

# Guidelines

## Building a Lighting Laboratory

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*These guidelines contain descriptions and troubleshooting necessary to install and maintain your lighting laboratory.*

*For news, Q&A and support at Viso Systems, visit our website at <http://www.visosystems.com>*

*Other manuals for Viso products can be downloaded from [www.visosystem.com](http://www.visosystem.com)*

## Safety Information

*Warning! This product is not for household use.*

**Read this manual before installing and operating Viso laboratory equipment, follow the safety warnings listed below, and study all the cautions in the relevant manuals.**

### Preventing electric shocks

Make sure power supplies are always grounded.

Use a source of AC power that complies with the local building and electrical codes, that has both overload and ground-fault protection.

If the controller or the power supply are in any way damaged, defective, wet, or show signs of overheating, disconnect the power supply from the AC power and contact Viso Service for assistance.

Do not install or use the device outdoors. Do not spray with or immerse in water or any other liquid.

Do not remove any covers or attempt to repair the controller or the power supply. Refer any service to Viso.

### Disposing of products

Viso Systems products are supplied in compliance with Directive 2012/19/EU on waste - electrical and electronic equipment (WEEE) together with the RoHS Directive 2011/65/EU with amendments 2015/863. Help preserve the environment! Ensure that this product is recycled at the end of its lifetime. Your supplier can give details of local arrangements for the disposal of Viso Systems products.

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## Introduction

### About this Document

These guidelines describe how a lighting laboratory can be designed and built to support optimal measuring conditions for your Viso product.

Illustrations primarily show the Viso LabSpion goniometer but principles apply to any goniometer system.

## Laboratory Environment Considerations

- Always keep your laboratory clean from dust and particles. Dust may interfere with measurement if it accumulates on and around the sensor by introducing straylight and disturbing translucence. Dust and particles in the mechanical parts of the goniometer may disturb functionality and may cause wear on motors, belts and bearings. Disconnect all USB cables and power supplies, and vacuum clean your goniometer regularly (normally every month) to remove dust. Mount a brush on the vacuum cleaner handle. Dry off all external surfaces with a clean, dry, cotton cloth (avoid statics).
- Avoiding air currents is necessary to minimize cooling of devices under test. Limit air flow (e.g. from air conditioning systems or draught) around the system (may alter light source intensity).
- Limit heat transmission from light source through mounting system. Should be mounted as realistically as possible

The standard test conditions and tolerance intervals of CIE DIS 025 (laboratory conditions)	Standard test condition	Tolerance interval
Ambient temperature	25.0 °C	±1.2 °C
Surface temperature for device under test (DUT)	Nominal operating temperature $t_p$	±2.5 °C
Air movement	Stationary air	0 m/s to 0.25 m/s

According to ANSI/IES LM-79-19 the temperature shall be measured max. 1,5 from DUT and in the same height and the temperature sensor shall be shielded from direct optical radiation from any source – DUT (Device Under Test) and auxiliary.

## Humidity

Relative humidity values greater than approximately 65% can lead to corrosion effects in some instruments, and values below 10% can lead to electrostatic effects. Therefore, laboratory humidity should be monitored and maintained between 10% and 65%.

## Electrical test conditions

Correct measurements rely on steady and correct power feed to both instruments and DUT. Viso systems contain a power analyzer that will automatically provide you with an overview of your power feed. In some areas, the mains power is not sufficiently stable or cannot sustain the voltage needed for the DUT in case. Under such conditions, Viso recommends to feed at least the DUT with an external power supply. The Viso Light Inspector software readily supports three types:

Manson SSP-8160, Korad KA3005P and Velleman PS3005. For more information please see the software user manual.

### Power supply requirements

According to LM79-19, AC power supplies shall provide a sinusoidal waveform at the prescribed frequency (60/50 Hz +/- 2 Hz). The total harmonic distortion or RMS shall not exceed 3% of the fundamental frequency.

During test (both AC and DC), the voltage shall be kept at +/- 0,2%. This stability is tested automatically on Viso power analyzers.

