. 12x12 inch)
SG 3170	SG 3170-N	SG 3170-U	≈5 %	300x300x11 mm (approx. 12x12 inch)
SG 3156	SG 3156-N	SG 3156-U	≈95 %	500x500x12 mm (approx. 20x20 inch)
SG 3157	SG 3157-N	SG 3157-U	≈90 %	500x500x11 mm (approx. 20x20 inch)
SG 3186	SG 3186-N	SG 3186-U	≈80 %	500x500x11 mm (approx. 20x20 inch)
SG 3158	SG 3158-N	SG 3158-U	≈50 %	500x500x11 mm (approx. 20x20 inch)
SG 3187	SG 3187-N	SG 3187-U	≈30 %	500x500x11 mm (approx. 20x20 inch)
SG 3159	SG 3159-N	SG 3159-U	≈20 %	500x500x11 mm (approx. 20x20 inch)
SG 3173	SG 3173-N	SG 3173-U	≈10 %	500x500x11 mm (approx. 20x20 inch)
SG 3160	SG 3160-N	SG 3160-U	≈5 %	500x500x11 mm (approx. 20x20 inch)
SG 3161	SG 3161-N	SG 3161-U	≈95 %	1000x1000x12 mm (approx. 40x40 inch)
SG 3162	SG 3162-N	SG 3162-U	≈90 %	1000x1000x11 mm (approx. 40x40 inch)
SG 3188	SG 3188-N	SG 3188-U	≈80 %	1000x1000x11 mm (approx. 40x40 inch)
SG 3163	SG 3163-N	SG 3163-U	≈50 %	1000x1000x11 mm (approx. 40x40 inch)
SG 3189	SG 3189-N	SG 3189-U	≈30 %	1000x1000x11 mm (approx. 40x40 inch)
SG 3164	SG 3164-N	SG 3164-U	≈20 %	1000x1000x11 mm (approx. 40x40 inch)
SG 3174	SG 3174-N	SG 3174-U	≈10 %	1000x1000x11 mm (approx. 40x40 inch)
SG 3165	SG 3165-N	SG 3165-U	≈5 %	1000x1000x11 mm (approx. 40x40 inch)

For industrial applications and high-volume inquiries, targets with full aluminium background are available on request:

SG 314X-10-ALU	Reflectance values choose from above	100 x 100 x 7 mm (8 mm for 95 %), aluminium base plate with M3 thread in the middle
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