RECOMMENDATION ITU-R BT.1686

Methods of measurement of image presentation parameters for large screen digital imagery* programme presentation in a theatrical environment

(Question ITU-R 15/6)

(2004)

Scope

This Recommendation specifies the correct way for on-screen measurements of the main projection parameters of LSDI applications based on presentation of programmes in a theatrical environment. The Recommendation is based on recent IEC Publications, integrated with the specifications for a specialized device intended to limit the influence of stray light falling on the screen on the measured parameter values.

The ITU Radiocommunication Assembly,

considering

a) that it is desirable that LSDI programmes presented in a theatrical environment should correctly and consistently reflect the content of their programme master, as far as differences in presentation equipment and environment will allow;

b) that in order to achieve this goal, it is desirable to identify appropriate measuring methods, which can be used to measure the main image presentation parameters on the assumption that, if they reasonably match those under which LSDI programmes were mastered, then programmes presented to the public will reasonably reflect the content of the programme master;

c) that extensive International Electrotechnical Commission (IEC) documentation exists, covering measurement methods for large-screen electronic projection;

d) that similar documentation also exists in some Recommendations of the BT Series;

e) that Resolution ITU-R 41 encourages ITU-R cooperation with the IEC and the International Standards Organization on matters of common interest,

recognizing nevertheless

a) that although compliance with the assumption in *considering* c) is necessary as a first approximation, it is not always sufficient to achieve the desired image presentation match;

b) that it could be necessary to make measurements in the venue where the system is installed;

c) that the venue usually used for LSDI presentation does not match the requirement of the IEC Standard;

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* Large screen digital imagery (LSDI) is a family of digital imagery systems applicable to programmes such as dramas, plays, sporting events, concerts, cultural events, etc. from capture to large screen presentation in high resolution quality in appropriately equipped theatres, halls and other venues.

d) that accuracy of measuring the light output of projection display systems can be compromised by the conditions of the viewing room. Room lights directly illuminate the screen and these light sources reflect off walls, floors, furniture and other objects;

e) that additionally, light from the projection screen reflecting off objects in the room and back on to the screen must be considered;

f) the stray-light components can contribute to the measured result, providing erroneous results,

recommends

1 that the methods used to measure LSDI image presentation parameters should be based on the last version of IEC Publication 61947-1 "Fixed resolution projectors" or on IEC Publication 61947-2 "Variable resolution projectors" as appropriate[1], on Recommendation ITU-R BT.814 and on the other relevant Recommendations in the BT Series;

2 that a device should be used to eliminate stray light, such as described in Annex 1, in any light measurement in the incident flux, since that stray light can be present even in typical darkroom conditions;

3 that the measurements should be performed after verification of the correct alignment of the LSDI projector as requested in IEC Publication 61947-1 or on IEC Publication 61947-2.

NOTE 1 – IEC Publications 61947-1 and 61947-2 are available in electronic version at the following address: http://www.iec.ch/itu.

Annex 1

Stray-light elimination

1 Introduction

Electronic projection displays involve the projection of an image, usually through a lens system, onto a viewing screen. Metrics such as light output, contrast, non-uniformity, and colour gamut are used to describe the resultant image quality. The accuracy of measuring the light output of projection display systems can be compromised by the conditions of the viewing room. Room lights directly illuminate the screen and these light sources reflect off of walls, floors, furniture, and other objects. Additionally, light from the projection screen reflecting off of objects in the room and back onto the screen must be considered. The stray-light components can contribute to the measured result, providing erroneous results.

With the advent of ultra-light projectors, more of these displays are being transported to a wide variety of viewing environments. LSDI applications cover a wide range of use. Often equipment is

[1] Matrix displays such as liquid crystal ones are examples of fixed resolution displays; cathode ray tube or laser-based projectors are examples of variable resolution display.

compared to alternative or competitive technologies (within or outside of the projection display arena). Stray-light contributions can affect image quality, penalizing the projector for conditions beyond its control. In such situations, it may be important to separate out the ambient and screen effects to measure the darkroom projector performance. A stray-light elimination tube (SLET) is used to remove such contamination so that the user can better evaluate the performance of the projection system independent of ambient light conditions. This Annex describes the design of the SLET.