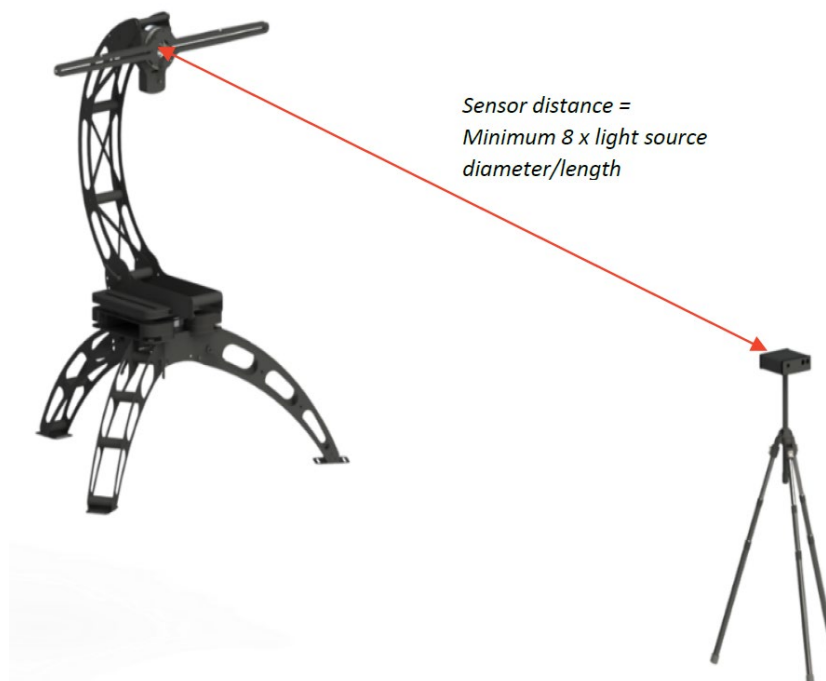
### Electrical settings

The DUT shall be operated at the rated RMS AC or DC Voltage or rated DC current per the specification of the SSL product for its normal use. The set value measurement shall fall within a tolerance interval of +/-0,5% for AC RM Voltage, +/- 0,2% for DC Voltage, and +/-0,2% for DC current.

More good advice can be found in ANSI/IES LM-79-19.

## Sensor Distance

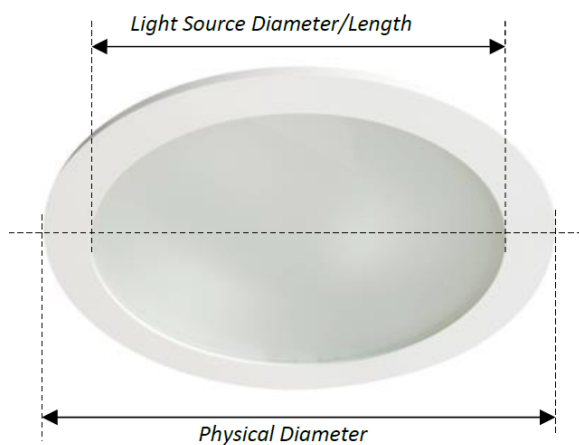
The measurement method used in the Viso systems is called “far field”, which means that the distance between the measuring light source and the sensor should be at least 8 times the diameter/length of the light source as shown below.



According to CIE S 025/E:2015, minimum measuring distances should be (D is the largest dimension of the luminous area):

