

# The importance of screen selection in achieving correct light levels in cinemas

by Andrew Robinson, CEO of Harkness Screens International



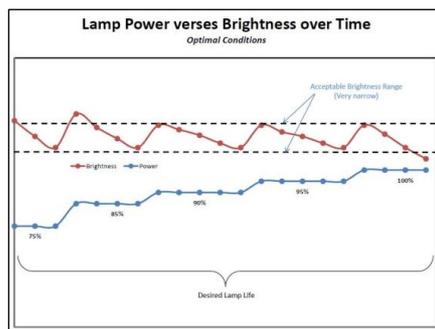
The large number of cinemas that are now showing 3D movies has made screen brightness levels an important topic. Because of the low light efficiency of all 3D systems (some are better than others but all lose a lot of light) the *de facto* screen brightness standard for 3D presentations is 4.5 Foot Lamberts (fL) which is only one third of the agreed standard for 2D of 14fL. In practice many 3D screens are operating with much less than 4.5fL and the choice of screen is a significant factor in this. However it is not just 3D where correct light levels are important – there are many cinemas operating in 2D with light levels below 14fL and a factor here is the higher operating costs of digital projection compared with 35 mm film projection. Screen selection is an important consideration in achieving the 14fL brightness standard in 2D presentation.

The consequences of low light levels (in both 2D and 3D) can be a loss of contrast and colour rendition. 3D effects may be lost. With a significantly low level the whole ‘big screen’ experience is diminished, which cannot be in the long-term interests of the exhibition industry as home theatre systems get even better.

There are various factors contributing to low light levels of which the main ones are:

- The projector or 3D system is not set up correctly
- The lamp is too small or nearing the end of its life
- The screen gain is too low

Lamps can lose 40% or more of their light output by the end of warranty life and the projector operating power has to be adjusted to compensate during life. Initially there must be some ‘headroom’ so this can be achieved. Starting with 100% power will inevitably lead to a low screen brightness level at the end of lamp life. Running over warranty life leads to a further drop off in light as well as possible explosion risks.



It is important to check brightness levels as the lamp degrades and adjust the set-up accordingly. This can be done with various professional measuring instruments. Harkness has recently introduced the ***Digital Screen Checker*** – a low cost device that can accurately measure brightness of 2D and 3D screens in fLs.

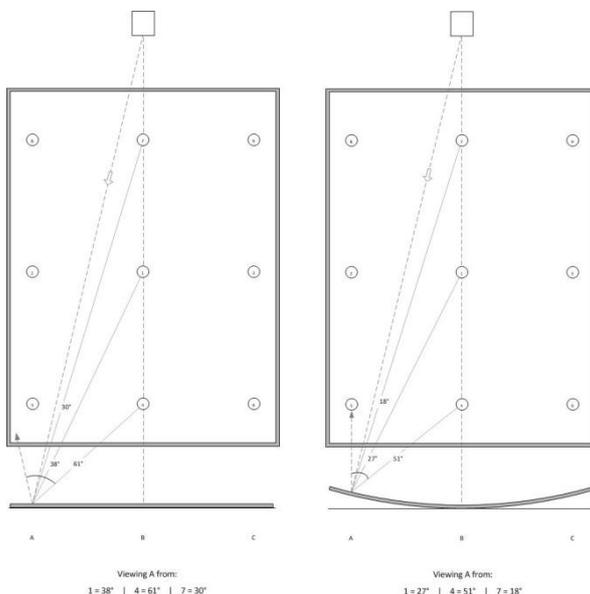
Even assuming the projector is set up correctly, it may be impossible to achieve the correct brightness level throughout the life of the existing lamp because the power of the lamp is too small or the screen gain is too low. Options are to change the lamp or change the screen. Often changing the screen to a higher gain will be the most economic long-term



solution. This can be the case in all 2D situations and in 3D using white screens. ‘Silver’ 3D screens are already very high gain so the only option, for improving brightness, is a larger lamp.

The screen choice is therefore critical with digital projection. There is a trade-off between screen gain and lamp power in 2D projection and ‘white screen’ 3D. Many 3D presentations on ‘white’ screens are dark simply because the screen gain is too low as the screen was not changed when the system was installed.