1.1 Determination of the presence of stray light

One can use a simple black patch to determine if a stray-light problem exists. The patch, called a projection mask, should be placed near the screen, between the image and the projector, such that the shadow of the patch eclipses the rectangle image and the sensor of the light measuring device. See Fig. 8. With the mask in place, the illuminance meter will obtain a reading that approximates the contribution of stray light from the viewpoint of the meter. The projection mask is then removed, and another reading is taken. The difference between the two readings offers a more accurate measurement of the illuminance of the black rectangle and thus an indication of the level of stray-light present, and thus whether a SLET should be used.

The location of the mask is related to the position of the projector and screen. If the mask is placed too close to the screen, some of the reflected light will be obscured. If the mask is moved too far away, diffraction around the mask and forward scattering of light by dust particles in the air may contribute to the measurement. Ideally, the size of the projection mask should be no smaller than the diameter of the projection lens so that the projector is effectively eclipsed. However, the mask must be larger than the sensor area of the light measuring device.

2 Construction

2.1 SLET tube

The SLET consists of a 61 cm (2 ft) long piece of polyvinyl chloride (PVC) tubing[2] with a wall thickness of 0.64 cm (0.25 in.) and an inner diameter of 15 cm (6 in.), as shown in Fig. 1. Several frustums are inserted to provide for the baffling and redirecting of stray light. A lengthwise section of the tube is cut out and remounted with hinges and thumbscrews to allow access into these interior frustums. The edges of this cut out are lined with black felt so a light-tight seal is made when closed. The entire tube is painted glossy black: the glossy paint provides for approximately 0.2% diffuse (non-specular) reflection, whereas flat black offers at best around 2-3% diffuse refection. By careful positioning of the gloss black frustums, the SLET can direct the specular reflections off the interior tube surface away from the illuminance meter measurement head. The back plate needs to be thin enough so that reflections off its edge do not contribute to the illuminance measurement.

[2] Common sewer drain tube can work, although a smooth interior tube should be better for controlling reflections.

2.2 Frustums

The two frustum pairs have apex angles of 90°, with a 15 cm (6 in.) exterior diameter and a 5 cm (2 in.) inner diameter. These are positioned as shown in Fig. 1. A single frustum, mounted at the rear of the SLET tube, has an apex angle of 18º, with a 15 cm (6 in.) exterior diameter and a 14 cm (5.5 in.) inner diameter, Fig. 1.

The frustums are constructed from 10 mil black vinyl plastic with a gloss surface on both sides, using the procedure described in Fig. 2. The equations relate the frustum apex angle and inner/outer diameters to a flat surface that can be easily cut using a mechanical compass with a sharpened edge for cutting the plastic. Figure 2a) demonstrates methods for joining the frustum ends.