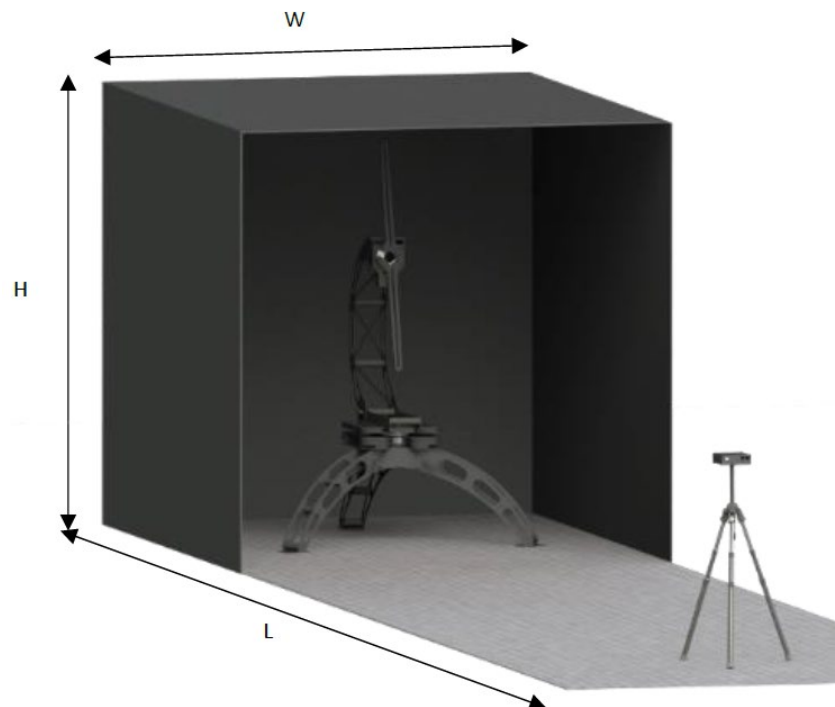
- Beam angle  $\geq 90^\circ$  (in all measurement planes):  $\geq 5xD$  (Viso Systems  $\geq 8xD$ )
- Beam angle  $\geq 60^\circ$ :  $\geq 10xD$
- Narrow angular distribution / steep gradients:  $\geq 15xD$
- Large non-luminous areas with maximum distance S:  $\geq 15x(D+S)$

Please note that “light source diameter/length” is only the illuminated part of the luminaire!



## Minimum Room Dimensions

As the distance to the sensor must be at least 8 x luminaire diameter plus the physical properties of the goniometer (1 m) and the sensor (0.5 m), we can calculate the minimum dimensions of the room to be as shown below.



Luminaire diameter	W = Room width	H = Room height	L = Room length
0.25 m	1.7	2.2	3.5 m
0.50 m	1.7	2.2	5.5 m
1 m	1.7	2.3	9.5 m
1.5 m	2.0	2.4	13.5 m

### Measuring through a Door Opening

In cases where the length of the room is not sufficient for larger luminaires, the sensor can be placed outside a door opening to extend the sensor-to-light source distance as shown below. Placing the sensor outside of the room using a door opening does not adversely affect the measurement. In fact, the doorway opening can help reduce stray light.

It should be noted that if the outside room is not dark, the “calibrate to ambient” functionality must be used to deduct the ambient light from the measurement.



## Creating Darkness

### Avoiding Ambient Light

Viso systems and the Light Inspector software can be set to detect and compensate for ambient light automatically. This feature works well given

- that the ambient light is not dominant (contributes to sensor input with less than about 10%),
- that the ambient light is static, which is not the case with e.g. daylight that might shift during measurement while clouds drift by.

Consequently, it is always recommended to perform measurement in a dark room facility to optimize precision.

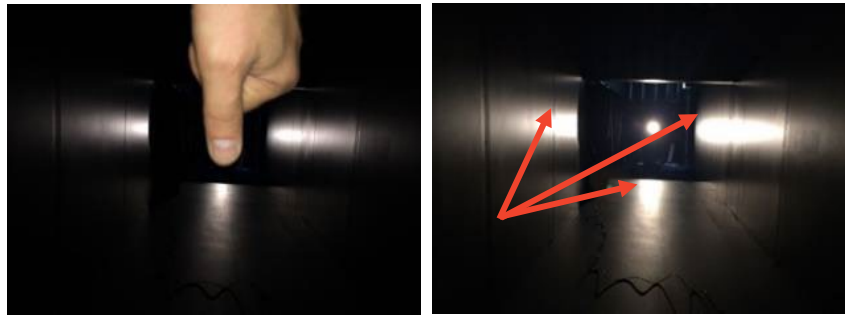
## Avoiding Stray Light or Reflected Light

Black is not black and very few materials absorb all light. Even a dark wall or floor can reflect light also known as stray light. This results in measurement values which are too high. When the sensor is close to the walls or floor the stray light can enter the sensor and give higher measurement result.

