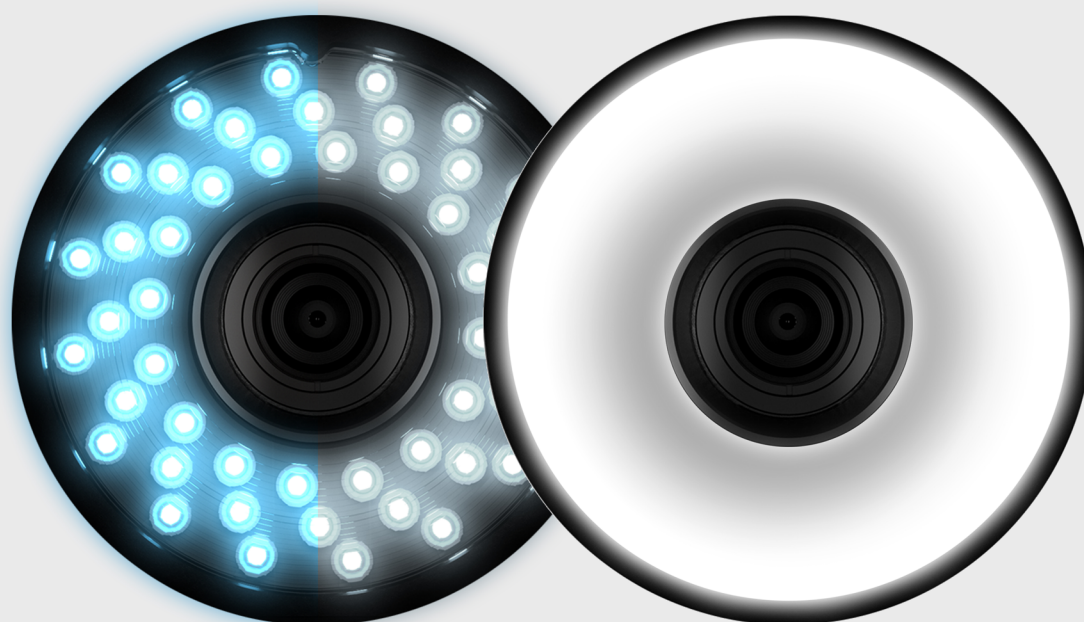


# **Illumination as the key to a stable optical measurement**

How the diffuse ringlight works



## **ZEISS Optical Series**

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# What Is a Homogeneous Diffuse Light?

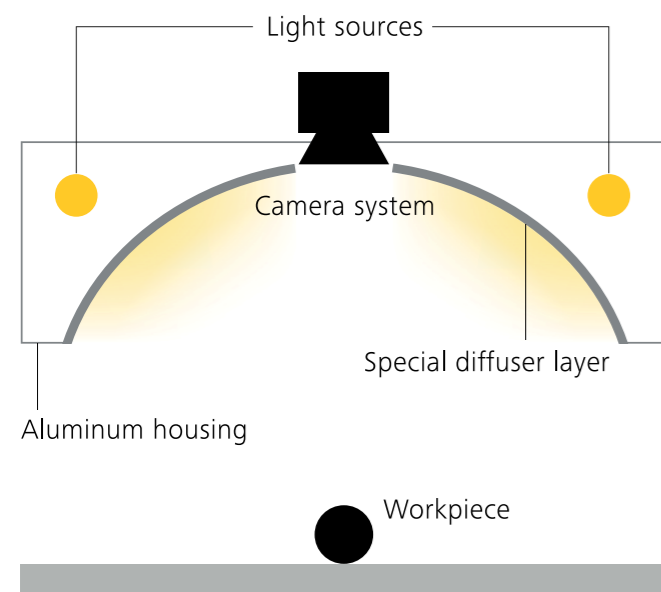
ZEISS Industrial Quality Solutions embarks on an alternative type of top lighting called diffuse lighting for its optical measuring machine, ZEISS O-DETECT. This white paper dives deeper into the underlying technology and the benefits of such a lighting strategy - such as the measurement of highly reflective workpieces and curved objects.

## How it works

In general, diffuse illuminations consist of three parts:

1. A central opening for the camera system
2. A semitransparent layer with a high reflecting index and scattering surface
3. A light source hidden behind the semitransparent layer

The camera system comprises of the lens and camera sensor which together, capture images for metrology purposes. ZEISS O-DETECT uses a high-resolution telecentric optical system with continuous digital zoom to negate any aspect errors a traditional zoom lens may cause.

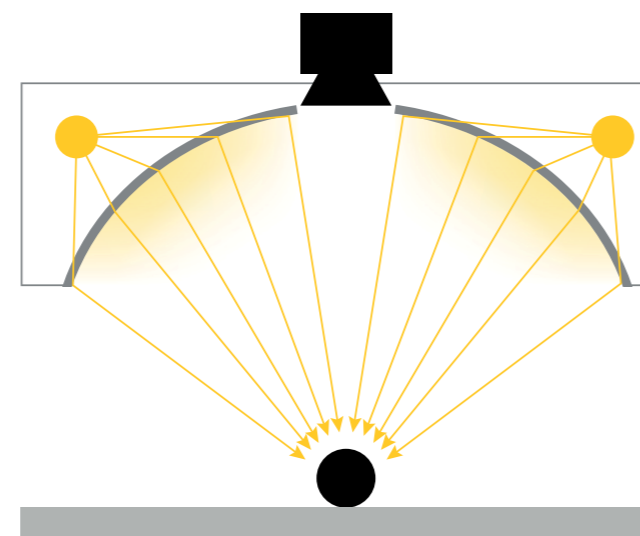


Sketch of a diffuse light source

The diffuse layer itself needs two special things: first is the material, and second is the shape. The material needs to be highly reflective, and it also needs to scatter light in multiple directions. Not only this, but the material needs to be semitransparent because the light source is placed behind the

semitransparent layer. Thus, the light needs to come through the material to light the workpiece. Furthermore, the shape of the layer material is essential. The light option is designed to illuminate the focal point of the optics with as much diffuse light as possible. The diffusing screen enables that the light coming from the light source is scattered to a homogeneous and smooth illumination.