FIGURE 1

Layout of stray-light elimination tube

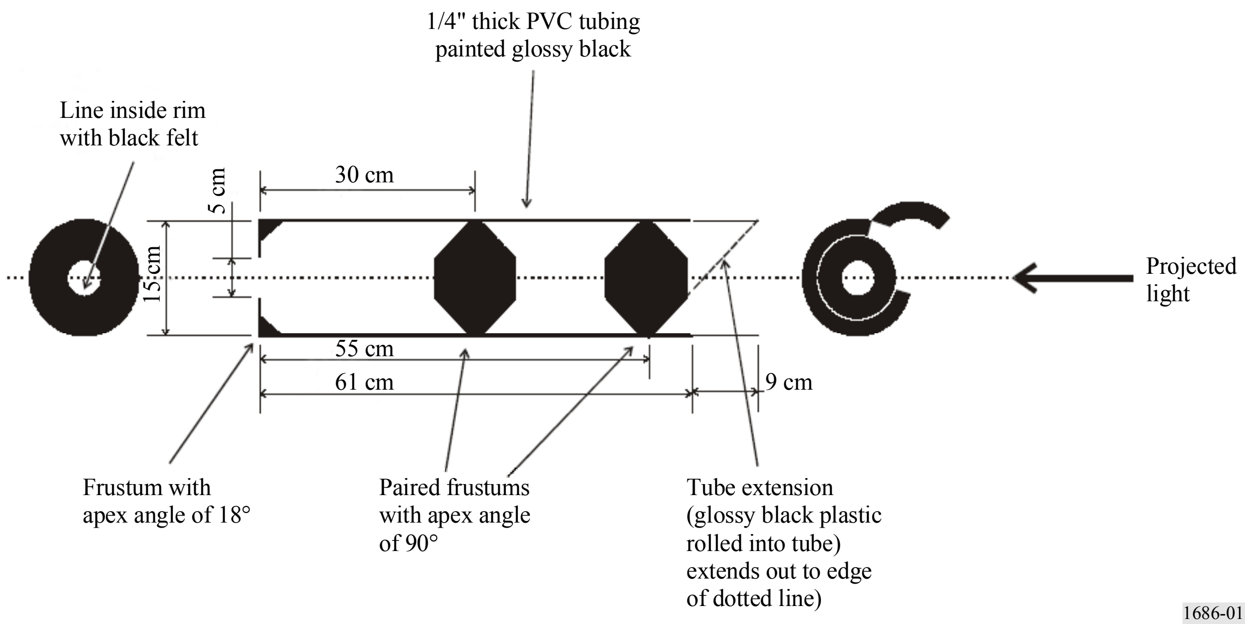

FIGURE 2

Frustum joining methods

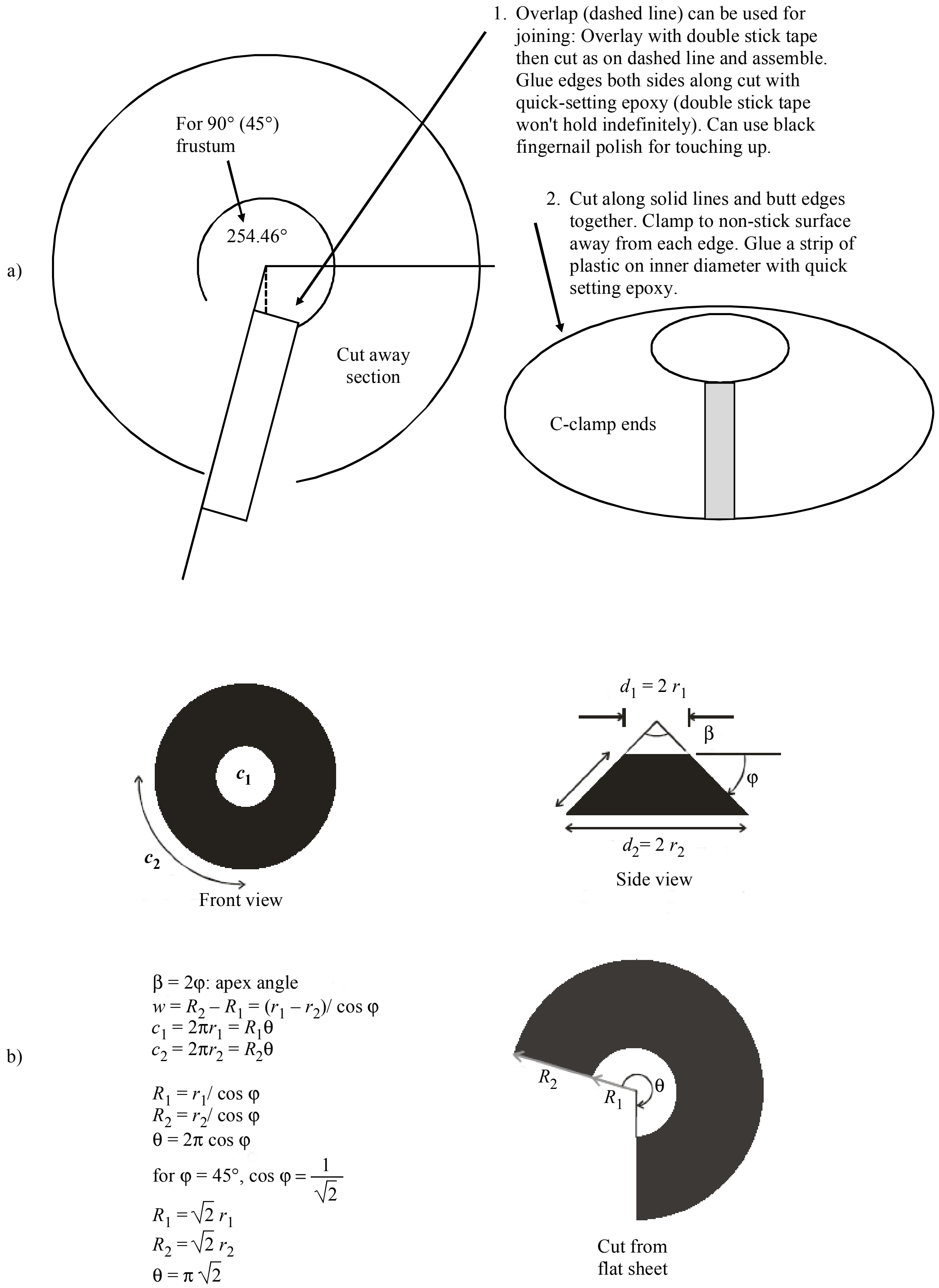

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FIGURE 3

Frustum rings

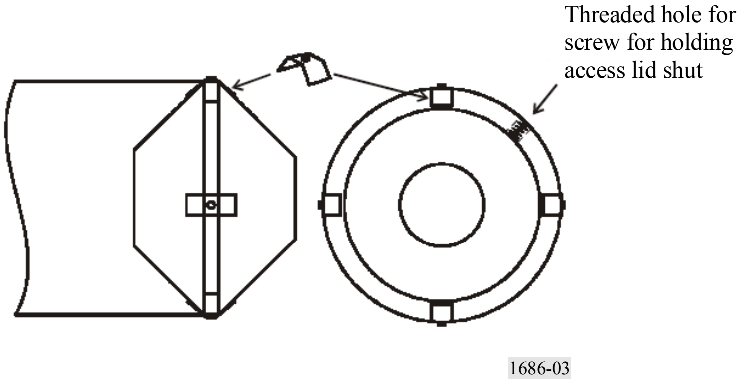
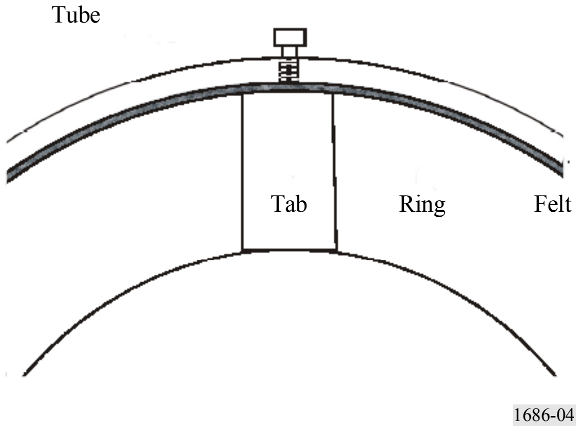


FIGURE 4

Detail of frustum rings



3 Operation

To perform illuminance measurements on front-projection displays, be sure the SLET is aligned correctly. Aim the tube toward the projector source as shown in Fig. 5. Mounting the SLET onto a tripod may ease use and improve stability of alignment. Use the shadow of the tube aperture (with the illuminance meter removed) imaged onto the screen as an alignment guide. Be sure there are no stray-light sources directly near the SLET field of view in the direction of the projector.

3.2 Small area light measurement

To accommodate the small measurement areas, a slit, using razor blades painted in glossy black, is used to create an adjustable aperture (see Fig. 6). The blades are secured with set screws to provide for adjustment. This allows the user to control the area of the projected image to be measured. Thus, one could measure contrast modulation by adjusting the aperture to allow only either the black or the white portion of the image to illuminate the detector head. The slit adapter is mounted to the SLET as shown in Fig. 7.

