

Introduction

Together with color measuring instruments, light booths are key components for effective color control. Especially when parts of different materials or surface texture need to harmonize, the human eye is often the final judge for approving a new design. Therefore, the visual inspection conditions need to be standardized to guarantee repeatable visual results.

Visual Color Evaluation

Color perception is dependent on personal experience as well as illumination and observing conditions. As the ambient conditions are highly variable and not consistent at all, it is required to simulate different common lighting situations. Additionally, these should be easily switchable to recognize and avoid so-called "Metamerism", i.e. differences in color matching when lighting conditions change. In order to guarantee comparable testing and evaluation conditions, international standards specify testing procedures defining the following components:

Observer

The observer conducting the visual appraisal must have normal color vision and should be trained in observing colors. To avoid eye fatigue the color decision has to be performed within seconds and small breaks are to be taken between evaluations. As people describe color differently, the following order should be used for communication and documentation of color: first hue, second chroma and third lightness.

Object

The samples and standards should be prepared with a specified method; be flat and have uniform color, gloss and surface texture. The specimen shall be placed in the same plane as the standard; both should be in close contact and be reversed from time to time. The preferred size of the samples is approximately 10 by 15 cm. The viewing distance between eyes and specimen should be 50 cm, which corresponds to the 10° standard observer.

Surrounding

For color appraisal the visual field immediately next to the product as well as the ambient visual field, when the observer glances away to let his eyes rest, are of high importance. In practice, this means to use a light booth or viewing room with matte light gray interior surfaces and the appraiser should wear neutral colored clothing to avoid disturbing chromatic reflections.

While solid colors ask for diffusely distributed light, metallics and other effect colors require directed light to see the influence of flake orientation.

LIGHT BOOTHS



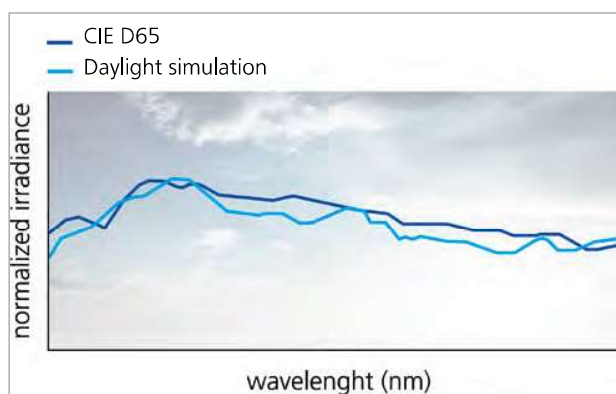
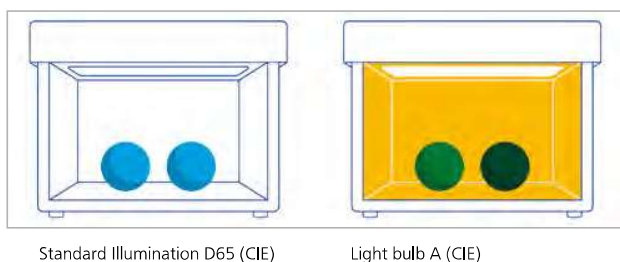
Light Source versus Standard Illuminant

Color impression is highly dependent on the spectral distribution of the ambient light. The same good matching under an artificial light source in a department store can mismatch under natural daylight. For reliable color evaluation, CIE defined so-called standard illuminants.

Daylight Illuminants

The main illuminant is always daylight. As natural daylight varies in color and intensity over time, CIE defined the standard illuminant D65, which describes an average daylight with a color temperature of 6500 K. Other daylight illuminants recommended by CIE are D75 describing overcast north-sky daylight, D50 common for applications in graphic arts and C, which is an outdated illuminant of average north-sky daylight.

These illuminants are a theoretical representation for daylight with defined spectral power distributions. The challenge is to simulate these using artificial light sources, because there are no lamps available, which fulfill exactly the defined CIE standard illuminants. The closer a lamp meets the CIE specification, the better is the accuracy of visual color matches.