When you bring all components together, light passes through the semitransparent diffusing screen and is scattered in all directions. The shape of the dome enables that the diffuse light is bundled in the focus point to illuminate the workpiece in the best possible way.



Path of light rays during diffusion

Through this process, the light is scattered by the semitransparent layer itself and eventually to the workpiece. The camera sensor is then positioned in the center of the illumination to provide optimal lighting homogeneity to the workpiece at the optimal camera working distance. This behaviour results in an equally distributed light density all over the illuminated area, and a decreased chance of shadowing.

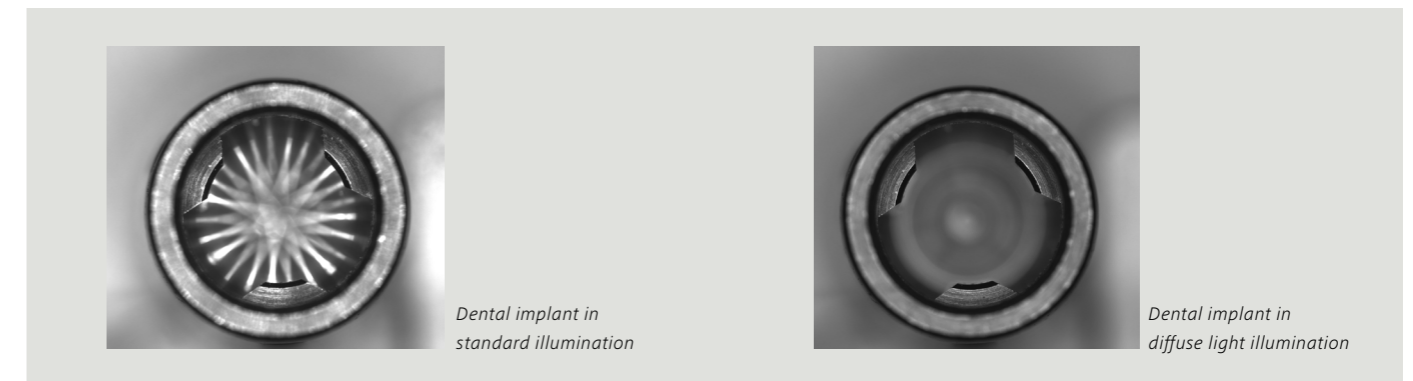
## What does it mean in application?

By diffuse illumination, shiny and reflective surfaces appear more homogeneous and consistent. Reflections a standard LED illumination would cause, get suppressed.

# Use Case: Homogeneous Diffuse Lighting

## Example: Measurement of a reflective dental implant

The following image examples are of a highly reflective dental implant. The image on the left is captured using a standard ring light, while the image on the right is captured with a homogeneous diffuse light.



The diffused light supports the measurement by suppressing reflections on the workpiece surface and eases the detection of the correct edge. Thus, the diffuse light source enables more flexibility in measuring shiny workpieces and challenging edges. For example polished or reflecting surfaces can be illuminated homogeneously and smoothly, whereas a standard ringlight illumination would lead to specular reflections of the single LED spots.

## Summary

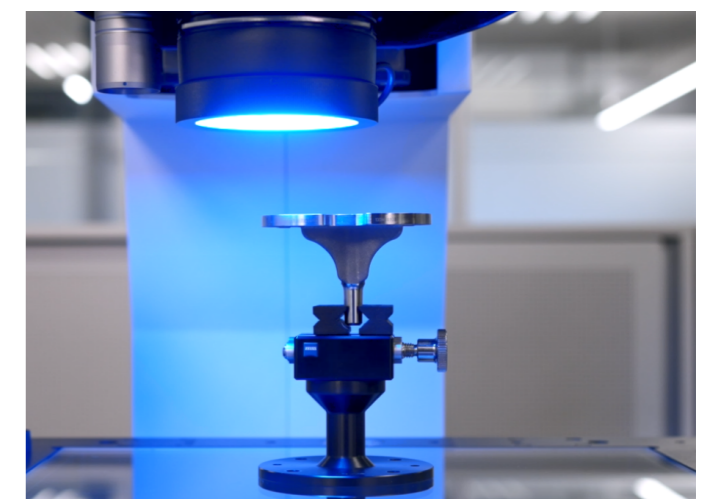
Using a homogeneous diffuse light allows you to measure highly reflective and curved objects.

The main advantages are:

- Less specular reflection on polished or highly reflective surfaces
- More homogeneous surfaces due to scattered light
- More stable and reproducible edge detection and thus more stable measurement results



Diffuse light option on ZEISS O-DETECT



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