FIGURE 5

Example of how to use the SLET

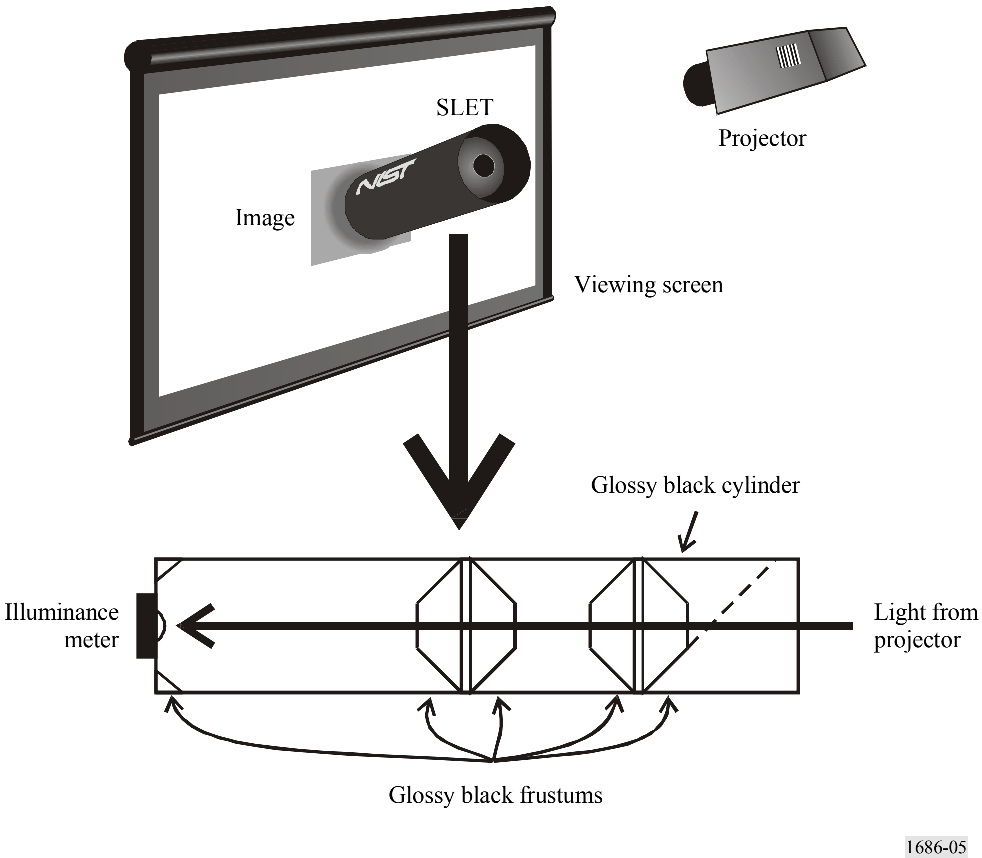


FIGURE 6

Slit adapter for illuminance meters

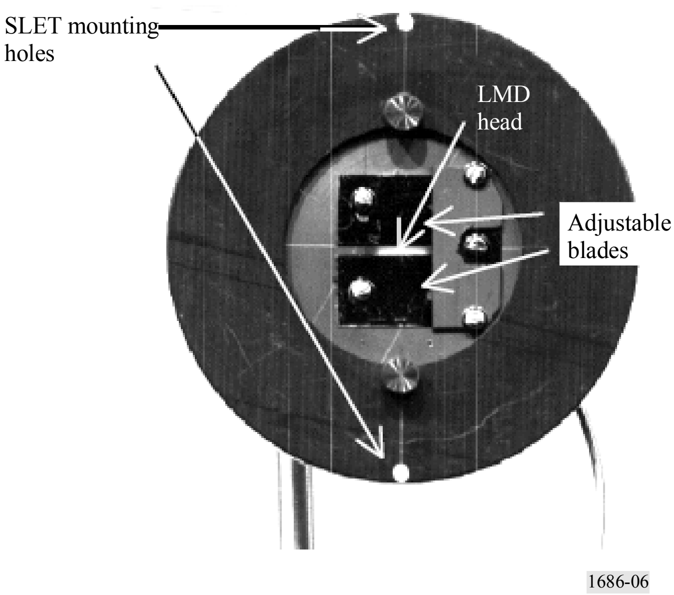


FIGURE 7

Using the SLET with a slit adapter for small-area measurements