In a narrow space, light will be reflected in walls/ceiling/floor of the lab. The most important surface is the surface just behind the goniometer (thus facing the sensor). When measuring in gamma-angles close to 180 much light will go backward, potentially being reflected on the back wall, and bounce straight back to the sensor.

A good way of testing the reflections of the ceiling/floor/side wall of the lab is placing a powerful, uncovered light source (e.g. 70 W MH lamp) in the gonio, placing you eyes next to the sensor and gazing at the gonio, while covering the light source with you hand stretching out the arm. Then, after adaptation, you should be able to distinguish the surfaces that reflect most. To test the stray light situation in total, run a full measurement with the straight view to the sensor is shielded. If the room is not prone to reflect light that measurement result should be very close to zero lumen. If you have a UV light source this method is your only way of checking stray light in your lab.





*Light reflected into sensor from the walls and the floor*

To test the absorption properties of the back wall explicitly, run a light measurement of directional light source facing the sensor. The measurement should then show a zero output in the upper hemisphere.

An extra precaution to avoid straight light is to place baffles like the proposed curtain between the sensor and the gonio to physically restrict straight light from getting into the sensor, see Light Baffles, page 11.

### Room Surfaces

In general, many black, fuzzy textiles are more absorbent than black paint because the surface can trap light.

Theatre masking and blackout materials (cloth and paints) are especially designed to absorb light and work very well in the lighting laboratory as well. Many theatre supply websites even list the absorption percentage.

Black **richly folded** curtains will work better than just black curtains since light might be reflected back into the folds.

Black carpeting work well on both floors and ceilings.

### Goniometer Dark Zone

Normally when doing light measurement, a completely dark room is needed. But with Viso spectrophotogoniometers it is not a necessity for the whole room to be dark as the system comprises a special directional sensor. This means having only the goniometer zone dark will be sufficient as shown below.



The Dark Zone is recommended to be 2 meters deep or more.

A room can be darkened either by painting the walls black or using a black curtain.

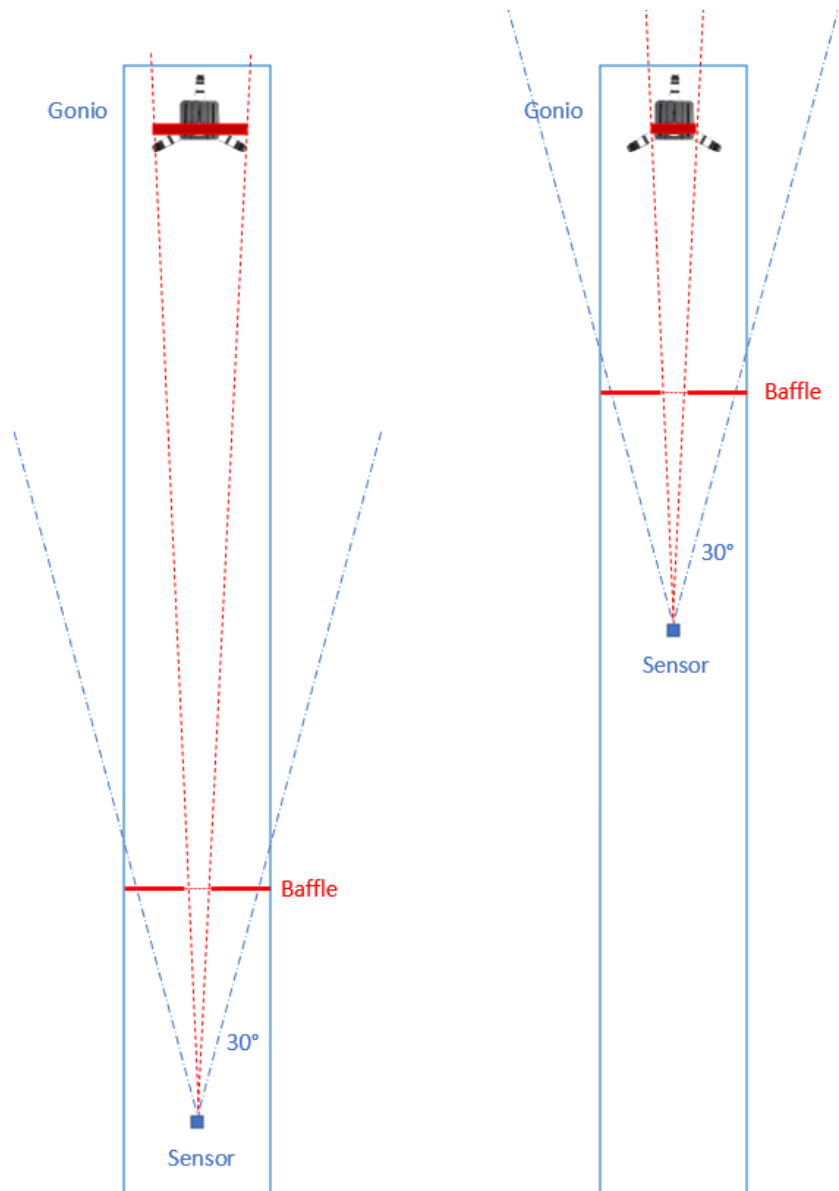
A black theatre fabric curtain can work better than a painted wall, as the folds in the curtain can function as small light bafflers trapping the light.