Digital projection lamps are designed to generate more light for a given power rating but they generally have shorter lives than corresponding film lamps. The smaller the power rating of the digital lamp, the better, because the lamp costs less, lasts longer and uses less electric power, than a larger lamp. However the screen brightness needs to be achieved and raising the screen gain can achieve this whilst optimizing operating costs.



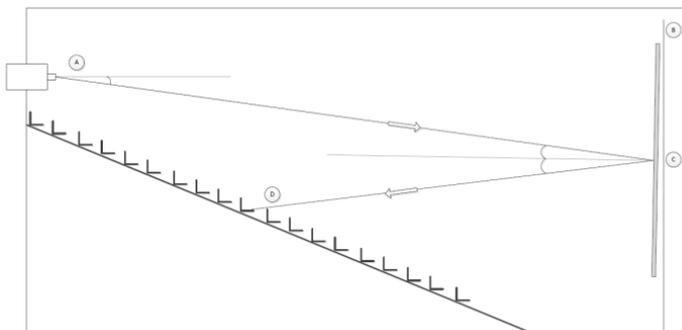
What’s the down side from using high gain screens? With gain screens the peak brightness is on the screen axis (centre line of the cinema), and light distribution is lower to the sides of the auditorium. The brightness can vary across the screen and in extreme cases a ‘hot spot’ can be seen. However digital projection has an intrinsically more even distribution of light onto the screen than film projection, so higher gain screens can be used with digital than with film.

***Curving the screen*** improves the light distribution and a screen depth to width curvature ratio of 1:20 is recommended.

The drawings show how the viewing angle is reduced with a curved frame, thereby improving the brightness at the edge of the screen.

With high gain screens screen 'rake' should be considered. The screen should, if necessary, be tilted so that the 'spectral' path of the light is from the projector to the centre of the screen and then reflected to the centre of the seating area.

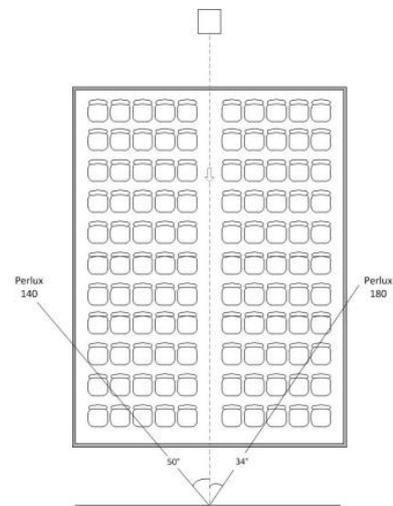
This is a particular consideration with very high gain silver screens as the 3D light level is relatively low and must be directed correctly.



- A - Projector Down Angle
- B - Rake Angle
- C - Centre of Screen
- D - Mid Point of Seating
- - Spectral Path

Finally, theatre shape is a factor in determining the maximum level of gain that can optimally be used. **Longer throw auditoria** are better than shorter ones when using high gain screens. As 3D screens are, in most cases, high gain this should be a factor in selecting the 3D auditoria in a complex. In this theatre most of the seating is within the 'half-gain angle' even with a 1.8 gain screen, and so has a good light distribution.

Measuring gain of the existing screen is relatively easy and Harkness can advise on how to do this. Screens are likely to lose gain with age so the original gain level (assuming this is known) is not a firm guide to the current gain level.



Harkness have available free to use on their website the **Digital Screen Selector** which can quickly give a guide on screen options to achieve the correct brightness level in both 2D and 3D. It can also indicate potential operating cost savings from upgrading 2D screens to higher gain levels.

## About Harkness Screens

Harkness Screens™ is the world's largest manufacturer of projection screen surfaces, specialising in the design and production of cinema screens and custom screens of virtually any shape and size. Harkness Screens is the world leader in cinema with screens in more cinemas worldwide than any other manufacturer. From single-screen independent theatres to large multiplexes to large format immersive theatre experiences or live events, Harkness supplies thousands of screens every year for cinema, film production, special effects, live events and custom AV applications.

Founded in 1929, Harkness' corporate office is located in Ireland with other offices and factories located in the USA, UK, France and China. Harkness Screens combines unrivalled experience with the latest technology and production methods to provide innovative solutions to the company's key markets worldwide. For more information, visit the Harkness Screens web page at [www.harkness-screens.com](http://www.harkness-screens.com).