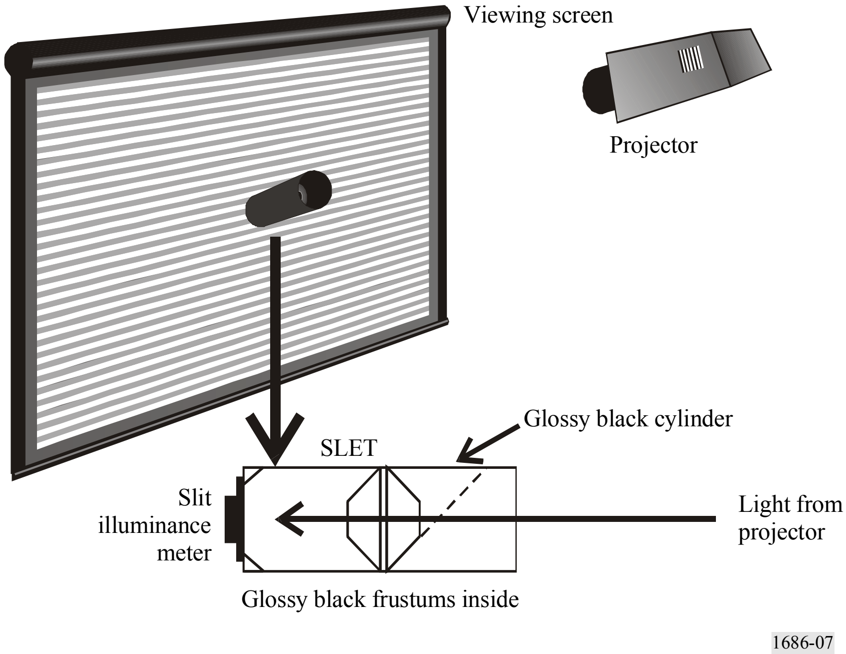
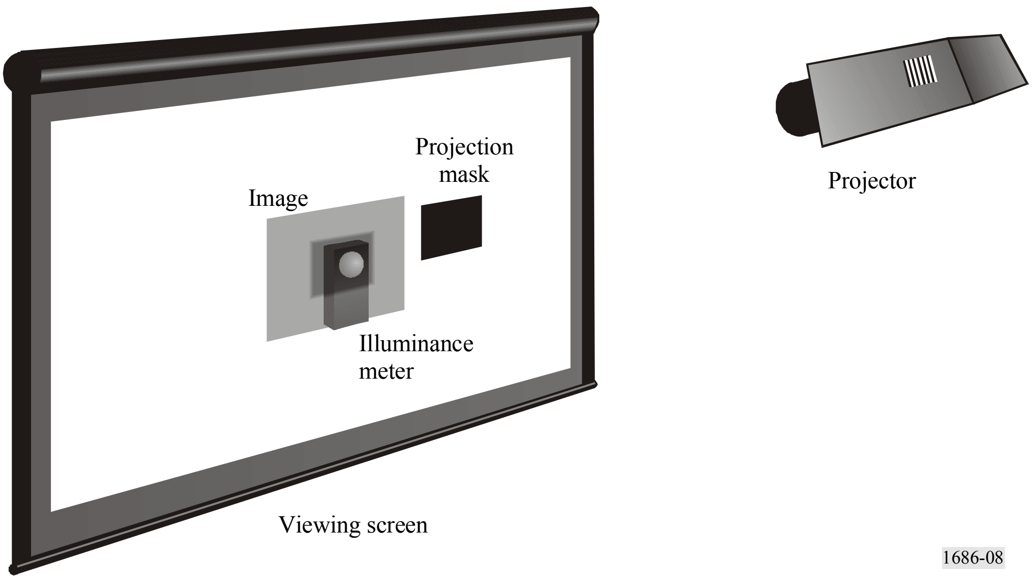


FIGURE 8

Projection mask method of stray-light compensation



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