Note: If you have the option to have a fully dark room, this should be your first choice.

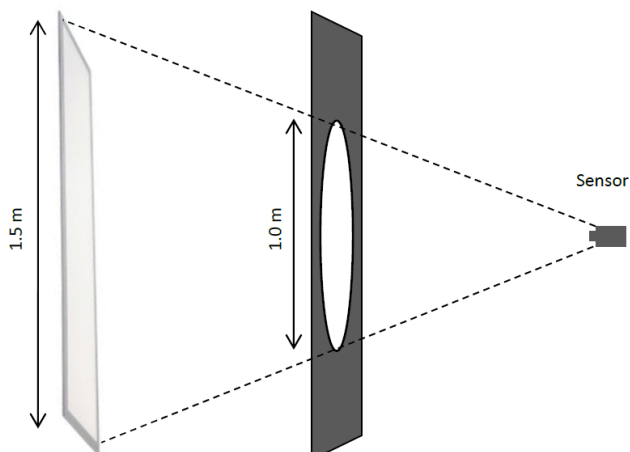
### Light Baffles

The Viso sensor “sees” something like a 30-degree cone. The longer the measurement distance, the more straylight from walls/ceiling/floor will be able to hit the sensor. One of the simplest solutions to eliminate stray light is to place a port hole (light baffle) as illustrated below.



A baffle with a suitable diameter (maybe 40-100 cm) can be used at different distances. The important thing is that the sensor can “see” all luminous parts through the hole.

To check, stand just behind the sensor head and make sure that you can see all parts of the luminaire through the hole.



### Creating a Light Baffle

Preferably, the baffle should be a sheet of molton or a thin wooden plate painted black to ensure that no ambient light is reflected on the baffle. Creating a light baffle can be done by using a black curtain and making a circular hole in the middle, as shown below. Place the light baffle between the goniometer and sensor at a distance where the lamp is visible from the sensor.



For example, the LabSpion can measure luminaires with a maximum length/diameter of 150 cm, so the size of the light beam halfway from the sensor to the lamp will be 75 cm. Consequently, a light baffle placed halfway needs to have a diameter of  $75+25$  cm to compensate for small errors in installation.

The procedure of cutting out a light baffle along with the final result is shown above.

### Laboratory Work Light

As the room surfaces are dark, it is a good idea to install powerful general lighting that allow practical work inside the laboratory to take place safely and efficiently. Good lighting will also be necessary for cleaning and maintenance.

Make sure, that the general lighting is turned off ahead of every measurement. Some laboratories have contacts that turn lights off when closing the lab door (as in a refrigerator).

Some clients install a webcam in the lab. With a webcam, the operator can both check that the general lighting is off and watch the progress of the measurement.



Light measurement made easy

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