Simulation of Natural Daylight

As D65 is the most commonly used illuminant, the artificial light sources should offer an as close as possible simulation. CIE Publication 51.2 describes a method to rate the quality of daylight sources. The method uses metameric sample pairs with a meta-merism index (MI) for standard illuminant D65 of MI=0. The bigger the MI-value is the worse is the simulation quality. Class A with a low MI-value provides the best daylight simulation, while class E with very high MI = 2 indicates a very poor simulation. For critical color evaluation, ASTM D 1729 recommends in the visual range (M_{vis}) class B or better. The byko-spectra *pro* offers the highest M_{vis} class A for daylight simulation of CIE D65 and D75 utilizing filtered tungsten halogen lamps combined with LEDs.

BYK-Gardner offers a complete line of standardized light cabinets: Light booths in various sizes and at different price levels dependent on your final application and accuracy needed.

Metamerism

Visual appraisal is particularly important for multi-component products consisting of different materials or parts with different pigment formulations, which can cause different spectral curves. In these cases, a match under one light source might not ensure a match under another one. To test this phenomenon called metamerism, the specimens are usually compared under daylight and at least one other light source, depending on the final sales or enduse application. Therefore, CIE defined additional illuminants: Standard illuminant A, which describes tungsten lamps, as well as a variety of fluorescent illuminants e.g. F2 or F11, which represent common fluorescent tubes used in department stores.

Light Booth	Viewing Area	Application	Illuminants	Daylight Source
byko-spectra <i>effect</i>	32 x 60 cm (sample table)	Multi-angle Color Sparkle	1 3 LEDs	Fluorescent tube
byko-spectra <i>pro</i>	56 x 89 x 60 cm	Solid Color	8	Filtered halogen lamps with LEDs
byko-spectra <i>lum</i>	89 x 60 cm (luminaire)	Solid Color	5	Fluorescent tubes
byko-spectra <i>standard</i>	48 x 71 x 51 cm	Solid Color	5	Fluorescent tubes
byko-spectra <i>lite</i>	36 x 61 x 41 cm	Solid Color	3	Fluorescent tubes
byko-spectra <i>basic</i>	37 x 60 x 33 cm	Solid Color	3	Fluorescent tubes
byko-spectra <i>mini</i>	33 x 46 x 25 cm	Solid Color	3	Fluorescent tubes

byko-spectra effect

Visual Evaluation of Effect Finishes

Metallic and effect finishes are getting more and more popular in many applications like automotive, appliances, furniture or architectural elements to emphasize the design and make the color "alive". In contrast to solid colors, effect finishes change their color and appearance with viewing angle and lighting conditions. Metallic and interference pigments will not only change their lightness and color, but also their sparkling effect will be different when lighting conditions change from sunlight to cloudy sky.

To perform a standardized visual evaluation of metallic and effect finishes correlating to instrumental results of multi-angle spectrophotometers, like BYK-mac i, different viewing angles and viewing conditions are necessary:

- Lightness flop and color travel:
45° illumination under daylight illuminant and 6 viewing angles: -15°/15°/25°/45°/75°/110°.
- Sparkling effect: Direct illumination under three angles 15°/45°/75° using bright LEDs and direct viewing.

To enhance the direct illumination a black surrounding is important.

Total Color Impression with Defined Light

With BYK-Gardner's byko-spectra effect light booth, it is now possible to set all these parameters and ensure visual evaluation under standardized conditions, which achieve the best agreement with instrumental evaluation.

- The high-quality daylight sources ensure quick and reliable color and effect judgement, without warm-up time or flickering.
- To simulate flake impression under direct sunlight bright white LEDs are used for illumination. Lifetime of the LED light sources is guaranteed for 10 years.
- The LEDs can be dimmed to adjust the lightness depending on sample type or user needs.



Helpful Functions – Easy Operation

- Time tracker indicates how long the lamps are in operation and you exactly know when a replacement is necessary.
- A tiltable sample table allows the samples to be precisely evaluated at the six defined angles. The illumination system pivots together with the sample table.

Info!

For information on objective measurements of effect finishes see BYK-mac i.



Ordering Information

Cat. No.	Description
6027	byko-spectra effect

Comes complete with:
byko-spectra effect light booth
Operating instructions

Technical Specifications

Voltage	
115 / 230 V, 50 / 60 Hz	
Dimensions Light Booth	121 x 80 x 76 cm (47.7 x 31.7 x 29.9 in)
Dimensions Sample Table	32 x 60 cm (12.6 x 23.6 in)
Weight	58,8 kg (127.2 lbs)



Ordering Information

Cat. No.	Description
6026	Daylight Tube, byko-spectra effect

Accessories

Replacement is recommended after 750 hours